



Investigation of myxomycetes in Selcen Mountain (Turkey) and its close environs

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Abstract

In this study, myxomycetes, which have an important place in forest ecosystem, were determined. Myxomycetes act as saprophyte in the forest ecosystem. In this context, the myxomycet diversity of Selcen Mountain and its close environs was determined. This study has been made on the specimens which were obtained from 11 different station areas of Selcen Mountain and its close environs in 2011-2012. The samples were acquired from barks of trees, leaves and the materials of decayed trees. These materials were employed the Moist Chamber Culture and it was tried to develop myxomycetes sporophore. In addition myxomycetes were obtained from natural environment. As a result of field and laboratory studies 57 taxa belonging to 10 families and 21 genera were identified, and they were added to the Turkish Myxobiota.

Keywords: Myxomycetes, Diversity, Selcen Mountain.

Özet

Bu çalışma 2011-2012 yılları arasında, Selcen Dağı ve yakın çevresini kapsayan 11 ayrı istasyondan toplanan numuneler üzerinde yapılmıştır. Örnekler ağaç kabukları, yaprak, çürümüş veya çürümemiş bitkisel materyallerden elde edilmiştir. Toplanan numunelere Nem Odası Tekniği uygulanmış ve miksomiset sporoforları geliştirilmeye çalışılmıştır. Ayrıca doğal ortamında gelişmiş olan miksomisetlerde toplanmıştır. Elde edilen örneklerden arazi ve laboratuvar çalışmaları sonucu 10 familyaya ait 21 cins toplam 57 takson tespit edilmiştir. Belirlenen taksonlar Türkiye Miksobiyotasına ilave edilmiştir.

Anahtar Kelimeler: Myxomycetes, Çeşitlilik, Selcen Dağı.

Introduction

Myxomycetes are small, relatively homogeneous group of eukaryotic organisms. Myxomycetes are multi-nucleate, lack of cell wall and free living organisms. The plasmodium a colorless or brightly colored vegetative body of myxomycetes that consists of multinucleate protoplasm lacking a membrane. According to last classification the myxomycetes classified in kingdom protista. Some groups of myxomycetes sometimes include lime in sporangium, out of the sporangium and sometimes both in sporangium and out of the sporangium which are important for taxonomy (Farr, 1981; Ergül and Akgül, 2011).

Some species of myxomycetes most widely distributed and the others keep their living in certain habitats. The myxomycetes are shown awareness on developed substrate and are sensitive to light, moisture, temperature and pH. The myxomycetes live on bark of living trees, plant litter on the ground, 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, decaying fruit, herbivorous animal faces and animal bone. The myxomycetes feeding with other organism (bacteria, yeast, green algae) which are living in their habitat. The material which collected from the field bring to labrotory to developed myxomycetes in moist chamber culter (Gilbert ve Martin, 1933; Ergül et al., 2005a).

Like many microorganisms, myxomycets play an important role in the forest ecosystem. Results from studies carried out across different types of terrestrial ecosystems suggest that the species associated with coarse woody debris represent one of the main components of overall myxomycete diversity (Ing, 1994; Rufino and Cavalcanti, 2007; Takahashi and Harakon, 2012). Studies may help to determine the crucial biotic and abiotic factors determining species richness and diversity of myxomycetes in major ecosystems of the world (Novozhilov et al., 2017).

The number of myxomycetes are about 1017 in the world (Lado, 2019). The number of the myxomycetes in Turkey are 286 (Ergül et al., 2005b; Baba et al., 2013; Süerdem et al., 2015; Baba, 2015; Baba and Zümre., 2015; Alkan et al., 2016; Dülger et al., 2016; Ergül et al., 2016; Baba et al., 2016; Sesli et al., 2016; Baba and Arslan, 2017; Baba and Özyiğit, 2017; Baba and Er, 2018; Baba et al., 2018; Ocak and Konuk, 2018). Aim of this study identify myxomycetes of Selcen Mountain and its close enviroins.

Materials and Methods

Sampling Area

Yayladağı is located in Hatay city in Akdeniz region. Antakya is located at the North of the town, Mediterranean sea is in the west, Syria at the east and South, Samandağı is in the northwest and Altınözü is located at the northeast of the town. Yayladağı is located between 35 ° 48 ' - 36 ° 04' north latitude and 35 ° 55 ' - 36 ° 13' east longitude. Map of the Study Area is below (Figure 1).

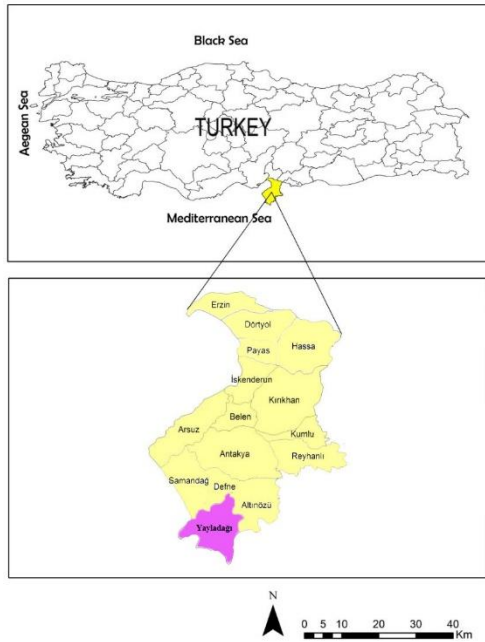


Figure 1. Map of the research area

In this study, 11 station was stated in Selcen Mountain and and its close enviroins in 2011-2012. In summer, autumn, winter and spring seasons was done field studies and sporophores were collected.

Localities, date, altitude and coordinate of study area was shown in Table 1.

Table 1. Localities, date, altitude and coordinate of study area

No	Localities	Date	Altitude (m)	Coordinate
1	Eski Kapı Hill	03.12.2012	501 m	35° 54' 39" N; 36° 00' 55" E
2	Doruca Hill	03.12.2011	516 m	35° 54' 13" N; 36° 01' 00" E
3	Karpuzlu Hill	17.12.2011	489 m	35° 54' 21" N; 36° 01' 41" E
4	Salakçam Hill	24.12.2011	507 m	35° 54' 45" N; 36° 02' 14" E
5	Karpuzluk Hill	05.02.2012	476 m	35° 53' 49" N; 36° 01' 41" E
6	Dağardı Hill	11.03.2012	460 m	35° 54' 21" N; 36° 01' 41" E
7	Ölüali Hill	18.03.2012	486 m	35° 51' 02" N; 36° 02' 29" E
8	Habeştepe Hill	25.03.2012	540 m	35° 53' 23" N; 36° 03' 45" E
9	Köşker Hill	28.04.2012	585 m	35° 53' 15" N; 36° 06' 36" E
10	Ayvacık Farm	28.04.2012	589 m	35° 53' 24" N; 36° 04' 50" E
11	Alibey Farm	28.04.2012	569 m	35° 53' 20" N; 36° 05' 28" E

Collecting samples and laboratory studies

Myxomycetes sporophores were collected from barks, woods, organic material debris. It was then carefully placed in cardboard herbarium boxes. In addition, the fructification of myxomycetes were as obtained from the moist chamber culture in the laboratory. The cultures were moistened with distilled water. Moisturized sporophores were examined every day under a dissecting microscope (Baba et al., 2018).

Identification of Samples

For identification of samples was used stereo microscope and high definition light microscope. With the stereo microscope general structure, shape, color, macroscopic dimensions of fructification and, lime availability or color and shape of lime were analyzed. The capillitium, whether lack of the pseudocapillitium and columella, if available shape and dimensions, strands of capillitium ornamentation, branch shape of the capillitium, situation of the columella free or not, features of the pseudocapillitium, shape, color, size and ornamentation of spores were studied in detail by light microscopy.

The identification of the samples was made by using different studies (Martin and Alexopoulos 1969; Farr 1976; Thind 1977; Farr 1981; Martin et al., 1983; Neubert et al., 1993; Neubert et al., 1995; Neubert et al., 2000; Stephenson and Stempen 1994; Alexopoulos et. al., 1996; Lado and Pando 1997; Ing 1999). The fungarium samples were stored in the laboratory of Department of Biology, Faculty of Arts and Science, Mustafa Kemal University.

Results

In this study 642 myxomycetes sporophores were obtained from 11 different station of Selcen Mountain and its close environs in 2011-2012. As a result of field and laboratory studies 57 taxa belonging to 10 families and 21 genera were identified.

Systematic classification

Eukaryota
Protozoa
Amoebozoa
Myxomycetes
Ceratiomyxales

Ceratiomyxaceae

1. *Ceratiomyxa fruticulosa* (O.F. Müll.) T. Macbr., Karpuzluk Hill, on *Pinus sp.* L. wood, Zümre. 218.

Echinosteliales

Echinosteliaceae

2. *Echinostelium minutum* de Bary, Eski Kapı Hill, on *P. brutia* wood, Zümre. 1; Dağardı Farm, on *P. brutia* wood, Zümre. 297; Habeştepe Hill, on *P. brutia* wood, Zümre. 468; Köşker Hill, on cone stamps, Zümre. 540.

Liceales

Cribrariaceae

3. *Cribraria cancellata* (Batsch) Nann.-Bremek., Eski kapı Hill, on *P. brutia* wood, Zümre. 1; Eski kapı Hill, on *P. brutia* wood, Natural, Zümre. 64; Karpuzlu Hill, on *P. brutia* wood, Zümre. 101; Karpuzlu Hill, on *P. brutia* wood, Zümre. 164; Dağardı Farm, on *P. brutia* wood, Zümre. 322; Ölüali Hill on *P. brutia* wood, Zümre. 376; Köşker Hill, on *P. brutia* wood, Zümre. 536; Ayvacık Farm, on *P. brutia* wood, Zümre. 569.

4. *C. intricata* Schrad., Karpuzlu Hill, on *P. brutia* wood, Zümre. 104; Dağardı Farm, on *P. brutia* wood, Zümre. 305.

5. *C. macrocarpa* Schrad., Eski kapı Hill, on *P. brutia* wood, Zümre. 58; Karpuzluk Hill, on *P. brutia* wood, Zümre. 230.

6. *C. microcarpa* (Schrad.) Pers., Eski kapı Hill, on *P. brutia* wood, Zümre. 53; Salakçam Hill, on *P. brutia* wood, Zümre. 164; Karpuzluk Hill, on *P. brutia* wood, Zümre. 240; Dağardı Farm, on *P. brutia* wood, Zümre. 295; Köşker Hill, on *P. brutia* wood, Zümre. 541; Ayvacık Farm, on *P. brutia* wood, Zümre. 565.

7. *C. minutissima* Schwein, Eski kapı Hill, on *P. brutia* wood, Zümre. 11; Köşker Hill, on *P. brutia* wood, Zümre. 533; Ayvacık Farm, on *P. brutia* wood, Zümre. 566; 569.

8. *C. piriformis* Schrad., Habeştepe Hill, on *P. brutia* wood, Zümre. 462.

9. *C. vulgaris* Schrad., Karpuzlu Hill, on *P. brutia* wood, Zümre. 105; Karpuzluk Hill, on *P. brutia* wood, Zümre. 226; Ölüali Hill, on *P. brutia* wood, Zümre. 378; Habeştepe Hill, on *P. brutia* wood, Zümre. 455; Habeştepe Hill, on *P. brutia* wood, Zümre. 462.

Liceaceae

10. *Licea castanea* G.Lister, Karpuzlu Hill, on *P. brutia* wood, Zümre. 101; Karpuzluk Hill, on *P. brutia* wood, Zümre. 226; Dağardı Farm, on *P. brutia* wood, Zümre. 295; Habeştepe Hill, on *P. brutia* wood, Zümre. 463; Köşker Hill, on *Quercus sp.*, Zümre. 544.

11. *L. kleistobolus* G.W. Martin, Eski kapı Hill, on *P. brutia* wood, Zümre. 42; Habeştepe Hill, on *P. brutia* wood, Zümre. 471.

12. *L. minima* Fr., Eski kapı Hill, on *P. brutia* wood, Zümre. 31; Dağardı Farm, on *P. brutia* wood, Zümre. 322; Habeştepe Hill, on *P. brutia* wood, Zümre. 456; Köşker Hill, on *P. brutia* wood, Zümre. 538; Alibey Farm, on *P. brutia* wood, Zümre. 629.

Reticulariaceae

13. *Lycogala epidendrum* (L.) Fr., Eski Kapı Hill, on *P. brutia* wood, Zümre. 1.
14. *Reticularia lycoperdon* Bull., Köşker Hill, on cortex of *P. brutia*, Zümre. 547.

Trichiales

Arcyriaceae

15. *Arcyria affinis* Rostaf., Dağardı Farm, on *P. brutia* wood, Zümre. 301.
16. *A. cinerea* (Bull.) Pers., Eski kapı Hill, on *P. brutia* wood, Zümre. 11; Karpuzluk Hill, on *P. brutia* wood, Zümre. 239; Dağardı Farm, on *P. brutia* wood, Zümre. 295; Ölüali Hill, on *P. brutia* wood, Zümre. 378; Habeştepe Hill, on *P. brutia* wood, Zümre. 451; Köşker Hill, on *P. brutia* wood, Zümre. 536; Alibey Farm, on *P. brutia* wood, Zümre. 601.
17. *A. denudata* (L.) Wettst., Karpuzluk Hill, on *P. brutia* wood, Zümre. 240; Habeştepe Hill, on *Quercus* sp. wood, Zümre. 464.
18. *A. ferruginea* Saut., Karpuzluk Hill, on *P. brutia* wood, Zümre. 240; Dağardı Farm, on *P. brutia* wood and bark, Zümre. 302; Habeştepe Hill, on *Quercus* sp. wood, Zümre. 469.
19. *A. incarnata* (Pers. ex J.F. Gmel.) Pers., Eski kapı Hill, on *P. brutia* wood and bark, Zümre. 4; Karpuzluk Hill, on *P. brutia* wood, Zümre. 232; Dağardı Farm, on *P. brutia* wood and bark, Zümre. 306; Köşker Hill, on *P. brutia* wood, Zümre. 561.
20. *A. pomiformis* (Leers) Rostaf., Eski kapı Hill, on *P. brutia* wood, Zümre. 31; Dağardı Farm, on *P. brutia* wood, Zümre. 296; Ölüali Hill, on *P. brutia* wood, Zümre. 380; Köşker Hill, on *P. brutia* wood, Zümre. 534; Alibey Farm, on *P. brutia* wood, Zümre. 597.
21. *A. stipata* (Schwein.) Lister, Ayvacık Farm, on *P. brutia* wood, Zümre. 564.
22. *A. versicolor* W. Phillips, Habeştepe Hill, on *P. brutia* wood, Zümre. 460.

Trichiaceae

23. *Hemitrichia abietina* (Wigand) G. Lister, Ölüali Hill, on *P. brutia* wood, Zümre. 380.
24. *Trichia botrytis* (J.F. Gmel.) Pers., Dağardı Farm, on *Quercus* sp. wood, Zümre. 303; Habeştepe Hill, on *P. brutia* wood, Zümre. 461; Köşker Hill, on *Quercus* sp. wood, Zümre. 537; Salakçam Hill, on *P. brutia* wood, Zümre. 174; Karpuzluk Hill, on *P. brutia* wood, Zümre. 225; Köşker Hill, on *Quercus* sp. wood, Zümre. 537.
25. *T. crateriformis* G.W. Martin, Karpuzluk Hill, on *P. brutia* Ten., wood, Zümre. 240; Dağardı Farm, on *P. brutia* Ten., wood, Zümre. 322; Köşker Hill, on *P. brutia* Ten. bark, Zümre. 538.
26. *T. decipiens* (Pers.) T. Macbr., Dağardı Farm, on *P. brutia* wood, Zümre. 297.
27. *T. erecta* Rex., Eski kapı Hill, on *P. brutia* bark, Zümre. 19.
28. *T. lutescens* (Lister) Lister, Eski kapı Hill, on *P. brutia* wood, Zümre. 47; Salakçam Hill, on *P. brutia* wood, Zümre. 164; Habeştepe Hill, on *P. brutia* wood, Zümre. 459.
29. *T. munda* (Lister) Meyl. Eski kapı Hill, on *P. brutia* wood, Zümre. 53.
30. *T. verrucosa* Berk., Dağardı Farm, on *P. brutia* wood, Zümre. 302; Habeştepe Hill, on *P. brutia* wood, Zümre. 450.

Physarales

Didymiaceae

31. *Diderma carneum* Nann.- Bremek., Eski kapı Hill, on *P. brutia* wood, Zümre. 62; Ölüali Hill, on *P. brutia* wood, Zümre. 367.
32. *D. radiatum* (L.) Morgan, Eski kapı Hill, on *P. brutia* wood, Zümre. 58; Ölüali Hill, on *P. brutia* wood, Zümre. 375.
33. *Didymium bahiense* Gottsb., Karpuzluk Hill, on *P. brutia* wood, Zümre. 244.

34. *D. difforme* (Pers.) Gray, Habeştepe Hill, on *P. brutia* wood, Zümre. 451; Köşker Hill, on *P. brutia* wood, Zümre. 536.

35. *D. melanospermum* (Pers.) T. Macbr., Ölüali Hill, on *P. brutia* wood, Zümre. 370.

Physaraceae

36. *Badhamia nitens* Berk., Salakçam Hill, on *P. brutia* wood, Zümre. 164.

37. *Physarum album* (Bull.) Chevall., Eski kapı Hill, on *P. brutia* wood, Zümre. 19; Karpuzluk Hill, on *P. brutia* wood, Zümre. 244.

38. *P. flavicomum* Berk., Eski kapı Hill, on *P. brutia* wood, Zümre. 10.

39. *P. murinum* Lister, Salakçam Hill, on *P. brutia* wood, Zümre. 167.

Stemonitales

Stemonitidaceae

40. *Collaria lurida* (Lister) Nann.-Bremek., Eski kapı Hill, on *P. brutia* wood, Zümre. 11; Köşker Hill, on *P. brutia* wood, Zümre. 540.

41. *Comatricha ellae* Härk., Eski kapı Hill, on *P. brutia* wood, Zümre. 3; Karpuzluk Hill on *P. brutia* wood, Zümre. 117; Salakçam Hill, on *P. brutia* wood, Zümre. 168; Karpuzluk Hill, on *P. brutia* wood, Zümre. 239; Dağardı Farm, on *P. brutia* wood, Zümre. 296; Ölüali Hill, on *P. brutia* wood, Zümre. 386; Habeştepe Hill, on *P. brutia* wood, Zümre. 452; Köşker Hill, on *P. brutia* wood, Zümre. 535; Alibey Farm, on *P. brutia* wood, Zümre. 598.

42. *C. elegans* (Racib) G. Lister, Eski kapı Hill, on *P. brutia* wood, Zümre. 31, Ölüali Hill, on *P. brutia* wood, Zümre. 377.

43. *C. nigra* (Pers. ex J.F.Gmel.) J.Schröt., Eski kapı Hill, on *Quercus* sp. wood, Zümre. 5; Karpuzluk Hill, on *P. brutia* wood, Zümre. 234; Dağardı Farm, on *P. brutia* wood, Zümre. 298; Ölüali Hill, on *P. brutia* wood, Zümre. 383; Habeştepe Hill, on *P. brutia* wood, Zümre. 455; Alibey Farm, on *P. brutia* wood, Zümre. 599.

44. *C. pulchella* (C. Bab.) Rostaf., Eski kapı Hill, on *P. brutia* wood, Zümre. 16; Salakçam Hill, on *Quercus* sp. wood, Zümre. 160.

45. *Enerthenema papillatum* (Pers.) Rostaf., Eski kapı Hill, on *P. brutia* wood, Zümre. 28; Dağardı Farm, on *P. brutia* wood, Zümre. 297.

46. *Lamproderma arcyrroides* (Sommerf.) Rostaf., Karpuzluk Hill, on *P. brutia* wood, Zümre. 240.

47. *L. laxum* H. Neubert, Ölüali Hill, on *P. brutia* wood, Zümre. 370; Köşker Hill, on *P. brutia* wood, Zümre. 557.

48. *Paradiacheopsis rigida* (Brândza) Nann. –Bremek., Eski kapı Hill, on *P. brutia* wood, Zümre. 23.

49. *Stemonitis axifera* (Bull.) T. Macbr., Eski kapı Hill, on *P. brutia* wood, Zümre. 14; Dağardı Farm, on *P. brutia* wood, Zümre. 298; Habeştepe Hill, on *P. brutia* wood, Zümre. 468; Köşker Hill, on *P. brutia* wood, Zümre. 539.

50. *S. flavogenita* E. Jahn, Karpuzluk Hill, on *P. brutia* wood and bark, Zümre. 226; Dağardı Farm, on *P. brutia* wood, Zümre. 318; Ölüali Hill, on *P. brutia* wood, Zümre. 373; Habeştepe Hill, on *Quercus* sp. bark, Zümre. 466; Köşker Hill, on *P. brutia* bark, Zümre. 544.

51. *S. fusca* Roth, Salakçam Hill, on *P. brutia* wood, Zümre. 180; Karpuzluk Hill, on *P. brutia* wood, Zümre. 296; Habeştepe Hill, on *P. brutia* wood, Zümre. 470; Ayvacık Farm, on *P. brutia* wood, Zümre. 570.

52. *S. herbatica* Peck, Alibey Farm, on *P. brutia* wood, Zümre. 594.

53. *Stemonitopsis amoena* (Nann.-Bremek.) Nann.-Bremek., Ölüali Hill, on *P. brutia* wood, Zümre. 382; Habeştepe Hill, on *P. brutia* wood, Zümre. 475.

- 54. *S. hyperopta*** (Meyl.) Nann.-Bremek., Eski kapı Hill, on *P. brutia* wood, Zümre. 22; Karpuzlu Hill, on *P. brutia* wood, Zümre. 135; Karpuzluk Hill, on *P. brutia* wood, Zümre. 235; Dağardı Farm, on *P. brutia* wood, Zümre. 295; Köşker Hill, on *P. brutia* wood, Zümre. 540.
- 55. *S. reticulata*** (H.C. Gilbert) Nann.-Bremek. & Y. Yamam., Ölüali Hill, on *P. brutia* wood, Zümre. 235; Dağardı Farm, on *P. brutia* wood, Zümre. 306; Alibey Farm, on *P. brutia* wood, Zümre. 595.
- 56. *S. subcaespitosa*** (Peck) Nann.-Bremek., Köşker Hill, on *P. brutia* wood, Zümre. 534.
- 57. *Symphytocarpus trechispora*** (Berk. ex Torrend) Nann.-Bremek., Dağardı Farm, on *P. brutia* wood, Zümre. 296.

Discussion

In this study, 57 taxa belonging to 10 families and 21 genera were identified in Selcen Mountain (Turkey) and its close environs. In our study, the distributions of families were determined as Ceratiomyxaceae 1, Echinosteliaceae 1, Cribrariaceae 7, Liceaceae 3, Reticulariaceae 2, Arcyriaceae 8, Trichiaceae 8, Didymiaceae 5, Physaraceae 4 and Stemonitidaceae 18 taxa respectively. In our study, 4 families (Cribrariaceae 7, Arcyriaceae 8, Trichiaceae 8 and Stemonitidaceae 18) constituted the majority of taxa. In this context, our study showed similarity with that of Yağız and Afyon (2005). In literature search samples of the myxomycetes mostly have been identified on the Gymnosperms rotted wood, leaves and debris (Martin ve Alexopoulos 1969; Ergül and Akgül, 2011; Baba et al., 2018). Members of Liceales, Trichiales and Stemonitales are usually grows in conifer forests (Martin and Alexopoulos 1969; Ergül and Akgül 2011; Baba et al., 2018). The majority of the samples that were identified have been deceted on the angiosperm debris.

Corticolous myxomycetes are found on decaying leaf litter, and still others on the bark of living trees and vines. Lignicolous myxomycetes are found on rotten wood and wood cortex. Foliicolous myxomycetes are found on leaves. Fimicolous myxomycetes are found on faces of the animals (Everhart and et. al., 2008). From the materials collected from the study area just from the cortex and rotten wood samples myxomycetes were obtained.

In addition, *E. minutum*, *A. cinerea*, *A. denudata* and *S. fusca* are cosmopolitan taxa (Stephenson and Stempen 1994). These species were also detected in our study area. *E. minutum*, *A. pomiformis*, *A. cinerea*, *C. ellae* and *C. nigra* have been identified in many areas of our study. In this context, it has been similar to the studies of many researchers (Ocak and Hasenekoğlu, 2003; Yağız and Afyon, 2007; Baba, 2015; Ergül et al., 2016).

Conclusion

In our study, myxomycetes were determined to be rotten in the forest ecosystem. In this context, myxomycetes were determined in Selcen Mountain (Turkey) and its close environs. As a result of field and laboratory studies 57 taxa belonging to 10 families and 21 genera were identified, and they were added to the Turkish Myxobiota. Identified myxomycetes can contribute to determine of microhabitat located in the forest ecosystem.

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Submitted: 21-07-2019 Accepted: 22-10-2019