Analysis of phytopathogenic micromycetes common in fruit trees and shrubs (the city of Samarkand as an example)

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Abstract. The study identified phytopathogenic micromycetes common on fruit trees and shrubs. The article was prepared on the basis of mycological analysis of herbarium data collected during planned expeditions. They grow *Cydonia oblonga, Malus Domestica, Vitis vinifera, Prunus cerasus, Prunus persica, Prunus Armeniaca, Prunus Domestica, Diospyros kaki, Elaeagnus angustifolia, Crataegus turkestanicum, Morus nigra, Juglans regia,* etc. During the expeditions it was noted that that the above host plants are damaged by the orders *Helotiales* (10 species), *Venturiales* (6 species), *Mycosphaerellales* (4 species) and *Pleosporales* (4 species). Also identified were 2 species belonging to the orders *Diaporthales* and *Botryosphaeriales* and *Pucciniales*, and 1 species each belonging to the orders *Dothidiales* and *Taphrinales*. The article contains detailed information on the results of mycological and taxonomic analysis, host plants and phytopathogenic fungi. This information will be useful when compiling. As a result of morphological and microscopic analysis of the collected herbarium samples and analysis of the literature, it was established that 32 species of micromycete fungi are found in 18 plant species and are pathogenic. As a result of the analysis, it was established that 32 species of micromycete fungi belong to 2 sections, 5 classes, 9 orders, 15 families and 25 genera.

1 Introduction

More than 50% of the population of Uzbekistan permanently lives in cities. The city of Samarkand is one of the largest tourist cities in Uzbekistan and is highly urbanized depending on the location of the population. The need for large amounts of vegetation cover is high in densely populated centralized cities. Dendroflora of the city of Samarkand with its species richness, the presence of centuries-old trees, many ornamental trees and shrubs (spruce, oak, pine, birch, willow, maple, magnolia, tulip tree, roses, etc.) fruit trees and shrubs are planted in all parts of the city (apple trees, quince, pears, hawthorn, almonds, mulberries, grapes, plums, cherries, apricots, peaches, etc.). At the same time, many types of decorative annual and perennial flowers are used in landscaping the central streets of Samarkand.

The susceptibility of fruit trees and shrubs to fungal diseases largely depends on their seasonal development. For example, infected leaves fall this season in the fall. Fungal spores on the leaves of the plant go into a dormant period and in the next season repeatedly cause pathological symptoms in the vegetative and generative organs of the host plant. As a result of the impact of phytopathogenic fungi on host plants, important physiological processes in plants are disrupted. In particular, it is observed that in damaged leaves the photosynthetic process is disrupted, the quality and taste of the affected fruits change, and rotting occurs. Infected seedlings lag behind in development.

In the conditions of the city of Samarkand, during planned expeditions in the spring, summer and autumn seasons of 2023-2024, phytopathogenic fungal diseases of fruit trees and shrubs were observed. Based on observations and collected herbarium data, macro- and micromorphological experiments were carried out and the following pathogenic fungi were identified. many types of decorative annual and perennial flowers are used in landscaping the central streets of Samarkand.

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2 Material and methods

Our mycological studies were carried out in the spring, summer and autumn of 2023-2024. Herbarium samples of trees and shrubs infected with pathogenic micromycetes were collected and analyzed in the Mycological Laboratory of the Herbarium-Botanical Scientific Laboratory, created at the Institute of Biochemistry of Samarkand State University. For macro- and micromorphological examination of herbarium specimens, binocular LC microscopes XSZ-PW206 and MED D30T were used.

The study of the morphology and symptoms of fungal diseases, determination of the species composition was carried out on the basis of a number of scientific literature. [1-17]. Also presented is a modern systematic nomenclature of identified micromycetes based on mycobank.org and host plant names based on powoscience.org databases [18,19].

3 Research results

As a result of morphological and microscopic analysis of the collected herbarium samples and analysis of the literature, it was established that 32 species of micromycete fungi are found in 18 plant species and are pathogenic. As a result of the analysis, it was established that 32 species of micromycete fungi belong to 2 sections, 5 classes, 9 orders, 15 families and 25 genera.

According to the taxonomic analysis of data collected during the research, it was established that pathogenic micromycetes belong to 2 divisions: Ascomycota and Basidiomycota. In particular, of the identified 32 species of phytopathogenic micromycetes, 30 species (93.75%) belong to the section Ascomycota, 4 classes, 8 orders, 13 families and 23 genera. In terms of the number of species, *Helotiales* (10 species), *Venturiales* (6 species), *Mycosphaerellales* (4 species) and *Pleosporales* (4 species) dominated. Also identified were 2 species belonging to the orders *Diaporthales* and *Botryosphaeriales*, and 1 species belonging to the orders *Dothidiales* and *Taphrinales*. 1 species (6.25%) belonging to the division Basidiomycota were analyzed for belonging to the order *Pucciniales*, the family *Phragmidaceae* (1 species) and *Gymnosporangiaceae* (1 species).

Herbarium data collected during the study were analyzed and it was found that 32 species of phytopathogenic micromycetes parasitize 18 species of host plants. These 18 host plant species belong to 11 genera and 7 families, of which 15 tree species and 3 shrub species have been identified. Representatives of the family Rosaceae (11 species) stood out in terms of number of species due to their high incidence rates.

Ascomycota (Berk.) Caval. -Sm.
Pezizomycotina O.E. Erikss. & Winka

LEOTIOMYCETES O.E. Erikss. & Winka
Helotiales Nannf.
Drepanopezizaceae Baral.

DIPLOCARPON F.A. Wolf.
D. mespili (Sorauer) B. Sutton, The Coelomycetes. Fungi imperfecti with pycnidia, acervuli and stromata: 150 (1980).
Host – *Cydonia oblonga* Mill., *Malus domestica* (Suckow) Borkh. SR: 19 April 2024. GN- 71, GN-72. (Mycology Laboratory of Herbarium-Botany Research Laboratory of Samarkand State University).

PSEUDOPEZIZA Fuckel.
Pseudopezicula tracheiphila (Müll.-Thurg.) Korf & W.Y. Zhuang, Mycotaxon 26: 464 (1986).
Host – *Vitis vinifera* L. SR: 20 June 2024. GN-233. (Mycology Laboratory of Herbarium- Botany Research Laboratory of Samarkand State University).
Sclerotiniaceae Whetzel.

MONILIA Bonord.
M. laxa (Aderh. & Ruhland) Honey, Amer. J. Bot. 23: 105 (1936).
Host – *Cydonia oblonga* Mill. SR: 25 August 2023. GN-35. (Mycology Laboratory of Herbarium-Botany Research Laboratory of Samarkand State University).

Dermateaceae Fr.

GLOEOSPORIUM Desm. & Mont.
Elsinoë ampelina (de Bary) Shear, Phytopathology 19: 677 (1929).

Host – *Vitis vinifera* L. SR: 15 September 2023. GN-42. (Mycology Laboratory of Herbarium-Botany Research Laboratory of Samarkand State University).
Erysiphaceae N.K. Sredinsky.

ERYSIPHE R. Hedw. ex DC.
E. necator Schwein., Trans. Amer. Philos. Soc. n.s. 4 (2): 270 (1832).
Host – *Vitis vinifera* L. SR: 11 October 2023. GN-50. (Mycology Laboratory of Herbarium- Botany Research Laboratory of Samarkand State University).

PODOSPHAERA Kunze.
P. oxyacanthae* f. *cydoniae Jacz., Karmannyi opredelitel' gribov. II. Muchnisto-rosjanye griby: 117 (1927).
Host – *Cydonia oblonga* Mill. SR: 17 June 2024. GN-179. (Mycology Laboratory of Herbarium-Botany Research Laboratory of Samarkand State University).
P. leucotricha (Ellis & Everh.) E.S. Salmon, Memoirs of the Torrey Botanical Club 9: 40 (1900)

Host – *Malus domestica* (Suckow) Borkh. SR: 12 June 2024. GN-162. (Mycology Laboratory of Herbarium-Botany Research Laboratory of Samarkand State University).
P. tridactyla* f. *cerasi Jacz., Karmannyi opredelitel' gribov. II. Muchnisto-rosjanye griby: 124 (1927)
Host –*Prunus cerasus* L. SR: 12 June 2024. GN-163 (Mycology Laboratory of Herbarium- Botany Research Laboratory of Samarkand State University).

PHYLLACTINIA Lév.
P. suffulta* f. *moricola Jacz., Karmannyi opredelitel' gribov. II. Muchnisto-rosjanye griby: 434 (1927)
Host – *Morus alba* L. SR: 12 June 2024. GN-166 (Mycology Laboratory of Herbarium- Botany Research Laboratory of Samarkand State University).
P. suffulta* f. *pruni Jacz., Karmannyi opredelitel' gribov. II. Muchnisto-rosjanye griby: 438 (1927)
Host –*Prunus persica* (L.) Batsch. 17 June 2024. GN-205. (Mycology Laboratory of Herbarium-Botany Research Laboratory of Samarkand State University).

SORDARIOMYCETES O.E. Erikss. & Winka.
Diaporthales Nannf.
Gnomoniaceae G. Winter.

OPHIOGNOMONIA (Sacc.) Sacc.
O. leptostyla (Fr.) Sogonov, Studies in Mycology 62: 62 (2008).
Host – *Juglans regia* L. SR: 12 June 2024. GN-160. (Mycology Laboratory of Herbarium- Botany Research Laboratory of Samarkand State University).

ASTEROMA DC.
A. diospyri (Schwein.) Sacc., Sylloge Fungorum 3: 207 (1884).
Host – *Diospyros kaki* Thunb. SR: 15 September 2023. GN-43 (Mycology Laboratory of Herbarium-Botany Research Laboratory of Samarkand State University).

DOTHIDEOMYCETES O.E. Erikss. & Winka.
Pleosporales Luttr. ex M.E. Barr.
Camarosporiaceae Wanas.

CAMAROSPORIUM Schulzer.
C. elaeagni Potebnia, Annales Mycologici 5 (1): 18 (1907).
Host – *Elaeagnus angustifolia* L. SR: 19 April 2024. GN-74. (Mycology Laboratory of Herbarium-Botany Research Laboratory of Samarkand State University).
C. juglandis Ellis & Barthol., Transactions of the Kansas Academy of Science 16: 167 (1899)
Host – *Juglans regia* L. SR: 20 April 2024. GN-102. (Mycology Laboratory of Herbarium- Botany Research Laboratory of Samarkand State University).

Pleosporaceae Nitschke.

STEMPHYLIUM Wallr.
S. vesicarium (Wallr.) E.G. Simmons, Mycologia 61 (1): 9 (1969).
Host – *Lycium barbarum* L. SR: 23 May 2023. GN-10. (Mycology Laboratory of Herbarium-Botany Research Laboratory of Samarkand State University).

Dothidotthiaceae Crous & A.J.L. Phillips

WILSONOMYCES Adask.
W. carpophilus (Lév.) Adask., J.M. Ogawa & E.E. Butler, Mycotaxon 37: 283 (1990).
Host –*Prunus persica* (L.) Batsch. 2 June 2023. GN-16. *Prunus cerasus* L. SR: 20 June 2023. GN-23., *Prunus domestica* L., *Prunus armeniaca* L. 19 June 2024. GN-78, GN-79. (Mycology Laboratory of Herbarium-Botany Research Laboratory of Samarkand State University).
Dothideales Lindau.
Saccotheciaceae Bonord.

AUREOBASIDIUM Viala & G. Boyer.
A. pullulans (De Bary) G. Arnaud ex Cif., Ribaldi & Corte, Atti Ist. Bot. Lab. Crittog. Univ. Pavia 14: 85 (1957).
Host – *Elaeagnus angustifolia* L. SR: 13 November 2023. GN-57. (Mycology Laboratory of Herbarium-Botany Research Laboratory of Samarkand State University).

Mycosphaerellales (Nannf.) P.F. Cannon.
Mycosphaerellaceae Lindau.

MYCOSPHAERELLA Johanson.
M. pomi (Pass.) Lindau, Die Natürlichen Pflanzenfamilien: 424 (1897).
Host – *Malus domestica* (Suckow) Borkh. SR: 16 September 2023. GN-44. (Mycology Laboratory of Herbarium-Botany Research Laboratory of Samarkand State University).

NEOPHLOEOSPORA U. Braun, C. Nakash., Videira & Crous.
N. maculans (Bérenger) Videira & Crous, Stud. Mycol. 87: 338 (2017).
Host – *Morus nigra* L. SR: 12 June 2024. GN-170 (Mycology Laboratory of Herbarium- Botany Research Laboratory of Samarkand State University).

RAMULARIA Unger.
R. vitis (Richon) U. Braun, International Journal of Mycology and Lichenology 3 (2-3): 283 (1988).
Host – *Vitis vinifera* L. SR: 10 Jule 2024. GN-239. (Mycology Laboratory of Herbarium- Botany Research Laboratory of Samarkand State University).

CERCOSPORA Fresen. ex Fuckel.
C. moricola Cooke, Grevillea 12 (61): 30 (1883).
Host – *Morus alba* L. SR: 12 June 2024. GN-167 (Mycology Laboratory of Herbarium- Botany Research Laboratory of Samarkand State University).

Botryosphaeriales C.L. Schoch, Crous & Shoemaker.
Botryosphaeriaceae Theiss. & P. Syd.

DIPLODIA Fr.
D. mori Berk., London J. Bot. 6: 325 (1847).
Host – *Morus alba* L. SR: 18 Jule 2023. GN-30 (Mycology Laboratory of Herbarium- Botany Research Laboratory of Samarkand State University).
D. cydoniae Sacc., Michelia 2 (7): 269 (1881).
Host – *Cydonia oblonga* Mill. SR: 10 Jule 2023. GN-29. (Mycology Laboratory of Herbarium-Botany Research Laboratory of Samarkand State University).

Venturiales Y. Zhang ter, C.L. Schoch & K.D. Hyde.
Venturiaceae E. Müll. & Arx ex M.E. Barr.

VENTURIA Sacc.
V. inaequalis f.sp. *mali* R. Menon, Phytopathologische Zeitschrift 27: 129 (1956).
Host – *Malus domestica* (Suckow) Borkh. SR: 1 June 2024. GN-133. (Mycology Laboratory of Herbarium-Botany Research Laboratory of Samarkand State University).
V. carpophila E.E. Fisher, Trans. Brit. Mycol. Soc. 44: 337 (1961).
Host – *Prunus bucharica* (Korsh.) Hand. -Mazz. SR: 15 June 2024. GN-242. (Mycology Laboratory of Herbarium-Botany Research Laboratory of Samarkand State University).

PSEUDOCERCOSPORA Speg.
P. mori (Hara) Deighton, Mycological Papers 140: 148 (1976).
Host – *Morus nigra* L. SR: 12 June 2024. GN-169 (Mycology Laboratory of Herbarium- Botany Research Laboratory of Samarkand State University).
P. vitis (Lév.) Speg., Anales del Museo Nacional de Historia Natural Buenos Aires ser. 3, 13: 438 (1911).
Host – *Vitis vinifera* L. SR: 17 Jule 2023. GN-26. (Mycology Laboratory of Herbarium- Botany Research Laboratory

of Samarkand State University).

PHOMA Sacc.
P. armeniacae Thüm.
Host – *Prunus armeniaca* L. 5 May 2024. GN-117. (Mycology Laboratory of Herbarium- Botany Research Laboratory of Samarkand State University).

DIDYMELLA Sacc.
D. negriana (Thüm.) Qian Chen & L. Cai, Stud. Mycol. 82: 178 (2015).
Host – *Vitis vinifera* L. SR: 30 May 2023. GN-11. (Mycology Laboratory of Herbarium- Botany Research Laboratory of Samarkand State University).

Taphrinomycotina O.E. Erikss. & Winka

TAPHRINOMYCETES O.E. Erikss. & Winka.
Taphrinales Gäum. & C.W. Dodge.
Taphrinaceae Gäum. & C.W. Dodge.

TAPHRINA Fr.
T. deformans (Berk.) Tul.
Host –*Prunus persica* (L.) Batsch. 4 May 2024. GN-113. (Mycology Laboratory of Herbarium-Botany Research Laboratory of Samarkand State University).
Basidiomycota Whittaker ex R.T. Moore
Pucciniomycotina R. Bauer, Begerow, J.P. Samp., M. Weiss & Oberw.

PUCCINIOMYCETES R. Bauer, Begerow, J.P. Samp., M. Weiss & Oberw.
Pucciniales Clem. & Shear.
Gymnosporangiaceae Chevall.

GYMNOSPORANGIUM R. Hedw. ex DC.
G. turkestanicum Tranzschel, Conspectus Uredinalium USSR: 77 (1939)

Host – *Crataegus turkestanica* Pojark. SR: 10 June 2024. GN-153. (Mycology Laboratory of Herbarium-Botany Research Laboratory of Samarkand State University).
Phragmidiaceae Corda.
PHRAGMIDIUM Link.
P. rubi-idaei (DC.) P. Karst., Bidrag till Kännedom av Finlands Natur och Folk 31: 52 (1879).
Host – *Rubus caesius* L. SR: 13 November 2023. GN-58. (Mycology Laboratory of Herbarium-Botany Research Laboratory of Samarkand State University).

4 Conclusion

As a result of the analysis of the collected herbarium, it was established that 32 species of micromycete fungi were found in 18 plant species. As a result of the analysis, it was established that 32 species of micromycete fungi belong to 2 sections, 5 classes, 9 orders,
15 families and 25 genera. In particular, it was found that out of 32 species of phytopathogenic micromycetes, 30 species (93.75%) belong to the Ascomycota department, and 2 species (6.25%) belong to the Basidiomycota department. 18 species of host plants belong to 11 genera and 7 families, of which 15 species of trees and 3 species of shrubs were identified. Representatives of the family *Rosaceae* (11 species) stood out in terms of number of species due to their high incidence rates.

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