PARASITIC FUNGI ON ESTIVAL PLANTS FROM THE NE PART OF ROMANIA

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Abstract

Diversity is vital for effective ecosystem functioning and represent a part of biodiversity and ecosystem research. Parasitic fungi that grow on plants have reshaped the biosphere and caused the deaths of millions of people since the beginning of agriculture. Nowadays, interest for biodiversity conservation is intensified by concern about the conservation of genetic resources, destruction of forest, extinction of species and the effects of global warming. There are more than 70,000 species of fungi described by mycologists and over 90% of them are classified within Phylum *Basidiomycota* and Phylum *Ascomycota*. Understanding relationships between biodiversity and ecosystem functions is very important in the context of global plant diversity loss. This paper presents some parasitic micromycetes identified on some estival plants from different areas of Iasi County. In our fieldwork made in the spring of 2023 were indentified some parasitic micromycetes to species as: *Corydalis solida* L. Clairv., *Scilla bifolia* L., *Anemone ranunculoides*, *Ranunculus ficaria* L. and *Fritillaria meleagrioides* Patrin ex Schult. & Schult. f.. Identified parasitic micromycetes during the observations that have been made were differentiated according to the disease they cause on plants. Thus, the main diseases identified are represented by: rusts, smuts and downy mildew.

Key words: parasitic fungi, biodiversity, conservation.

Global change studies have demonstrated that we must account for the response of pathogens to a changing environment in order to understand host physiological population and community responses (Eviner V.T., Likens G.E., 2008). Mounting evidence shows that biodiversity loss frequently increases disease transmission. conversely, areas of naturally high biodiversity may serve as a source pool for new pathogens. Overall, current evidence indicates that preserving intact ecosystems and their endemic biodiversity should generally reduce the prevalence of infectious diseases (Keesing F. *et al*, 2010)

Throughout time plant pathologists have conventionally been concerned with the control or elimination of plant pathogens from crops, rather than their conservation or studies of their role and significance in natural ecosystems. But with the continuing accelerated loss of habitats and ecosystems world-wide, the increased use of fungicides, pesticides and herbicides in agriculture, and the permittig of genetically modified organisms (GMOs), the threats to pathogen diversity in the wild are immense.

Biodiversity is under threat because steady decline in the numbers of pathogen systematists, brought about by ignorance of the importance of systematics and changes in scientific approach, will undermine the curation of those collections that survive and will lead to significant losses of these irreplaceable resources. Therefore is an urgent need for plant pathologists to address to issues like diversity and significance of plant pathogen populations in natural ecosystems.

MATERIAL AND METHOD

Observation regarding the presence of the parasitic fungi on estival plants have been conducted according to an itinerary from two different areas of Iași County, durind the months March - April of 2023. A first area in which were made observations is located in the Northern part of the Cotu Morii village, from Popricani commune, Iasi county (Coordonate: 47°18′14″N 27°33′0″E). The other area were situated in Aroneanu commune, also from Iasi county (Coordonate: 47°12'59.5"N 27°37'36.2"E).

Identified host plants were collected and brought to the research laboratory of the Phytopathology discipline, within the “Ion Ionescu de la Brad” Iasi University of Life Sciences (IULS). Micromycetes identification was done based on microscopic preparations and specialized guide book, after that micromycetes were included in Herbarium Mycologicum Moldavicum” C. Sandu

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RESULTS AND DISCUSSIONS

Environmental conditions of the spring of 2023 were extremely favorable for some parasitic fungi infection on estival plants as: *Corydalis solida* L. Clairv., *Scilla bifolia* L., *Anemone ranunculoides*, *Ranunculus ficaria* L. and *Fritillaria meleagrioides* Patrin ex Schult. & Schult. f. As well as the growth stage of the plants, temperature and humidity have an important role in the onset of infections. The temperatures in the winter of 2023 were quite high, the monthly average exceeded 0 degrees in both January and February. During the observations, the monthly average air temperature (°C) was between 6.71°C in March and 15.79 °C in May (*figure 1*). Precipitation (mm) registred in the spring of 2023 for Iasi were over 75 mm in April (*figure 2*). These weather conditions have led to an increase of some parasitic fungi, such as: *Uromyces ficariae* (Schum) Lév., *Uromyces lilii* (Link.) Fuck., *Puccinia rossiana* (Sacc.) Lagh., *Tranzschelia pruni-spinosae* (Pers.) Dietel, *Ustilago scillae* Ciferri, 1931, *Peronospora corydalis* de Bary or *Peronospora ficariae* (Ness v. Essenb.) Tul. that infected wild estival plants.

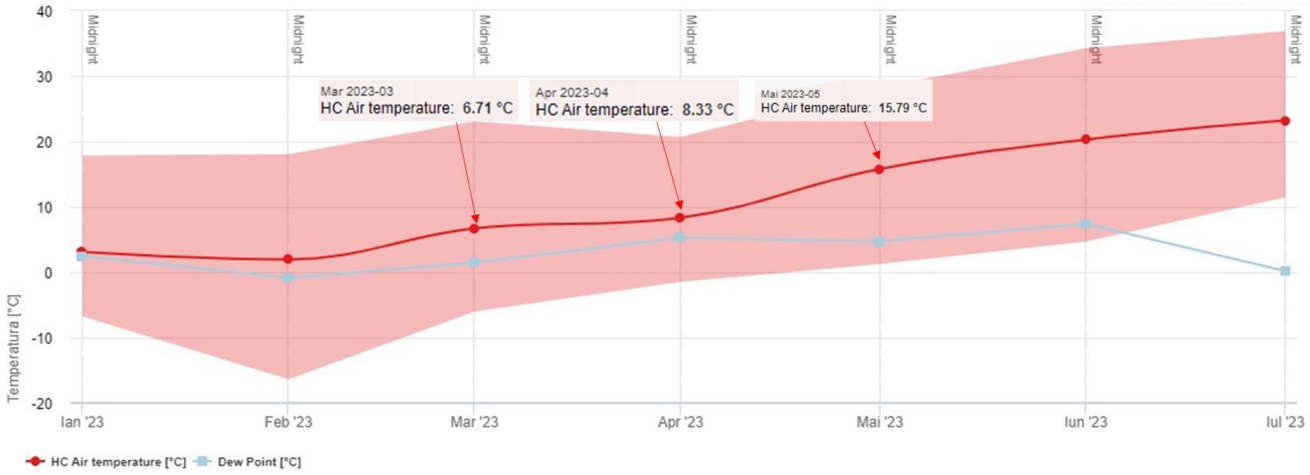

Figure 1 **Average of Air temperature (°C) and Dew Point (°C) registred in the spring of 2023 for Iasi, Romania**

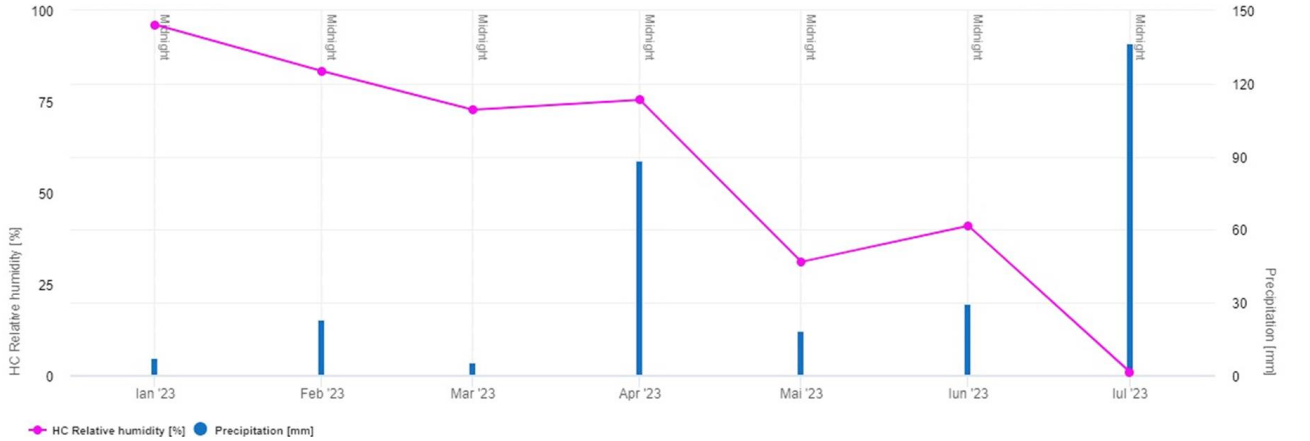

Figure 2 **Average of relative humidity (%) and precipitation (mm) registred in the spring of 2023 for Iasi, Romania**

Species of *Uromyces* occur on a wide variety of plant hosts around the world. The most important ones are caused by *Uromyces* spp. that cause infections and damage to various agricultural crops being recorded also on the host plants belonging to the families *Asteraceae*, *Euphorbiaceae*, *Fabaceae*, *Liliaceae*, *Loranthaceae*, and *Poaceae* (Gautam, A.K. *et al*, 2022).

As rust diseases occur most often in mild, moist conditions, in the spring of 2023 we observed this disease on species as *Anemone ranunculoides* L., *Ranunculus ficaria* L., *Scilla bifolia* L. and *Fritillaria meleagrioides* Patrin ex Schult. & Schult. f.

Human anthropogenic activities also play an important role in the global distribution of these organisms. So far, *Uromyces* species have been found on every land on earth except Antarctica

(Gautam, A.K. *et al*, 2022). One of the little explored groups includes heteroecious grass rusts, having aecial state on species of *Ranunculus* L. and *Ficaria verna* Huds. (Hrabětová, M. *et al*, 2015). On our observations *Ranunculus ficaria* L. was identified *Uromyces ficariae* (Schum) Lév., syn. *Aecidium ficariae* (Schum.) Saccardo, 1884 that produce on leaves yellow aecia in compact groups (*figure 3*), up to 20-50 together with spores about ± 3 µm large, slightly flattened, easily detachable appendages.

Figure 3 **Yellow aecia of *Uromyces ficariae* on *Ranunculus ficaria***

Another species identified was *Uromyces lilii* (Link.) Fuck. on *Fritillaria meleagrioides* Patrin ex Schult. & Schult. f. plant, that is a rare species recently reported in the Romania's vascular flora (Sârbu C. *et al*., 2019). First report of the species *Fritillaria meleagrioides* Patrin ex Schult. & Schult. f., in the northen part of Cotu Morii village (Popricani commune, Iasi) was in the year of 2015 (Oprea A. *et al*, 2015).

Figure 4 **Aecia of *Uromyces lilii* on *Fritillaria meleagrioides***

Uromyces lilii (Lk.) Fuck were identified on *Fritillaria meleagrioides* in the last decade of April 2023. Infected plants showed on stem, petiole and leaves pale yellow amphigenous aecia, opening with a central pore (*figure 4*).

Aeciospores are spherical, subspherical, angular spherical or elongated, with a yellow washed almost colorless membrane that presents dense and fine protuberances (*figure 5*).

From our knowledge, *Uromyces lilii* (Link.) Fuck is cited in our contry only on two other different *Fritillaria* species such as *F. tenella* M. Bieb. and *F. meleagris* L. (Florea A.M. *et al*, 2021).

First–largest rust genus is rapresented by *Puccinia*. From this genus we observed in the spring of 2023 the presence of *Puccinia rossiana* (Sacc.) Lagh., Syn. *Puccinia liliacearum* Duby ssp. *rossiana* Sacc. on *Scilla bifolia* L. a herbaceous perennial plant belonging to the genus *Scilla* of the family A*sparagaceae* known as alpine squill or two-leaf squill.

On infected plants teliospores are formed in large groups around the leaf tip, dark brown colored (*figure 6*).

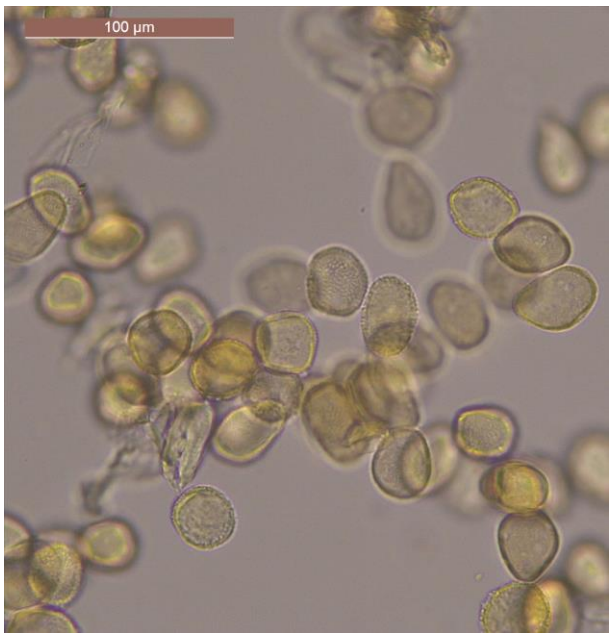

Figure 5 **Aeciospores of *Uromyces lilii***

Puccinia rossiana (Sacc.) Lagh forms two-celled teliopores, all with many small but clear pits, also they have pore of the apical cell with an acute papilla (*figure 7*).

Figure 6 **Teliospore pustules of *Puccinia rossiana* on *Scilla bifolia***

Infected plants of *Anemone ranunculoides* L. with the fungus *Tranzschelia pruni-spinosae* (Pers.) Dietel 1922, Syn. *Aecidium puctatum* Pers. appeared paled and with a grow stiffly upwards and narrowed leaves (*figure 8*).

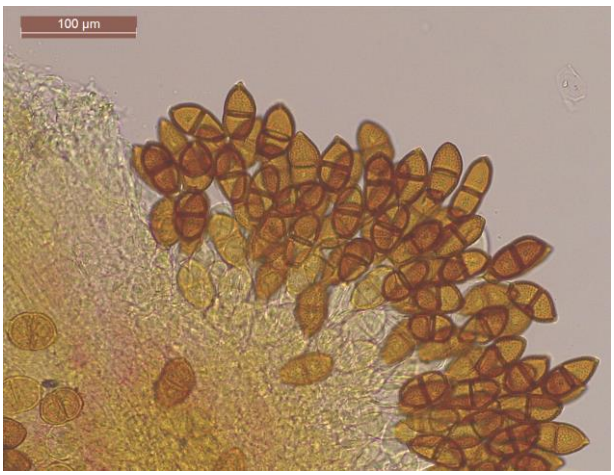

Figure 7 **Teliopores of *Puccinia rossiana***

Tranzschelia pruni-spinosae produce leaf rust on plum and the main reason of the incidence is represented by the aecial state of this rust via its aecial host viz. *Anemone ranuncoloides* L., also by increasing of nitrogen and other pollutants as a result of intensive human activity in the forests and climatic change seems to be involved in occurrence of *Tranzschelia pruni-spinosae* (Abbasi, M., 2021).

Figure 8 ***Anemone ranunculoides* infected plants with *Tranzschelia pruni-spinosae***

Smut fungi represent a large group of biotrophic plant pathogens that cause extensive yield loss and are also model organisms for studying plant–pathogen interactions. The vast majority of smut fungi infect angiosperms, and while most prefer annuals, some infect perennial

plants (Van der Linde K., How G.V., 2021). In Central Europe, *Ustilago scillae* Ciferri, 1931, smut fungus is present from the lowland to submontane vegetative belts. It was registred on *Scilla bifolia* L. by Vánky (1985) near Mosonmagyaróvár in Hungary, as well as in Romania and Yugoslavia (Bacigálová K. *et al*, 2005).

From smut group of plant pathogens, in the spring of 2023 we observed the presence of *Ustilago scillae* Ciferri, 1931, syn. *Antherospora scillae* (Ciferri) Bauer, Lutz, Begerow, Piątek & Vánky, 2008 on *Scilla bifolia* L., in a forest area situated in Aroneanu commune, from Iasi county (Coordonate: 47°12'59.5"N 27°37'36.2"E). During in the midle of March, infected plants appeared taller, higher, and bear more flowers with enlarged anthers and covered with silvery epidermis. Anthers and ovaria transformed into a dark olive-brown powdery spore mass (*figure 9*).

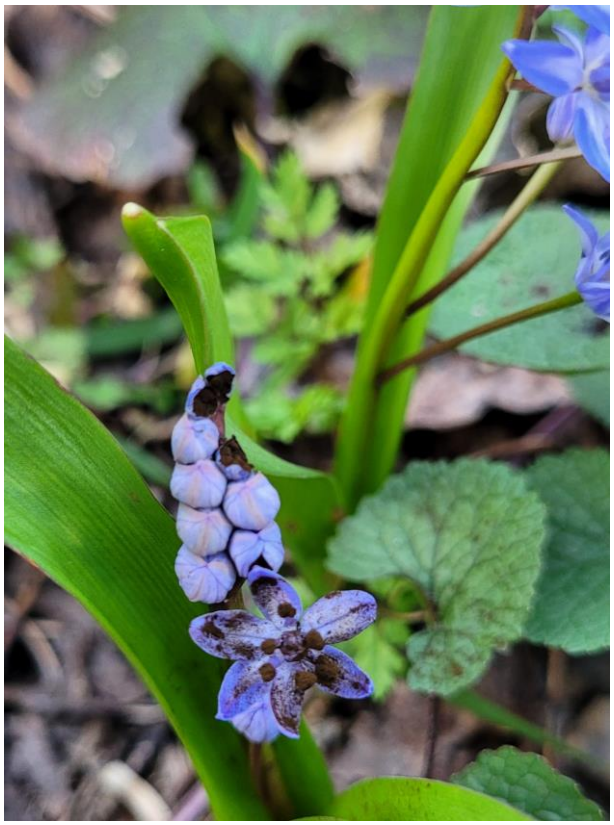

Figure 9 **Spore mass of *Ustilago scillae* on *Scilla bifolia* infected flowers**

Ustilago scillae Ciferri spores vary considerably in shape appearing globose, ovoid, elongated and irregular, pyriform, curved or subpolyhedral. Under the microscope the spores are olive-brown, with a thick sporewall, finely and densely verruculose (*figure 10*).

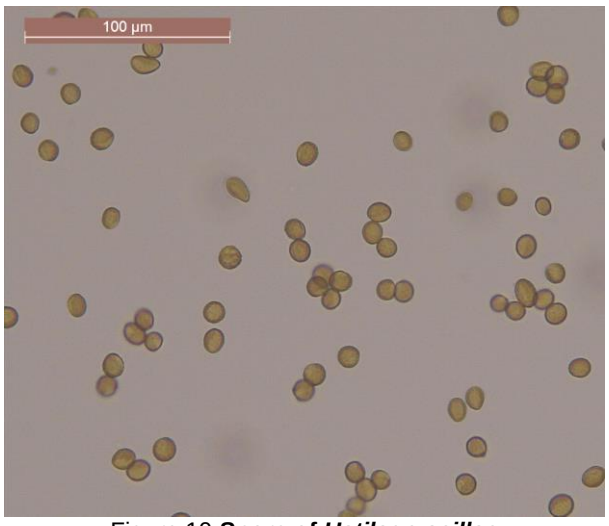

Figure 10 **Spore of *Ustilago scillae***

Peronospora is a genus of fungi classified as *Oomycetes*, that parasitisez plants, mainly dicotyledons. This group of parasitic fungi cause diseases called downy mildews and some species are of great economic importance because they cause serious diseases of crops and ornamentals (Thines M. and Choi Y.J., 2015).

We identified *Peronospora corydalis* de Bary on *Corydalis solida* L. Clairv. plants at the beginning of April 2023 in both observation locations. *Corydalis solida*, known as the fumewort, that is a species of flowering plant in the family *Papaveraceae*. On this plants an initial symptom of leaf infection was observed like a yellowing or chlorosis. As the pathogen develops, a purplish down of sporangiophores and sporangia becomes apparent on the lower leaf surface. Systemic infections with *Peronospora corydalis* de Bary. results in stunted growth, producing shorter plants with smaller leaves that are chlorotic and often curled (*figure 11*).

Figure 11 ***Corydalis solida* - healthy leaves (left side) and downy mildew appearance underneath leafs (right side).**

The morphology of sporangiophores, sporangia and oospores from symptomatic plant tissue was examined. Infected fresh leaf material from *Corydalis solida* L. plant was mounted in lactophenol for observing sporangiophores and sporangia.

In the same period and location that was observed downy mildew on *Corydalis solida* L. also we identified *Peronospora ficariae* (Ness v. Essenb.) Tul. on *Ranunculus ficaria* L. plants that are known as lesser celandine or pilewort. Is a low-growing, hairless perennial flowering plant in the buttercup family *Ranunculaceae*.

Symptoms were characteristic of those associted downy mildew on *Coridalis solida* L., leaf infection was observed like smaller leaves that are chlorotic and often curled. Infected fresh leaf material presented only sporangiophores and sporangia, wich were observed on the underside of leaves.

Sporangiophores are erect, hyaline with straight trunck, branches of sporangiophore arise from the main axis in up to seven orders, and ultimate branchlets are straight to curved and have pointed tips. Sporangia are also hyaline, in ovoid to elipsoidal shape.

CONCLUSIONS

The deficiency of distinguishing morphological characters and poor knowledge of physiological and ecological variability usually leads to a broad concept of the species that can cause important diseases.

Economically important rusts or downy mildew are relatively well known and studied, but not much attention is paid to species infecting wild plants.

Environmental conditions of the spring of 2023 were extremely favorable and lead to occurance of pathogen diversity on wild estival plants. Thus, identified parasitic fungi that infected wild estival plants are: *Uromyces ficariae* (Schum) Lév. on *Ranunculus ficaria* L., *Uromyces lilii* (Link.) Fuck. on *Fritillaria meleagrioides* Patrin ex Schult. & Schult. f., *Puccinia rossiana* (Sacc.) Lagh. on *Scilla bifolia* L., *Tranzschelia pruni-spinosae* (Pers.) Dietel 1922 on *Anemone ranunculoides* L., *Ustilago scillae* Ciferri, 1931 on *Scilla bifolia* L., *Peronospora corydalis* de Bary on *Corydalis solida* L. Clairv. and *Peronospora ficariae* (Ness v. Essenb.) Tul. on *Ranunculus ficaria* L.

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