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Research Article

RUST FUNGI OF PLANT SPECIES BELONGING TO THE LAMIACEAE FAMILY, COMMON IN THE NORTH-EASTERN REGIONS OF UZBEKISTAN

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ABSTRACT

The article presents scientific information about fungi of the genus Puccinia, found in plants of the Lamiaceae family, widespread in the north-east of Uzbekistan. According to the results of scientific research, 3 species of Puccinia were found in 10 species of plants of the Lamiaceae family: Puccinia menthae Pers., Puccinia phlomidis Thum., Puccinia ziziphorae P. Syd. and Syd. In addition, brief descriptions and summaries of the morphology and disease symptoms of some fungi are given.

KEYWORDS

Lamiaceae, Puccinia, Puccinia menthae, host plant, fungi.

INTRODUCTION

Zaprometov and Gaponenko were the first to conduct research on the microbiota of higher plants found in Central Asia. Their data includes information on 396 species of fungi found on 263 plant species [21, 42, 43]. In 1944-1960, Golovin and other scientists conducted research on micromycetes in higher plants [5, 6, 22, 23,

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24, 25, 26, 33]. In the period 1970-1990, information about fungi found in plants common on the territory of the Republic can be seen in the scientific works of scientists from the Botanical Institute at the Academy of Sciences of the Republic of Uzbekistan [27, 36, 38, 39, 40]. So far, in the course of scientific work and research carried out by Uzbek scientists, new species of fungi and new species of host plants have been identified on the territory of the Republic. The morphological characteristics of the identified fungi and their summaries are also formed [1, 2, 3, 4, 7, 9, 10, 11,12, 13, 14, 15, 16, 17, 18, 19, 28, 31, 32].

Scientists provided information on more than 3,500 species belonging to 200 genera of plants in the family Lamiaceae. In Central Asia there are more than 460 plant species of the Lamiaceae family, belonging to 53 families, and in Uzbekistan - 214 species, belonging to 38 families. The stem of plants of the Lamiaceae family is tetrahedral, the leaves on the stem are opposite, and a simple leaf. The petals of representatives of this family are bilabial, the lower lip consists of 3 petals, the upper lip - of 2 petals. Sometimes there are 2 skiers, and more often than not there are 4 skiers. There are 2 carpels. The fruit looks like a nut. The genera Ziziphora, Mentha, Origanum are widely used in the perfumery, confectionery, food industries, as well as in medicine [34,35].

METHODS

In 2023, field research was organized in the form of planned route monitoring of natural landscapes, crop fields and gardens in various regions of the Republic. Mycological methodological programs, various identifiers and scientific articles were used to determine the morphological characteristics of fungal species. The time and place of collection of plant samples taken for the study were also determined. The study of herbarium samples of fungi was carried out using trinocular microscopes N – MBI – 15 Biolam and 300M (HDCE-X5). A Canon IXUS 1260 digital camera was used to photograph mushrooms in natural conditions. The current systematic nomenclature of identified fungi is given based on the site indexfungorum.org [29] and the names of host plants powo.science.kew.org [30] (Fig. 1).

RESULTS AND DISCUSSION

As a result of the study of scientific sources, re-examination of samples of rust fungi stored in the Tashkent Mycological Herbarium, morphological study of newly collected materials and their taxonomic analysis, it was established that Puccinia menthae Pers is found in the majority of Puccinia fungi of 6 species Mentha aquatica L., Mentha arvensis L., Mentha longifolia L., Nepeta mariae Rege, Nepeta olgae Regel, Origanum tyttanthum Gontsch., Puccinia phlomidis Thüm. and 3 species Phlomoides hissarica (Regel) Adylov, Kamelin & Makhm., Phlomoides speciosa (Rupr.) Adylov, Kamelin & Makhm., Stachyopsis

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oblongata (Schrenk) Popov & Vved., [Eriophyton oblongatum (Schrenk) Bendiksby], Puccinia ziziphorae P Syd. & Syd.: Ziziphora pedicellata Pazij & Vved. Studies have shown that the species Puccinia menthae Pers., belonging to the Puccinia family, infect the largest number of plants of the Lamiaceae family (Diagram 1).

Table 1

Taxonomic analysis of Puccinia species found on plants of the Lamiaceae family in the north-eastern region of Uzbekistan

№	Species	Substrate/host plants	Quantity	Plant family
1	*P. menthae*	*Mentha longifolia* L.	6	**Lamiaceae**
2		*Mentha aquatica* L.		
3		*Nepeta mariae* Rege		
4		*Nepeta olgae* Regel		
5		*Origanum tyttanthum* Gontsch., [*Origanum vulgare* subsp. gracile (K.Koch) letsw.]		
6		*Mentha arvensis* L.		
7	*P. phlomidis*	*Phlomoides hissarica* (Regel) Adylov, Kamelin & Makhm.	3	
8		*Phlomoides speciosa* (Rupr.) Adylov, Kamelin & Makhm.		
9		*Stachyopsis oblongata* (Schrenk) Popov & Vved., [*Eriophyton oblongatum* (Schrenk) Bendiksby]		
10	*P. ziziphorae*	*Ziziphora pedicellata* Pazij & Vved.	1	

As can be seen from the table, 3 species of fungi belonging to the genus Puccinia were found in 10 plant species of the Lamiaceae family in the study area, and it was also found that the fungus P. menthae infects 6 plant species.

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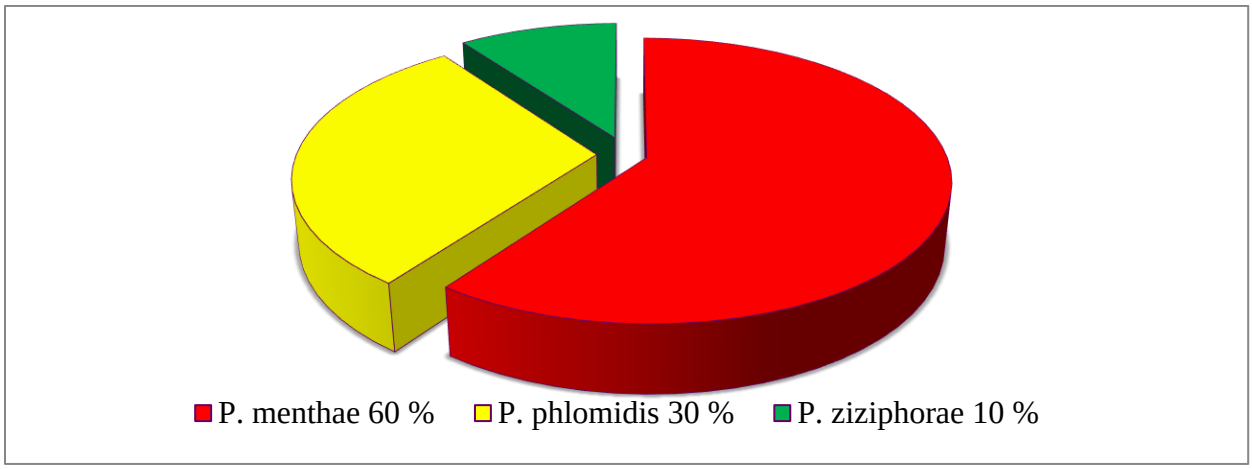
Diagram1



The conducted studies show that the species *Puccinia menthae Pers.*, belonging to the family Puccinia, affects the 6 most common plant species of the family Lamiaceae.

Brief morphological description of Puccinia species distributed among plants of the family Lamiaceae

Puccinia menthae Pers. – is the host plant of Mentha longifolia L. Spermogonia are scattered or in small groups on the underside of plant leaves, between the aecidia, with a diameter of 130-170 µm, light yellow or brown. Aecidiospores are oval, elliptical, oblong, with a diameter of 19-29×15-21 microns, the shell is pale yellow or colorless, thickness is 1-2 microns.

The mushrooms, located in the lower part of the leaves, are densely located on the surface of the leaves, fused, round, with a diameter of 0.2-0.6 mm, brown or dark brown. Uredenospores are round, elliptical, ovoid, 20-28×16-21 microns in diameter, the shell is pale yellow, 1.5-2 microns thick, spiny, with 2-3 poorly visible pores. Teliospores are broadly elliptical, with a diameter of 22-35×21-28 microns, the tip is rounded, the lower part is compressed or not narrowed, the shell is brown, 1.5-2.5 microns thick, not thickened at the tip, spiny, stalk. weak, equal to the length of the spore [44].

Puccinia menthae Pers. – is the host plant of Mentha longifolia L. Spermogonia are scattered or in small groups on the underside of plant leaves, between the aecidia, 130-170 µm in diameter, light yellow or brown. Aecidiospores are oval, elliptical, oblong, 19-29×15-21 µm in diameter, the shell is pale yellow or colorless, 1-2 µm thick. The mushrooms, located in the lower part of the leaves, are densely located on the surface of the leaves, fused, round, 0.2-0.6 mm in diameter, brown or dark brown. Uredenospores are round, elliptical, ovoid, 20-28×16-21 µm in diameter, the shell is pale yellow, 1.5-2 µm thick, spiny, with 2-3 poorly visible pores. Teliospores are broadly elliptical, with a diameter of 22-35×21-28 microns, the tip is rounded, the

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lower part is compressed or not narrowed, the shell is brown, 1.5-2.5 microns thick, not thickened at the tip, spiny, the stalk is weak, equal to the length of the spore [44].

Puccinia phlomidis Thüm. – is the host plant of Phlomoides tuberosa L. The spermogonia of the fungus are located on the underside of the leaves. Numerous, scattered or forming a small group, round in shape, 150-170 mm in diameter, pale yellow in color. Aecidiospores are spherical, oval, multifaceted, ovoid, diameter 21-25×16-19 microns, skin colorless or pale yellow, up to 1 micron thick, almost smooth or partially spiny, orange in color. There are no uredospores. Teleutococci on the upper side of the leaf, scattered or located around a ring, the body is larger, round or irregular in shape, up to 1 mm in diameter, brown in color. Teliospores are elliptical or broadly oval, 24-34×19-22 µm in diameter, the tip and base are round, the shell is brown, smooth, the stalk is colorless, very short, sometimes absent [44].

Puccinia ziziphorae P. Syd. & Syd. – is the host plant of Ziziphora pedicellata Pazij & Vved. The fungus is most often found on both sides of the plant's leaves. It also damages the branches and stems of the plant. It has the shape of round spots and is pale yellow in color. The etiospores of the fungus are pear-shaped, elliptical, round in shape, with a diameter of 19.8-21.1×18.2-22.5 microns, a shell of 1 micron, colorless. Uredospores are located mainly in the lower part of the plant leaf, sometimes in the upper part, have an ovoid, round, elliptical shape, diameter 21.6-26.0 × 16.5-23.2 microns. Teliospore diameter 26.4-33.0×19.8-23.1 µm, elliptical, slightly elongated, colorless stalk, thickness 39-45 µm. [37].

Summary of Puccinia species belonging to plants of the family Lamiaceae, distributed in the northeastern region of Uzbekistan

Basidiomycota	Phylum
Pucciniomycetes	Class
Pucciniales	Order
Pucciniaceae	Family
Puccinia	Genus

***Puccinia menthae* Pers.**

Mentha aquatica L. – Tashkent region, Parkent district, Bashkizilsoy, 07/19/1951, Bostanlyk district, Kainarsoy, 1949-1950. [37].

Mentha arvensis L. – Tashkent region, Parkent district, Bashkizilsay, 1949-1950 [37].

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Mentha longifolia L. – Namangan region, Popsky district, near Kandagan, 07/18/2000, Dubog village, 07/17/2000, Chartak district, Iskavat village, 07/23/2000, Uychinsky district, Kyzylrovot 07/24/2000, 06/29/2001, Chust, from the camp "Dustlik", 07/10/2001, 07/23/2002, Namangan district, Shor village 08/05/2000, Chartak district, Peshkurgan village, 05/26/2002 (Gaffarov-2005). Tashkent region, Parkent district, Bashkizilsay, Soyok, Gisarak, 1949-1950, Akhangaran district, 10/06/1953-1955, Angren district, 09/26/1953 [37]. Angren city, Ertoshsay village, N=41°11'0.03", E=70°18'11.93",^{h}– 1598 m, 06/26/2023.

Nepeta mariae Rege – Tashken region, Angren district, 10/06/1953-1955, Bustanlyk district, large Maydantal 07/06/1955 [37].

Nepeta olgae Regel – Tashken region, Parkent district, Bashkizilsay, 07/23/1953 [37].

Origanum tyttanthum Gontsch., – Fergana region, Fergana district, Shakhimardon, 07/10/1950. Tashken region, Parkenst district, Bashkizilsay, 04-06.1950, Sukak, 1953, Reserve, 08.13.1953, Angren district, 06-10.1953-1955 [37]. Angren city, Ertashsay village, Ertash street, N=41°11'06.03", E=70°18'11.93",^{h}– 1598 m.

Puccinia phlomidis Thüm.

Stachyopsis oblongata (Schrenk) Popov & Vved. – Fergana region, Fergana district, 07/06/1950. Tashkent region, Bustanlyk district, Alaudinsay, Maidantal, 07/22/1955 [37].

Phlomoides speciosa (Rupr.) Adylov, Kamelin & Makhm. – Tashkent region, Parkent district, Bashkizilsay reserve, 04-05.1950, Akhangaran district, Ohangaron tumani, lower Kainar hills, Yangi village, upper hills, 06/04/1953, Bustanlyk district, Maydantal, 07/22/1957 [37].

Phlomoides hissarica (Regel) Adylov, Kamelin & Makhm. – Tashkent region, Bustanlyk district, Khoramzadasay, 07/20/1961 [37].

Puccinia ziziphorae P. Syd. & Syd.

Ziziphora pedicellata Pazij & Vved. – Namangan region, Pap district, from the mountains of the eastern part of the village of Kandagan, 07/18/2000, 07/17/2002 [9]. Tashkent region, Parkent district, Shavvazsay, Bashkizilsay, 07.1949. Akhangaran district, Abiyasov, 06/26/1954, 10/02/1954. Orta-Chirchik district, Parlisoy village, upper hills, 06/08/1953. Bustanlyk district, large and small Maydontol, 08/06/1955 [37]. Bustanlyk district, Amirsay, N=41°29'10.42", E=69°56'43.1", altitude above sea level: 1611 m., 07/04/2023 [32].

CONCLUSION

Mycological studies of rust fungi found in plants of the Lamiaceae family, distributed in the North-Eastern region of Uzbekistan, showed that fungi of the Puccinia family were found in 3 species, such as Puccinia menthae Pers., Puccinia phlomidis Thüm., Puccinia ziziphorae P. Syd. & Syd.; Mentha aquatica L., Mentha arvensis L., Mentha longifolia L., Nepeta mariae Rege, Nepeta olgae Regel, Origanum tyttanthum Gontsch., Phlomoides hissarica (Regel) Adylov, Kamelin & Makhm., Phlomoides speciosa

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(Rupr.) Adylov, Kamelin & Makhm., Stachyopsis oblongata (Schrenk) Popov & Vved., [Eriophyton oblongatum (Schrenk) Bendiksby], Ziziphora pedicellata Pazij & Vved. found in 10 plant species of the Lamiaceae family. Observations have shown that these fungi are found in hilly, mountainous and foothill regions of the temperate zone. It has been observed that rust fungi develop from the second half of spring until the last months of summer and cause plant disease.

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