

SHORT COMMUNICATION

The Endemic Plant *Limonium mucronatum* L. (Fil.) Chaz., A New Host for *Uromyces limonii* (DC.) Lev., 1849 in Morocco

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Abstract

Uromyces limonii (DC.) Lev., 1849 was observed for the first time in Morocco to a Moroccan endemic *Limonium mucronatum* L. (Phil.) Chaz. harvested in coastal rocky cliffs (near Sale). The host species and the pathogen have been identified based on phenotypic traits. Symptoms rated on the host plant were described in this study.

Keywords: Morocco, Rust, *Limonium mucronatum*, *Uromyces limonii*.

Introduction

The genus *Uromyces*, rust cosmopolitan, has 600 species widespread in all regions of the world and on different host plants (Lindquist, 1951; Savulescu, 1953). In Morocco, *Uromyces* is represented by 91 species (Khouader et al., 2008), whose *Uromyces limonii* (DC.) Lev., 1849. In Morocco, *U. limonii* was encountered on *Statice sinuata*, between Essaouira and Tamarar (Oued Dbib), at Mohammadia (Oued Mellah) and Settat (Guyot and Malençon, 1963) and *L. beaumieranum*, *L. bonduelii*, *L. moretii*, *L. sinuatum*, and *L. Thouin* (locality not specified) (Rieuf, 1970). This species has never been reported before on *Limonium mucronatum* L. (Phil.) Chaz. endemic of Morocco (Fennane et al., 1999).

U. limonii is a heteroxenous parasite whose cycle of development takes place on two hosts "*Statice gmelini* and *S. Limonium*" (Savulescu, 1953). Eciospores are observed on *S. gmelini* while urediospores and teliospores are found in combination on *S. Limonium* (Savulescu, 1953).

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Limonium mucronatum is a plant that lives at the base of cliffs or on small ledges and rocky outcrops in the levels which are greatly influenced by ocean spray and set over the dunes (Gehu and Biondi, 1998; Fennane et al., 1999). It was observed irregularly around Sidi Ifni / Mirleft at the base of the cliffs north of Safi (Gehu and Biondi, 1998). *Limonium mucronatum* hemicytrophite species that is found in the Arid, Semi-arid mild, Subhumid, the Saharan Morocco, Anti Atlas, North Atlantic Morocco and Atlantic Morocco Through (Fennane et al., 1999). It is adapted to saline soils and wetlands (Simone, 2000).

Materials and Methods

Surveys in the coastal cliffs between Rabat and Kenitra allowed us to harvest between May and June 2010, a dozen diseased plants of *L. mucronatum*. The host plant was determined on the basis of phenotypic characters (Fennane et al., 1999). Leaf Symptoms are in the form of brown, black or orange pustules.

The identification of the causative agents responsible for different symptoms, was conducted by consulting some determination keys, including those of Savulescu (1953), Hiratsuka (1973), and the descriptions of Saccardo (1888), Lindquist (1951), Cummins and Hiratsuka (1996), and Garcia-Hernandez et al. (2008).

The description of symptoms was performed using a hand lens or dissecting microscope to better visualize the pustules observed on both sides of the leaves of *L. mucronatum*. To study the fungus, scraping was performed at pustules developed on leaves of *L. mucronatum*. Preparations were made to observe, through an optical microscope (X 400), urediospores and mostly teliospores because it is the latter aspect that determines the kind of fungus.

Mounting medium is tap water and sometimes is added to the preparation a drop of bleach to the elucidation of the spore wall. Measurements of urediospores, teliospores (at least 50 spores), and pedicel were made by the means of ocular micrometer.



Fig. 1a. *Limonium mucronatum* L. (Fil.) Chaz. located at the base of a cliff. Plant on the ground.

Results and Discussion

L. mucronatum grows among the stones on a rocky cliff to the Nations beach near Bouknadel (near Sale) (Fig.1a). The substrate is influenced by ocean spray.

Phenotypic Characteristics of the Genus *Limonium*

Radical leaves in rosettes, persistent and non-flowering stem leaves scattered in tiny scales or in small axillary fascicles. Inflorescence spikelet base containing one or more flowers each spikelet is bracted by 3 bracts, an external and an average internal sessile spikelets often unilateral and usually arranged in panicles or corymbs. Flowers often bracted. Calyx usually tubular or funnel-shaped, 5 or 10 ribs scarious, brightly colored in some species. Petals free or more or less united at the base. Stamens inserted at base of petals. Styles glabrous, free or fused at base. Fruit dehiscent or indehiscent (Fennane et al., 1999).

Phenotypic Characteristics of *Limonium mucronatum*

Palm three garlic wing well developed, wavy curly. Bract internal spikelets 6-7 mm long. Mucronate leaves, the basal rather abruptly attenuated into petiole. Panicle corymbose, with unilateral spikes. Bract external and internal spikelets broadly hyaline on margins, reddish on the back. The corolla is purple (Fennane et al., 1999).

Description of Symptoms and Characteristics of *Uromyces limonii*

Forms of reproduction observed are stages II and III disease. Pustules developed are brown, black or orange, arranged on both sides of the leaves of *L. mucronatum* (Fig. 1b and Fig. 2a). Two stages of the disease were observed. The telia are observed in powder, combined black and brown. Teliospores (25 to 30 μm in length and 23.30 to 26.65 μm in wide) are unicellular, oblong, rarely ovate or ellipsoid, stalked, colored yellow-orange to brown. The wall is light brown, smooth and thick (thicker



Fig. 1b. *Limonium mucronatum* L. (Fil.) Chaz. located at the base of a cliff. Plant after harvest.

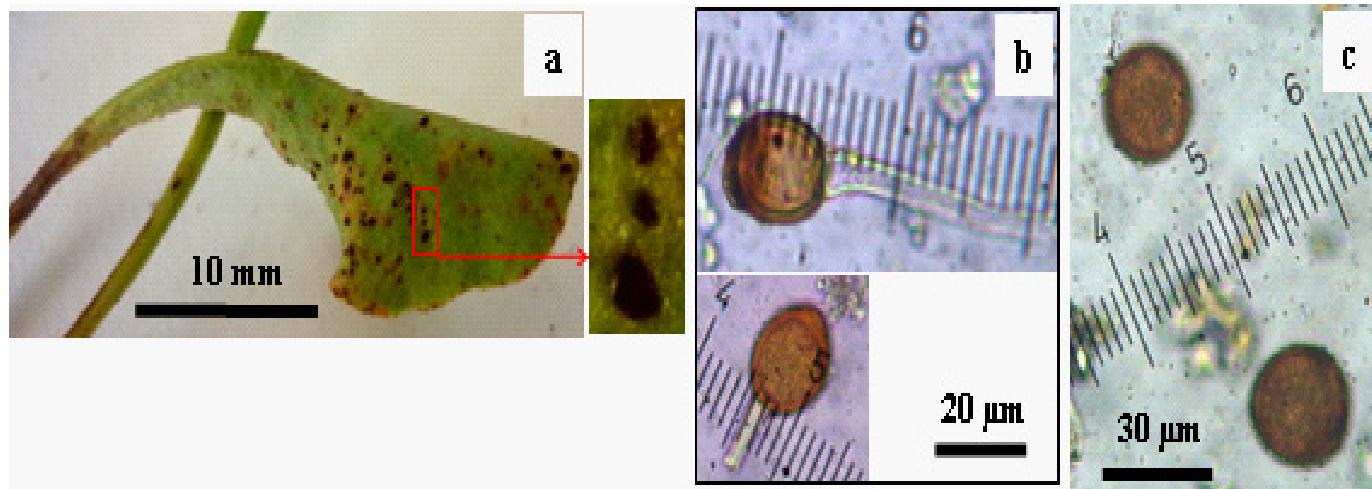


Figure 2. (a) Symptoms of *Uromyces limonii* (DC.) Lév. on *Limonium mucronatum* L.(Fil.) Chaz.; (b) Teliospores x400; (c) Uredospores x400.

at the top). The pedicel (53.30 microns) is hyaline, thick and long (2 times the length of teliospores) (Fig. 2b). The uredinia are pulverulent scored, oblong and orange. Urediospores (30.35 µm in diameter) are yellow-orange, warty, ellipsoidal or globular (2C). Aecial phase is absent. The description of these forms of reproduction is that of *U. limonii* (Savulescu, 1953; Malençon and Guyot, 1963; Garcia-Hernandez et al., 2008).

In Morocco, Guyot and Malençon (1963) reported the complete absence of aecial phase of *U. limonii*. Urediospores and teliospores can be encountered on *Statice sinuatum*. According to Rieuf (1970), *U. limonii* attack five species of the genus *Limonium* “*L. beaumieranum*, *L. bonduellii*, *L. mouretii*, *L. sinuatum*, and *L. thouin*”.

Statice mucronata (= *Limonium mucronatum*), encountered in the bush of Essaouira, the cliffs of Cape Cantin between El Jadida and Safi and Botanical Garden Cherifian the Scientific Institute in Rabat, may be attacked by *Uromyces- statice mucronatae* (Malençon, 1936; Guyot and Malençon, 1963). This species differs from *U. limonii* by the following characters:

- Remarkable predominance of aecial stage,
- Uredo stage is very small,
- Early onset of Teleuto stage is in contact with aecial groups,
- Longer Pedicel (can reach up to 87µm in length).

On the world scale, *Uromyces limonii* was found on several host plants: *Armeria* sp. and *Limonium* spp. in Chile (Lindquist, 1951; Garcia-Hernandez et al., 2008), *Statice gmelini* and *Statice limonium* to Romania (Savulescu, 1953), *Statice japonica* in Japan (Hiratsuka, 1973), *Limonium vulgare* and *Limonium* sp. in the British Isles (Ellis, 1985; Ellis, 1997), *L. vulgare* to Netherlands (Zadoks, 1988, 1992, 2005), *L. vulgare* and *Statice limonium* in Belgium (Mathieu, 1855; Vanderweyen and Fraiture, 2008).

Between May and early June 2010, we met for the first time *U. limonii* on *L. mucronatum*. Aecial phase was not observed, but the urediospores and teliospores were found in association on leaves of this new host species.

References

- Cummins G and Y Hiratsuka (1996) Illustrated Genera of Rust Fungi. Edition. The American Phytopathological Society. St. Paul, Minnesota, USA, pp. 152.
- Ellis MB and JP Ellis (1985) Microfungi on land plants. An identification guide. MacMillan Publ. Co., New York, pp. 818.
- Ellis MB and JP Ellis (1997) Microfungi on Land Plants an identification handbook. The Richmond Publishing Co Ltd., UK, pp. 868.
- Fennane M, M Ibn Tattou, J Mathez, A Ouyahya, and J El Oualidi (1999) Flore pratique du Maroc (Manuel de détermination des plantes vasculaires), Inst. Scient.- Univ. Mohammed V, Rabat, vol. 1, pp. 558.
- Garcia-Hernandez D, M Rojas-Jara, G Sepulveda, and F Chavera (2008) Presencia de *Uromyces limonii* (DC) Lév. (Roya del Limonium) Primer registro para El Valle de Lluta, Región de Arica y Parinacota, Chili. Vol. 26: 73–75.
- Géhu JM and E Biondi (1998) Nature et limites de quelque Végétations littorales de type macronésien sur les côtes sud occidentales du Maroc. Acta Bot Barc 45: 439–453.
- Guyot AL and G Malençon (1963) Uredinees du Maroc II. Trav Inst Sci Cherifien 28:1-161.
- Hiratsuka N (1973) Revision of taxonomy of the genus *Uromyces* in the Japanese Archipelago. Report of the Tottori Mycological Institute 10: 1–98.
- Khouader M, R Benkirane, A Ouazzani Touhami, E Boussalwa, and A Douira (2008) Biodiversité au service du développement durable. Vème Journées Nationales de Biodiversité, 18-20 décembre, Fès, Maroc.
- Lindquist JC (1951) Urédinales de la Provincia de Mendoza. Rev. Fac. Agr. Univ. La Plata 28: 65-144.
- Malençon G (1936) Notulae mcologiacaee. Maroccanee. I. Uredinales. Puccinia. Rev. De Mycologie I: 43-74.
- Mathieu C (1855) Supplément de la flore générale de Belgique. Additions, observations, correction Bruxelles, Gand, Leipzig, C. Muquardt 1855.
- Rieuf P (1970) Parasites et saprophytes des plantes au Maroc. Les cahiers de recherche agronomique 28: 179-357.
- Saccardo PA (1888) Sylloge Fungorum omnium hucusque cognitorum. *Uromyces limonii* (DC.) Lév. Vol. VII: 532-533.
- Savulescu A (1953) Monografia Uredinalelor din Republica Populara Romania. Tome II. Editura Academiei Republicii Populare Romane

pp. 1166.

Simone C (2000) Le geosystème dunaire anthropisé d'Essaouira-Est (Maroc atlantique) : Dynamique et paléoenvironnement. Thèse de Doctorat. Université Aix-Marseille I – Université de Provence, France, pp. 204.

Vanderweyen A and Fraiture (2008) Catalogue des Urédinales de Belgique (2ème partie). Lejeunia, série n°185, p. 31.

Zadoks JC (1988) A salty act. Notes on the dispersal of *Uromyces limonii*. Zeitschrift Pflanzenkrankheiten Pflanzenschutz 95: 384-391.

Zadoks JC (1992) Studies on the haploid stage of the sea lavender rust, *Uromyces limonii*, on *Limonium vulgare*. Journal Plant Disease and Protection 99: 168-173.

Zadoks JC (2005) Sea lavender, rust and mildew – a perennial pathosystem in the Netherlands. Wageningen Academic Publishers.