Puccinia (Pucciniales) Species Determined on Artemisia members in Turkey

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Abstract: In the current study, two species belonging to genus Puccinia (Puccinia abrotanii Fahrend. and P. artemisiicola P. Syd. & Syd.) are determine on Artemisia and these species are new records for Turkish mycobiota. Containing the previously reported three Puccinia members recorded on Artemisia (P. chrysanthemi Roze, P. dracunculina Fahrend. and P. tanaceti DC.), an identification key was given for Turkish Puccinia determine on Artemisia. Short descriptions of the newly reported species are provided together with macro and microphotographs and discussed briefly.

Key words: Puccinia, Artemisia, New records, Turkey.

Introduction
Artemisia L., belonging to the family Asteraceae, is a large a genus of small herbs and shrubs distributed in temperate climates, generally in dry or semiarid habitats. The genus includes more than 500 species that have ecological and economic importance (Tabur et al., 2012). Many species are used as food, medicine, forage, or soil stabilizers in disturb habitats, while some species are lethal or allergenic (Hayat et al., 2009). Tracing to literature (Kürsat and Civelek, 2011; Fırat, 2015), genus Artemisia is represented by 27 taxa (21 species, 3 subspecies and 3 varieties) in Turkey (Kürsat, 2012).

The rust fungi are obligate plant parasitic group of the order Pucciniales (Basidiomycota). The group contains approximately 7000 species within 168 genera and they cause diseases in economically important plant species including ferns, conifers and angiosperms (Cummins and Hiratsuka, 2003).
Puccinia Pers. is the largest genus of this group that comprise more than 5000 widely distributed species and there are 27 species report on several Artemisia species (Farr and Rossman, 2016)

According to literature (Bahçecioğlu and Kabaktepe, 2012; Kabaktepe et al., 2015a; 2015b; 2015c; 2015d), Puccinia chrysanthemi Roze, P. dracunculina Fahrend. and P. tanaceti DC. are known as Artemisia host species, but there is not any record of Puccinia abrotani Fahrend. and P. artemisiicola P. Syd. & Syd. in Turkey.

The current study aims to make contribution to the mycobiota of Turkey.

**Materials and Methods**

Fungi samples were collected in 2007 from Turkey. The host specimens were prepared according to established herbarium techniques. Host plants identified use the Flora of Turkey and the East Aegean Islands (Cullen, 1975). Spores were scraped from dried host specimens and mounted in lactophenol. Macrophotographs were taken under a stereo microscope (Novex trinocular zoom stereo microscope RZT-SF). Microphotographs were taken under a light microscope (Noveks B series 1000). Analysis LS Starterwas software was used to measure. The current names of fungi are given according to www.indexfungorum.org. Names of host plants and families are given according to http://www.theplanlist.org. Voucher specimen are deposited in the İnönü University Herbarium (INU).

**Results**

Systematic enumeration of the reported species belonging to the genus Puccinia is provided below.

Key to species of Puccinia determinate on Artemisia in Turkey.
1. Mesospores not seen ...............................2
1.* Mesospores seen ....................................3
2. Teleutospores smooth ..............P. dracunculina
2.* Teleutospores finely verruculose at upper cell ........................................P. tanaceti
3. Teleutospores smooth ..........P. artemisiicola
3.* Teleutospores verruculose .................4
4. Teleutospores chestnut brown and up to 46 μm................................. P. chrysanthemi
4.* Teleutospores dark brown and up to 62 μm ........................................P. abrotani


**Figure 1.** P. abrotani on Artemisia abrotanum
A- dried herbarium specimen;
B- infected plant leaves
C- stereo microscope view of P. abrotani on stem surface;
D- LM view of Teleutospores.

Uredinia generally hypophyllous, on irregular, pallid-yellow or brownish, scattered or in clusters, 1-1,5 mm, pulverulent, snuff brown. Uredinospores globoid-ellipsoid, 22-39 × 23-32 μm, wall echinulate, brown with 3 equatorial pores.
Teleutosori mixed with uredinia. Teleutospores ellipsoid or oblong, rounded at the both ends or slightly thickened above or slightly attenuate downwards, scarcely constricted on septa, 29-62 × 19-34 μm, wall delicately verruculose, dark brown, 1,5-2,5 μm, at apex up to 9 μm, pore in upper cell apical, pedicels up to 80 μm, hyaline, persistent. Mesospores subgloboïd or pyriform, 32-37 20-21 μm, dark brown.

Specimen examined: Muş, on Artemisia abrotanum L., 1266 m., N 38º 47.423, E 41º 29.795, 23.11. 2007, M. Kurşat 1044.


Specimen examined: Ağrı, on Artemisia absinthium L. Doğubeyazıt, Suluçem,northern slopes of Zor mountain, 2054 m, N 39º 42.476, E 43º 51.399, 22.09.2007, Ş. Civelek, M. Kurşat 1063; Bitlis, on Artemisia incana (L.) Druce, Adilcevaz-Ahlat pass, 1720 m, N 38º 47.855, E 42º 43.000, 23.09.2007, Ş. Civelek, M. Kurşat 1075; Malatya, Sivas, on Artemisia austriaca Jacq. and Artemisia taurica Willd. (Bahçecioglu and Yıldız, 2001; 2005).


Specimen examined: Hakkari, on Artemisia haussknechtii Boiss., Hakkari- Van pass,1624 m, N 37º 34.873, E 43º 54.148, 21.09.2007, Ş. Civelek, M. Kurşat 1059;

Figure 2. P. artemisiicola on Artemisia taurica
A- dried herbarium specimen;
B- infected plant leaves
C- stereo microscope view of P. artemisiicola on stem surface;
D- LM view of Teleutospores.
Van on *Artemisia splendens* Willd., Gürpınar, Sopa konak village, 2692 m, N 38° 12.533, E 43° 37.055, 21.09.2007, Ş. Civelek, M. Kurşat 1060; Kahramanmaraş, on *Artemisia campestris* L. (Bahçecioğlu et al., 2006); Kars, Ardahan; on *Artemisia campestris* L. var. *marschalliana* (Spreng.) Poljak. (given as *Artemisia marschalliana* Spreng.) (Bahçecioğlu et al., 2006); Kars, Ardahan, Kahramanmaraş, on *Artemisia vulgaris* L. (Bahçecioğlu et al., 2006; Bahçecioğlu and Kabaktepe 2012).

Discussion

*P. abrotani* and *P. artemisiicola* resemble other rust species growing on *Artemisia* due to their general appearance. *P. abrotani* can easily be separated from other *Puccinia* species growing on *Artemisia* by its larger and darker teliospores while *P. artemisiicola* by its smooth teliospores and mesosporides.

*P. abrotani* has been reported from Belarus, Germany, Lithuania, Poland and Romania on *Artemisia abrotanum* L. (Braun, 1982; Girilovich et al., 2003; Ignataviciute and Minkevicius, 1993; Savulescu, 1953).

Tracing to literature on Turkish *Puccinia* (Bahçecoğlu and Kabaktepe, 2012; Kabaktepe et al., 2015a), 215 taxa (205 species and 10 varieties) have previously been reported from Turkey.

With the current study, *Puccinia abrotani* Fahrend. and *P. artemisiicola* P. Syd. & Syd. are recorded for Turkish *Puccinia* for the first time and number of Turkish *Puccinia* taxa increase to 217. Among them, 5 species are determinate on *Artemisia* species.

Acknowledgements

We are indebted to TUBİTAK (Project no. TBAG-106T559) for its financial support.

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