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Mycology

New Species of Mycobiota from Adjara, Georgia

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Patogenical fungus belonging to the genus Fusarium (Hypocreales) was found on the living leaves, stems, roots and fruits of *Lycopersicum esculentum* Mill. A new species of Fusarium on L. esculentum (Solanaceae) is described in Adjara, Georgia. *Fusarium sp. nov.* is described, discussed, illustrated and compared with allied species. © *2020 Bull. Georg. Natl. Acad. Sci.*

Fusarium sp., Conidia, Lycopersicum esculentum, fungi

Fusarium is one of the most important genera of plant pathogenic fungi on earth, with a record of devastating infections in many kinds of economically important plants. It is a large genus of filamentous fungi, widely distributed in soil, subterranean and aerial plant parts, plant debris and other organic substrates. They are presented in water worldwide as part of water structure biofilms. The fungus is the most adaptable and resistant to the soil and has special plasticity to environmental conditions, persists many years in the soil and can use various substrates for food. Almost similar findings were made by foreign researchers [1, 2].

The fungus belongs to the genus Fusarium described in 1809. Until recently the taxonomy of Fusarium was in disarray, with several competing taxonomic schemes. A determined attack on this problem by an international collaborative group resolved the conflict and the taxonomy of Nelson et al. [3] was met with widespread approval.

In different classification schemes the genus is divided into subgenera and sections. There is poor correlation between the sections and phylogenetic clade. Fusarium contains 13 sections, 1,000 species and forms [4-6]. It seems that Fusarium has the ability to produce new varieties and physiological race in the process of evolution. The new species was discovered during the research of mycobionts (composition of pathogenic fungi) in the coastal zone of Georgia and neighbouring Artvin (Republic of Turkey).

Materials and Methods

The objects of research were various varieties of tomato plants (*Lycopersicum esculentum* Mill) and pathogenic fungi inhabited on them in agrocenoses of the coastal zone of Georgia and its neighbouring Artvin (Turkey). The materials were collected by using the well-known methods [7]. The routing and stationary methods were used to explore the study areas. The symptoms such as rot, mummification,

wilting, spotting, necrosis, mold, galls, canker, deformation, chlorosis, mosaic, etc., were recorded. During the study, upper and lower parts of infected plants were collected and labeled. The following procedures such as the cameral and laboratorial treatments, collection of preserved plant specimens, mounting, storage and assessment of the states of the infected plants were carried out to process the collected specimens. The dissemination and development of diseases were analyzed. The identification of fungi were carried out by using the modern identification guides [8, 9].

Collections of the new species were examined by standard light micro-scopy (Pereval, Carl Zeiss, Jena and Olympus, BX50, Hamburg, Germany). The SEM micrographs were prepared by means of a JSM-35 (Japan) SEM microscope. The specimens examined are deposited at HAL, KW and TGM [10]. Species identification was based on the morphological characteristics of single-spored isolates as described by [11-14].

For microscopic characteristic, the isolates were cultured onto carnation leaf-pieces agar (CLA) for 2 to 4 weeks [15]. Fifty macroconidia were observed randomly and the width and length were measured. Soil agar (SA) was used to enhance the formation of the chlamydospores [16]. For macrosco-pic observation, the cultural appearances (colony colour and pigmentations) were observed on potato dextrose agar (PDA). Colony colours and pigmenta-tions were determined by using Methuen handbook of colour chart [17-19].

Results and Discussion

Fusarium sp. nov. (Fig. 1, 2). We did not encounter this species on tomatoes and other plants during the research of mycobiota in Georgia for 25 years. Currently it is a widespread and aggressive fungus not only in the agrocenosis of the coastal zone of Georgia, but also in Artvin, the Republic of Turkey [20-23]. It seems Fusarium has the ability to produce new varieties and physiological race in the process of evolution. The fungus is the most flexible and resistant to soil; it persists in the soil for many years; various substrates can be used for food production [1, 2].

Etymology: The name of "Fusarium" comes from Latin "fusus", meaning [Spindle (textiles) spindle].

Holotype (designated here): in Georgia, in the vicinity of Batumi, “Mtsvane kontskhi”, on *Lycopersicum esculentum* Mill (Solanaceae), 13 July 2012, O.T. Shainidze.

Additional material examined (paratypes): Georgia, in the vicinity of Tbilisi, Delisi, river Gorge, on C. incana, 13 August 2012 and 13 July 2013, Sh. Khanchaveli; Adjara, Georgia, in the vicinity of Batumi, Mtsvane kontskhi Lab. Mycology and Phytopatology xi, on L. esculentum, 18 July 2014 and 13 September 2015, O.T. Shainidze; Kobuleti (Tsikhidziri, Chakvi, Tsetskhlauri, Alambari) 5 November 2015, 20 Augut 2016, 05 October 2016, 27 August 2017 and 7 October 2018, N. D. Beridze.

Isotypus: LAB M F BSU (Laboratory Mycology and Phytopatology, Batumi Shota Rustaveli State University, Adjara, Georgia).

Identification

Laboratory studies showed that the fungus is characterized by rapid growth in pure culture. Carnation leaf pieces on agar (of CLA), the fungus forms slimy colonies, and then it is covered with a thick, aerial hyphae of white to light purple color (Fig. 1). The fungus produces three types of spores: Macroconidia (Fig. 2, A) Microconidia (Fig. 2,B), and chlamydospores (Fig. 2,C). Macroconidia are spindle-shaped, less ellipsoidal, 20-65×2.5-5 mm, with pointed tips at both ends with five-septate (by determinant 3-5 septate less); whereas micro-conidia are non-septate, elliptical, less cylindric, 20-21.3×1.5-3 mm (by determinant, microconidias are oval, colorless and one-two-celled). Micro-

conidia are born on simple phialides arising laterally, elliptical, less cylindrical, 20-21.3 × 1.5-3 mm (by determinant, microconidias are oval, colorless and 1-2 septate). Chlamydospores colorless, oval, elliptic, 5-15 mm, smooth and rough walls, abundant and form terminally or on the basis of a leap. They are usually solitary but sometimes in pairs or chains.

Fig.1. Cultures of *Fusarium sp.* showing purple and pink pigmentation.

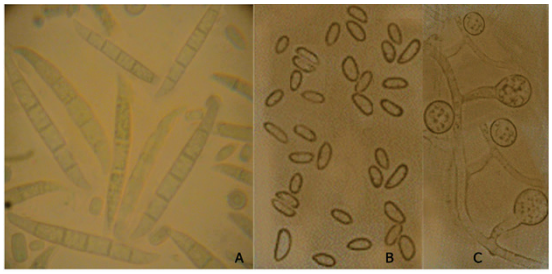

Fig. 2. Spores of *Fusarium sp.*
A – Macroconidia, B – Microconidia, C - Chlamydospores.

Symptoms

Long-term observations have shown that the first signs of infection appear be-fore the fruit ripening. The symptoms appear on older leaves and then they turn yellow, wilt and die. Yellowed and wilted leaflets drop early. A plant wilts and dies rapidly in case of the strong development of disease. An entire plant may wilt in hot, cloudy and wet weather conditions (28-32°C) within a day. The root system of the diseased plant gradually turns brown and the tap-root begins to rot off (Fig. 3). The brownish spots appear on the stem close to the soil surface. If the main stem is cut, dark brown streaks can be seen running lengthwise through the stem. This discoloration often extends far up the stem and is especially noticeable in a petiole scar. The observations have shown that the disease is not initially seen on the fruits. Then watersoaked spot appears on basal ends of the unripe fruits and they begin to fall off. However, this process can be visible before the symptoms appear. Infected fruits become soft and wet, and then they rot. Their surfaces are covered with grayish-black mycelium and they remain on the trees for a long time. Sometimes, infected fruits can be covered with different colored mycelia (Fig. 4).

Fig. 3. Root rot caused by *Fusarium sp*.

Fig. 4. Fruit rot caused by *Fusarium sp*.

Conclusion

Fusarium sp. is widespread. The dominant species are identified on tomatoes (*Lycopersicum esculentum* Mill). It differs significantly from other types of fusariosis not only by the shape and size of spores, but also by aggression.

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პათოგენური სოკო, რომელიც მიეკუთვნება ფუზარიუმის – Fusarium (Hypocreales) გვარს, გამოვლენილია პომიდვრის *Lycopersicum esculentum* ცოცხალ ფოთლებზე, ღეროზე, ფესვებსა და ნაყოფზე. ფუზარიუმის – Fusarium ახალი სახეობა *L. esculentum* (Solanaceae) აღწერილია აჭარაში, საქართველო. სტატიაში *Fusarium sp. nov.* აღწერილია, გაანალიზებულია, ილუსტრირებული და შედარებულია მონათესავე სახეობებთან.

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