



Host Range and Distribution of Rust Fungi *Puccinia calcitrapae* DC. on *Carduus* L. (Asteraceae) species in Turkey

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Abstract

This study presents of host range and distribution of *Puccinia calcitrapae* DC. on *Carduus* L. species in Turkey. *Puccinia calcitrapae* is determined on 10 species of genus *Carduus*. These species are *C. lanuginosus* Willd., *C. nutans* L., *C. onopordioides* Fisch. ex M.Bieb., *C. adpressus* C.A.Mey., *C. hamulosus* Ehrh., *C. candicans* Waldst. & Kit., *C. acanthoides* L., *C. rechingerianus* Kazmi, *C. argentatus* L. and *C. pycnocephalus* L. Among these species, *C. rechingerianus* is a new host species for *Puccinia calcitrapae* and also 5 species (*C. onopordioides*, *C. adpressus*, *C. hamulosus*, *C. candicans* and *C. argentatus*) are firstly recorded as a host in Turkey. In addition, description, figures, localities and distribution map of *Puccinia calcitrapae* on *Carduus* species in Turkey are given.

Key words: *Cardueae*, *Carduus*, new host, Pucciniales, Turkey

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Puccinia calcitrapae DC. Pas Mantarının Türkiye'de Yetişen *Carduus* L. (Asteraceae) Türleri Üzerindeki Konakçı Dağılımı ve Yayılışı

Özet

Bu çalışmada Türkiye'de *Carduus* L. türleri üzerindeki *Puccinia calcitrapae* DC.'nin konakçı dağılımı ve yayılışı verilmiştir. *Puccinia calcitrapae* 10 farklı *Carduus* türü üzerinde belirlenmiştir. Bu türler; *C. lanuginosus* Willd., *C. nutans* L., *C. onopordioides* Fisch. ex M.Bieb., *C. adpressus* C.A.Mey., *C. hamulosus* Ehrh., *C. candicans* Waldst. & Kit., *C. acanthoides* L., *C. rechingerianus* Kazmi, *C. argentatus* L. and *C. pycnocephalus* L. Bu türler arasından, *C. rechingerianus* *Puccinia calcitrapae*' için yeni bir konakçı türdür ve 5 türde (*C. onopordioides*, *C. adpressus*, *C. hamulosus*, *C. candicans* and *C. argentatus*) konakçı olarak Türkiye de ilk kez kaydedilmiştir. Ayrıca, Türkiye'de *Carduus* türleri üzerinde bulunan *Puccinia calcitrapae*'nin betimi, şekilleri, lokaliteleri, ve yayılış haritası verilmiştir.

Anahtar kelimeler: *Cardueae*, *Carduus*, yeni konakçı, Pucciniales, Türkiye

1. Introduction

Carduus L., is the member of the Asteraceae (tribe *Cardueae*) family, including ca. 90 species distributed in Eurasia (mainly in the Mediterranean region), Northern Africa, West Asia and introduced in America and Australia (Tamamschian, 1963; Davis, 1975; Kadereit and Jeffrey, 2007). According to the recent studies this genus is represented with 16 species (27 taxa) in Turkey, of which 4 are endemic (Davis, 1975; Arabacı, 2012). In the last decade, studies about the fungi have greatly increased in Turkey (Akata, 2012; Akata and Yaprak, 2013). Further research is required, as this studies are far less than the total number of potential host plants in Turkey.

Puccinia calcitrapae DC. is autoecious and occurs on various species of Asteraceae. It is characterized by uredinoid aecidia accompanied by spermogonia, uredospores with thin, echinulate walls with 3 equatorial pores and thin-walled, rounded, more or less verruculose teleutospores without apical thickening (Wilson and Henderson, 1966).

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Puccinia calcitrapae is determined on 10 different genera (including *Carduus*) and 40 species in Turkey, in previous studies (Bahçecioğlu and Kabaktepe, 2012).

This paper is presented the host range and distribution of *Puccinia calcitrapae* on *Carduus* species in Turkey (Figure 1).

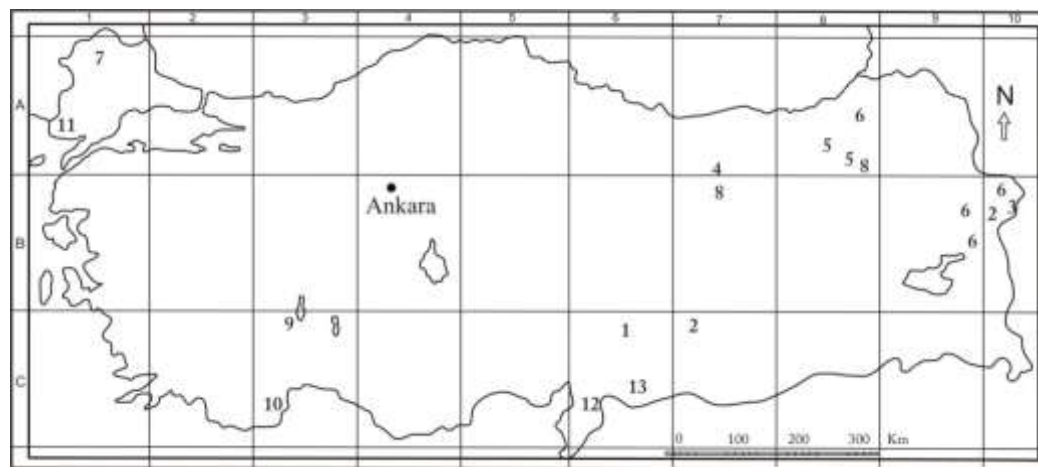


Figure 1. Distribution map of *Carduus* taxa infected by *Puccinia calcitrapae*; 1 –*C. lanuginosus*; 2 –*C. nutans* subsp. *falcato-incurvus*; 3 –*C. onopordioides* subsp. *onopordioides*; 4 –*C. onopordioides* subsp. *turcicus*; 5 –*C. adpressus*; 6 –*C. hamulosus* subsp. *hystrix*; 7 –*C. candicans* subsp. *candicans*; 8 –*C. acanthoides* subsp. *sintenisii*; 9 –*C. rechingerianus*; 10 –*C. argentatus*; 11 –*C. pycnocephalus* subsp. *albidus*; 12 –*C. pycnocephalus* subsp. *arabicus*; 13 –*C. pycnocephalus* subsp. *breviphyllarius*.

2. Materials and methods

The materials of this study were collected between the years 2006 and 2011 during the revisionary study of the Turkish *Carduus* species. The host specimens were prepared according to established herbarium techniques and identified with relevant literatures (Boissier, 1875; Tamamschian, 1963; Kazmi, 1964; Davis, 1975; Franco, 1976; Rechinger, 1979; Arabacı, 2012). Voucher specimens are deposited in the İnönü University Herbarium (INU). Examined specimens and localities are given at appendices.

Spores were scraped from dried host specimens and mounted in lactophenol and examined by light microscope (LM). In addition, the spores were mounted on stubs using double-sided adhesive tape, coated with gold using a BALTEC SCD-050 coater, and examined and photographed with a Leo Evo 40 scanning electron microscope (SEM) (Köstekci and Arabacı, 2011). Analysis LS Starter software was used for measurements. The current names of fungi are given according to www.indexfungorum.org.

3. Results

The description of *Puccinia calcitrapae* according to the Wilson & Henderson (1966) is given below:

***Puccinia calcitrapae* DC.**, in Lamarck & de Candolle, Fl. franç., edn 3 (Paris) 2: 221 (1805) (Figures 2-3).

Uredosori amphigenous, scattered, minute, pulverulent, brown. Uredospores globoid, subgloboid or ellipsoid, 20-30 × 16-28 µm, wall echinulate, 2-2,5 µm, with 3 equatorial pores. Teleutosori amphigenous, on petiols, on stems, scattered, small, sometimes confluent in large, irregular groups, dark brown. Teleutospores oblong to ovoid, rounded above and below or sometimes attenuate downwards, constricted on septa, chestnut brown, 24-50 × 16-27 µm, wall verruculose, 2-3 µm, pore in upper cell apical or subapical, in lower superior, pedicels thin, hyaline, up to 40 µm, deciduous.

Puccinia calcitrapae is a widespread rust fungi and determined from 28 *Carduus* species from previous studies of which 4 of them (*C. acanthoides*, *C. lanuginosus*, *C. nutans* and *C. pycnocephalus*) recorded from Turkey (Bahçecioğlu & Kabaktepe 2012; Farr & Rossman 2013).

In this study, the specimens of 15 of the 16 Turkish *Carduus* species (except for *C. amarus* Rech.f.) were examined. *Puccinia calcitrapae* is determined on 10 different *Carduus* species (13 taxa) belonging to 24 specimens from Turkey (Fig 1). These taxa are *C. lanuginosus* Willd., *C. nutans* L. subsp. *falcato-incurvus* P.H.Davis, *C. onopordioides* Fisch. ex M.Bieb. subsp. *onopordioides*, subsp. *turcicus* (Kazmi) P.H.Davis, *C. adpressus* C.A.Mey., *C. hamulosus* Ehrh. subsp. *hystrix* (C.A.Mey.) Kazmi, *C. candicans* Waldst. & Kit. subsp. *candicans*, *C. acanthoides* L. subsp. *sintenisii* Kazmi, *C. rechingerianus* Kazmi, *C. argentatus* L., *C. acicularis* Bertol., *C. pycnocephalus* L. subsp. *albidus* (M.Bieb.) Kazmi, subsp. *arabicus* (Jacq. ex Murray) Nyman and subsp. *breviphyllarius* P.H.Davis. Among these species, *Carduus rechingerianus* is established as a new host species for *Puccinia calcitrapae* (Figs 2-3). In

addition, *C. adpressus*, *C. argentatus*, *C. candicans*, *C. hamulosus* and *C. onopordioides s.l.* are firstly recorded as a host from Turkey.

As a result of this study, host range and distribution of rust fungi *Puccinia calcitrapae* on *Carduus* species has reached to 29 species.



Figure 2. *Puccinia calcitrapae* on *Carduus rechingerianus* A– dried herbarium specimen; B– stereo microscope view of *Puccinia calcitrapae* on leaf surface

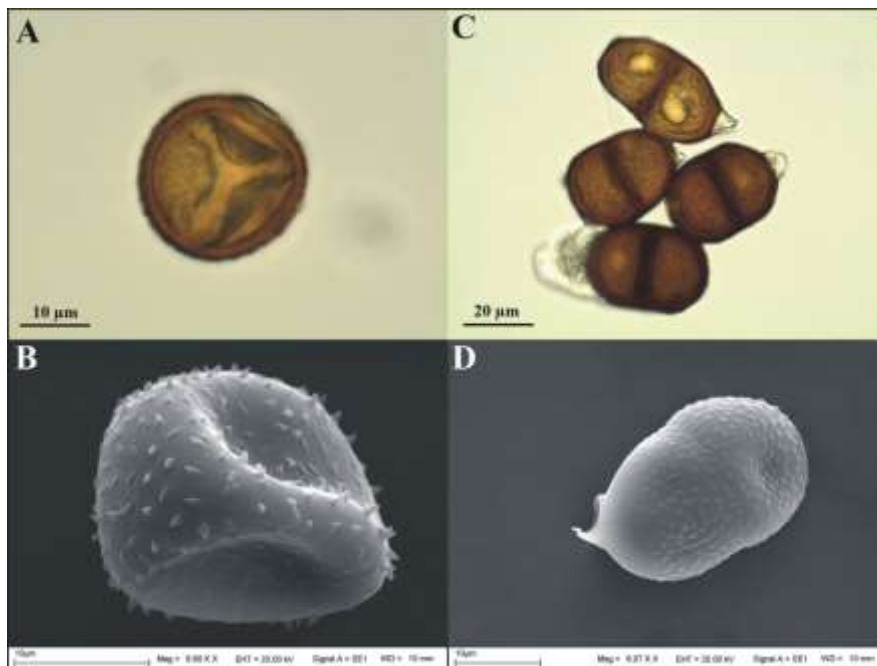


Figure 3. Uredospore A –LM view; B –SEM view. Teleutospore C –LM view; D –SEM view.

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Appendices

The examined taxa, localities and collectors.

Carduus lanuginosus Willd.: C6 Kahramanmaraş: Between Kabaktepe and Sarigüzel, 15. km, 1600 m, 09 viii 2007, Arabacı 2596-b & Dirmenci.

C. nutans L. subsp. **falcato-incurvus** Davis: B10 Ağrı: Between Ağrı and Doğubayazıt, 78. km, 1800 m, 12 viii 2007, Arabacı 2598 & Dirmenci; C7 Adıyaman: Between Şambayat and Gölbaşı, 2. km, 650 m, 26 v 2007, Arabacı 2199.

C. onopordioides Fisch. ex Bieb. subsp. **onopordioides**: B10 Ağrı: Doğubayazıt, above İshakpaşa Palace, 1900-2000 m, 28 vi 2008, Yıldız & Arabacı 2677.

C. onopordioides subsp. **turcicus** (Kazmi) Davis: A7 Gümüşhane: Between Gümüşhane and Kelkit, 10. km, 1200 m, 26 vi 2008, Arabacı 2665.

C. adpressus C.A.Meyer: A8 Rize: İkizdere, North of Ovıt Pass, Sivrikaya plateau, water side, 1800-1900 m, 19 viii 2006, Yıldız 16363 & Dirmenci; Between İkizdere and İspir, 25-30. km, alpinic meadows, 1600-1800 m, 27 vi 2008, Yıldız & Arabacı 2669; Erzurum: Between Erzurum and Ağrı, 10. km, 1800 m, 28 vi 2008, Yıldız & Arabacı 2673.

C. hamulosus Ehrh. subsp. **hystrix** (C.A.Meyer) Kazmi: A8 Artvin: Yusufeli, Sarıgöl, Yaylalar Village, South of Kaçkar Mountain, 2000-2200 m, 18 ix 2007, Yıldız 16701 & Arabacı; B9 Ağrı: Between Ağrı and Doğubayazıt, 10. km, field sides, 1700 m, 28 vi 2008, Yıldız & Arabacı 2675; Van: Between Doğubayazıt and Van, 83. km, 1900 m, 28.06.2008, Yıldız & Arabacı 2679; B10 Iğdır: Mount Ağrı, 4 km to Koran plateau, 2150 m, 13 viii 2007, Arabacı 2604.

C. candicans Waldst. & Kit. subsp. **candicans**: A1(E) Kırklareli: Between Kırklareli and Dereköy, 12. km, steppe, 350 m, 09 vi 2008, Yıldız & Arabacı 2645; Between Kırklareli and Dereköy, 3.-4. km, 250 m, 10 vi 2008, Yıldız 16784 & Arabacı.

C. acanthoides L. subsp. **sintenisii** Kazmi: A8 Erzurum: Between Erzurum and İspir, 90. km, 1900 m, 27.06.2008, Yıldız & Arabacı 2672; B7 Erzincan: Between Erzincan and Refahiye, 60. km, 1600 m, 25.06.2008, Arabacı 2663.

C. rechingeranus Kazmi: C3 Isparta: Eğirdir, between Gökdere village and Otluca, Kasnak forest, 900-1000 m, 06 vi 2008, Arabacı 2628; Between Ağlasun and Sagalassos, 1400 m, 09 vi 2011, Arabacı 2705 & Köstekci.

C. argentatus L.: C3 Antalya: Between Elmalı and Finike, 42. km, greenhouse openings, 280 m, 09 vi 2011, Arabacı 2707 & Köstekci.

C. pycnocephalus L. subsp. **albidus** (Bieb.) Kazmi: A1 (E) Edirne: Between Keşan and Enez, 7. km, 50 m, 08 vi 2008, Yıldız & Arabacı 2634.

C. pycnocephalus subsp. **arabicus** (Jacq. ex Murray) Nyman: C6 Hatay: Between Nurdağı and İslahiye, 8. km, 510 m, steppe, 15 v 2010, Köstekci 1040 & Arabacı; Between Kırıkhan and Hamam, 2. km, 100 m, road sides, 15 v 2010, Köstekci 1044 & Arabacı.

C. pycnocephalus subsp. **breviphyllarius** Davis: C6 Kilis: 1 km South of Kilis, 640 m, road sides, 15.05.2010, Köstekci 1045 & Arabacı.

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