STUDIES IN THE FLORA OF AFGHANISTAN XII: UREDINALES, 2

D. M. HENDERSON

This short enumeration of Rust Fungi collected in Afghanistan in the course of an expedition by I. C. Hedge, P. Wendelbo and L. Ekberg adds some species to the little-known rust flora of that country. I am indebted to my colleague, I. C. Hedge for most of the identifications of the hosts and to Per Wendelbo for helpful information on the identity of *Primula kauffmanniana*.

Aecidium euphorbiae Pers. in Syn. Meth. Fungorum 211 (1801).
On *Euphorbia* aff. *aucheri* Boiss. Prov. Laghman: Alishang, upper part of Darrah Rastyon, 3000 m, moist ground among stones, 15 vii 1969, *W.&E.*, *W.* 9668 a.

The spermogonia and aecidia are developed on systemic mycelium which deforms the host. There are many possible dicaryont hosts and taxonomic affinities for *Euphorbia* aecidia and these have been summarised previously (Henderson, 1964).

Aecidium sarcinatum Lindr. in Acta Soc. Fauna Flora Fennica 22: 165 (1902).
On *Ferula jaeschkeana* Vatke. Prov. Parvan: Tob Darrah, 3 km SW of Charikar, 2200 m, dry slopes, 28 iv 1969, *H.&W.*, *W.* 7403.

This collection agrees completely with the previous collection on this host (Henderson & Jørstad, 1966). Its correct placing without knowledge of dicaryont stages is equally doubtful.

Coleosporium tussilaginis (Pers.) Lév. in Orbigny, Dict. Univ. Hist. Nat. 12: 786 (1849).
On *Campanula* sp. Prov. Badakhshan: valley to the S of Qeshm, 1200 m, rock crevices, 29 vi 1969, *H.&W.*, *W.* 9274. [Uredinia only].
On *Campanula leucantha* Gilli. Prov. Baghlan: Khinjan valley, N side of Salang Pass, 1600 m, stony slopes, 4 vi 1969, *H.&W.*, *W.* 8587 [Uredinia only].

Melampsora euphorbiae (Schub.) Cast., Obs. Pl. Acotyl. 2: 18 (1843).
On *Euphorbia helioscopia L.* Prov. Fariab: Maimana, 800 m, 22 v 1969, *H.W.&E.*, *W.* 8258 [Uredinia and telia].
On *Euphorbia* aff. *megalocarpa* Rech. fil. Prov. Herat: Sabzak pass on road from Herat to Qala Nau, mountain at start of pass, 2300 m, 15 v 1969, *H.W.&E.*, *W.* 8046. [Uredinia only].
On *Euphorbia bungei* Boiss. Prov. Samangan: midway between Mazar-i-Sharif and Tashkurgan, 300 m, semi-desert, 31 v 1969, *H.W.&E.*, *W.* 8545. [Uredinia and telia].

On *Euphorbia oxyridea* Boiss. Prov. Herat: 40 km S of Herat on main road to Farah Rud, first pass, 1600 m, 14 v 1969, *H.W.&E.*, *W.* 7979 [Uredinia only].

Phragmidium bayatii Esf. & Petrak in Ann. Mycol. 39: 206 (1941).
On *Hulthemia berberifolia* (Pall.) Dum. Prov. Herat: 40 kms S of Herat on main road to Farah Rud, first pass, 1600 m, dry stony hillside, 14 v 1969, *H.W.&E.*, *W.* 7994.

Puccinia bulbocastani Fuck., Symb. Myc. 52 (1869).
On *Bunium* sp. Prov. Balkh: Ali Kuh, mt. 18 km S of Mazar-i- Sharif, 1600 m, stony slopes, 29 v 1969, *H.W.&E.*, *W.* 8485.
On *Bunium* sp. Prov. Zabul; near Kalat, 1800 m, dry slopes, 24 iv 1969, *H.&E.*, *W.* 7332.

Telia only, spores reticulate. The verrucose-spored *Puccinia litvinovii* was recorded previously from Afghanistan on *Bunium cabulicum* (Henderson & Jørstad, 1966).

Puccinia calcitrapae. DC., Fl. Fr. 2: 221 (1805).
On *Cousinia* sp. Prov. Badakhshan: pass W of Qeshm on road to Talaquan, 1600 m, dry slopes, 5 vii 1969, *H.&W.*, *W.* 9489.
On *Cousinia* sp. Prov. Herat: 35 km S of Herat on main road to Farah Rud, 1480 m dry stony slopes, 14 v 1969, *H.W.&E.*, *W.* 8019.
On *Cousinia* sp. Prov. Herat: 35 km S of Herat on main road to Farah Rud, 1480 m, dry stony slopes, 14 v 1969, *H.W.&E.*, *W.* 8018.
These collections show the same thick-walled teliospores (2–3 μm) noted in *P. calcitrapae* on *Cousinia* in the previous paper on Afghan rusts (Henderson & Jørstad, 1966).
On *Carduus pycnocephalus* L. Prov. Fariab: Maimana, 22 v 1969, *H.W.&E.*, *W.* 8261.

Puccinia cortusae Tranz. in Sydow, Monogr. Ured., 1: 886 (1904).
On *Primula kauffmanniana* Regel. Prov. Badakhshan: Khumbuk area, side valley to the SW of Robat, 3000 m, slopes, 3 vii 1969, *H.&W.*, *W.* 9403. Telia only, hypophyllous, confluent in groups, 2–3 mm in diameter, teliospores 22–29 × 19–22 μm, pale brown, wall smooth, 1 μm thick, upper pore sub-apical to median, lower pore median or near the septum each with a small hyaline cap, pedicels hyaline, very short.

This collection on *Primula kauffmanniana* is an exact match for the isotype of *Puccinia cortusae* Tranz. on *Cortusa matthioli* (Turkestania, Prov. Fergana. distr. Osch, 1900 vi 13/26, *W. Tranzschel*). It belongs to a small group of species centred on the autoecious eu-form *Puccinia primulae*. *Puccinia soldanellae* is another autoecious eu-form of the same group. From these have developed at least two micro-forms, *Puccinia dubyi* Muller-Arg. on *Androsace* and *Puccinia cortusae* on *Cortusa*. This find of *P. cortusae* on a *Primula* of course can also be used as additional evidence of the close relation between the two host genera, *Primula* and *Cortusa*, and especially between the section *Cortusoides* of *Primula* and *Cortusa*. Indeed, *Primula kauffmanniana* and *Cortusa matthioli* seem vegetatively indistinguishable and Wendelbo (1961) has stressed that the distinctions between *Cortusa* and its nearest relatives in *Primula* are slender.

Puccinia gymnandrae Tranz., in Sydow, Monogr. Ured. 1: 247 (1904).
On *Lagotis blatteri* O.E. Schulz. Prov. Vardak: 20 km S of Markas (Behsud), 2600 m, dry slopes, 13 vi 1969, *H.&W.*, *W.* 8806.
Telia only, teliospore wall finely and densely verrucose, upper pore lateral lower pore median, each with a flat cap.

This collection agrees with earlier descriptions from USSR (Tranzschel, 1939); the only additional information lies in the positions of the pores. The rust is known from various parts of the USSR (Tranzschel, 1939) and from Tibet (Sydow, 1904) but not hitherto from Afghanistan.

Puccinia isopyri Tranz. in Trudy Inst. Akad. Sci. URSS Ser II, 1: 268 (1933).
On *Isopyrum anemonoides* Kar. & Kir. Prov. Badakhshan; Khumbuk area, side valley to the SW of Robat, 2800 m, 3 vii 1969, *H.&W.*, *W.* 9402.

This interesting collection seems to match Tranzschel's original description perfectly. Together with *P. pulsatillae*, *P. melasmioides* and *P. phyllachoroides*, *P. isopyri* forms a very distinct group of micro-forms undoubtedly reduced from the complex group of heteroecious rusts forming *Puccinia recondita* in the widest sense. They are all microforms on ranunculaceous hosts showing the same characteristically compartmented telia as *P. recondita* in its telial stage on grass hosts. However, the origins of these microforms pose certain questions for the taxonomist. It is highly probable that they have arisen independently from different specialised races of *P. recondita* by reduction of the life cycle to telia on the original aecidial host. They may equally well have spread from a single microform arising on one aecidial host. It seems doubtful if the scanty morphology of these microforms will allow us to decide which of these possibilities is more likely.
It is possible that *P. isopyri* is a microform derived from *P. recondita* f. sp. *tritici* for the only wild aecidial host so far suggested for this rust is *Isopyrum fumarioides*.

Puccinia komarovi Tranz. in Sydow, Monogr. Ured. 1: 451 (1904).
On *Impatiens* sp. Prov. Badakhshan: Khumbuk area, Khumbuk Bala, 1800 m, streamside, 4 vii 1969, *H.&W.*, *W.* 9456.

This species, hitherto unknown from Afghanistan but recorded from the USSR, is unusual in the single apical pore of the uredospore. It is an auteuform but only telia containing teliospores and uredospores are present in this collection.

Puccinia tanaceti DC., Fl. Fr. 2: 222 (1805).
On *Tanacetum fischerae* Aitch. & Hemsl. Prov. Baghlan: N side of Salang pass, 2500 m, 22 vii 1969, *E.&W.*, *W.* 9836.

Uredinia and telia. This rust was recorded in a previous paper on several species of *Chrysanthemum*, on *Tanacetum turkestanicum* and on *Artemisia persica*. (Henderson & Jørstad, 1966). Notes on synonyms were given by Henderson (1964).

Puccinia malvacearum Bert. ex Mont. in Gay, Hist. Fis. Polit. Chile 8: 43 (1852).
On *Malva neglecta* Wallr. Prov. Fariab: Maimana, 800 m, 22 v 1969, *H.W.&E.*, *W.* 8263.

Puccinia phlomidis Thuem. in Bull. Soc. Nat. Mosc. 1878: 216 (1878).
On *Eremostachys gymnoclada* Rech. f. & Koeie. Prov. Badghis: Darrah-i-Bum, 800 m, stone slopes, 19 v 1969, *H.W.&E.*, *W.* 8192.
Telia only, chiefly epiphyllous on pale spots, 1–2 mm in diameter, teliospores 32–36 × 20–22 μm, thin-walled, smooth, light brown, upper pore apical, lower pore median.

The principal hosts for *Puccinia phlomidis* are species of *Phlomis* but it has been recorded on *Eremostachys laciniata* and *E. lehmanniana* (Tranzschel, 1939), *Stachyopsis oblongatus* and *Leonurus tataricus* (Nevodovski, 1956) in the USSR.

Puccinia plicata Kom. in Script. Bot. Hort. Univ. Imp. Petropol. 4: 28 (1895).
On *Prangos pabularia* Lindl. Prov. Fariah: pass between Farahrood and Shindand, 1160 m, stony slopes, 8 v 1969, *H.W.&E.*, *W.* 7681 [Telia only].

Puccinia pulvinata Rabenh. in Hedwigia 10: 20 (1871).
On *Centaurea bruguieriana* Hand.-Mazz. Prov. Herat: 30 km E of Herat on road to Obeh, 1050 m, fieldside, 13 v 1969, *H.W.&E.*, *W.* 7953.
On *Echinops* sp. Prov. Kabul: NW of Kabul on road to Charikar, 1900 m, stony slopes, 6 vii 1969, *E.*, *W.* 9543.

P. pulvinata clearly belongs to the *P. calcitrapae* affinity but differs in the slightly smoother teliospores and long-persistent teliospore pedicels. Its uredospores seem indistinguishable from *P. calcitrapae*. By those workers who regard generic identity of host plant as a taxonomic limit for rust species, this rust has been given several names without mention of *P. pulvinata* because *P. pulvinata* was described on *Echinops; P. centaureae* var. *australis* Trotter, *P. centaureae-asperae* Cast. and *P. centaureae-virgatae* Viennot-Bourgin are all candidates for synonymy.

Puccinia recondita Rob. ex Desm. in Bull. Soc. Bot. Fr. 4: 798 (1857).
On *Bromus* sp. Prov. Fariab: Maimana, 800 m, 22 v 1969, *H.W.&E.*, *W.* 8250. [Telia only].

Puccinia rhagadioli Syd., Monographia Uredinearum 1: 139 (1902).
On *Rhagadiolus stellatus* (L.) Gaertn. Prov. Fariab near Kawlyan E of Belcheragh, 1200 m, soil slopes, 26 v 1969, *H.W.&E.*, *W.* 8383.
Telia only, some uredospores intermixed with teliospores, small, 19–22 × 17–19 μm, with 3 equatorial pores, teliospores 30–33 × 24–27 μm, wall very dark brown, 2–3·5 μm thick, verrucose.

The relationships of this rust were noted in a previous paper (Henderson, 1964). A further distinctive feature of the species may be the relatively widely spaced verrucae on the teliospores (2–5 μm from centre to centre).

Puccinia scutellariae Henderson in Notes R.B.G. Edinb. 29: 389 (1969).
On *Scutellaria multicaulis* Boiss. Prov. Vardak: Khash Kul Bridge at Helmand river, 2560 m, stony slopes, 8 vi 1969, *H.&W.*, *W.* 8694.

This collection matches exactly the type material of this recently described species—on *Scutellaria glutinosa* from Afghanistan (Henderson, 1969). It is

interesting also that the witches' broom due to partial systemic infection noted on the rather scanty type specimen is amply confirmed by this richer gathering.

Puccinia smyrnii Biv.–Bern., Stirp. Pl. Sicil. 4: 30 (1816).
On *Smyrnium cordifolium* Boiss. Prov. Herat: mountain above Chesmeh Obeh, Kuh e Darunta, 2200 m, stony slopes, 11 v 1969, *H.W.&E.*, *W.* 7867.

Puccinia sogdiana Kom. in Script. Bot. Hort. Univ. Imp. Petropol. 4: 27 (1895).
On *Ferula* sp. Prov. Fariab: between Kata Qala and Zarshoy, c. 15 km NW of Belcheragh, 900 m, stony slopes, 23 v 1969, *H.W.&E.*, *W.* 8323.

This collection bears only teliospores as did the collection previously noted on *Ferula jaeschkeana* from Afghanistan (Henderson & Jørstad, 1966).

Puccinia tulipae Schroet. in Jahresber. Schles. Ges. 53: 117 (1875).
On *Tulipa stellata* Hook. f. Prov. Paktiva: Safed Kuh, Mt. Sikaram, 3700 m, stony slopes, 21 vi 1969, *H.&W.*, *W.* 9007.

This collection matches the one recorded previously from Afghanistan (Henderson & Jørstad, 1966) but uredospores are quite absent and a proportion of the teliospores (2–3 per cent) are one-celled.

Puccinia violae DC., Fl. Fr. 6: 62 (1815).
On *Viola* sp. Prov. Laghman: Alishang, lower part of Darrah Atekochakali, 1800 m, along irrigation channel, 16 vii 1969, *W.&E.*, *W.* 9731.

Uromyces acantholimonis Syd. in Ann. Mycol. 4: 28 (1906).
On *Acantholimon peculiare* Rech. f. Prov. Baghlan: N side of Salang pass, 2500 m, 22 vii 1969, *E.&W.*, *W.* 9843 [Aecidia, uredinia and telia].
On *Acantholimon cabulicum* Boiss. Prov. Parvan: E side of Shibar pass, 2800 m, dry slopes, 18 vii 1969, *W.&E.*, *W.* 9748 [Uredinia and telia].

Uromyces chenopodii (Duby) Schroet. in Kunze, Fungi Sel. No. 214 (1880).
On *Aellenia* sp. Prov. Kandahar: 20 km E of Kandahar, 1040 m, roadside, 6 v 1969, *H.W.&E.*, *W.* 7618 [Uredinia only].

Uromyces chenopodii has been previously recorded on *Aellenia auricula*, *Halocharis hispida* and *H. afghanica* from Afghanistan.

Uromyces mogianensis Bub. in Sitzungsber. Königl. Böhm. Bot. Ges. Wiss. II, 46: 16 (1902).
On *Rhinopetalum gibbosum* (Boiss.) Los. & Vved. Prov. Herat: Sabzak pass on road from Herat to Qala Nau, mt. at start of pass, 2150 m, stony slopes, 16 v 1969, *H.W.&E.*, *W.* 8075.

The teliospores of this species are interesting in that they seem to show a transition between verrucose and striate walls. The verrucae in *U. mogianensis* are arranged in lines, linked by raised striae, so that the spores are both striate and verrucose.

Uromyces pisi (DC.) Otth in Mitth. Naturf. Gesell. Bern. 1863: 87 (1863).
On *Onobrychis* sp. Prov. Badakhshan: Yawarzan, c. 30 km S of Qeshm, 1800 m, dry slopes in *Juniperus* belt, 1 vii 1969, *H.&W.*, *W.* 9355.

The rust frequently recorded on *Onobrychis* as *Uromyces onobrychidis* has almost smooth teliospores, whereas this collection has conspicuously verrucose spores. However, two species have been described from SW Asia on *Onobrychis*, *U. shahrudensis* Petrak and *U. teodorescui* Rayss, with teliospores of this type. Uredospores were lacking in Petrak's species but had four to five pores in *U. teodorescui*. This present collection has 3 usually 4 pores and seems to fit a wide concept of *U. pisi*. If indeed *U. teodorescui* has a high proportion of spores with five pores it agrees more with the 'macrospecies', *U. anthyllidis*.

On *Astragalus* sp. Prov. Fariab: W of salt lake on road from Daulatabad to Sheberghan, 450 m, dry soil slopes, 27 v 1969, *H.W.&E.*, *W.* 8409.

On *Astragalus* (sect. *Xiphidium*) Prov. Baghlan: near Doshi, 950 m, soil slopes, 4 vi 1969, *H.&W.*, *W.* 8616. [Uredinia only].

On *Astragalus* sp. Prov. Herat: 40 km S of Herat on main road, first pass, 1600 m, 14 v 1969, *H.W.&E.*, *W.* 7959. [Uredinia and telia].

On *Astragalus* (sect. *Myobroma*) Prov. Samangan: 1 km W of Taschkurgan, 300 m, undulating plain of gravel, 10 vi 1969, *E.*, *W.* 9036.

On *Astragalus* (sect. *Ammodendron*) Prov. Herat: S of Andraskan, 1430 m, stony slopes, 8 v 1969, *H.W.&E.*, *W.* 7709.

On *Astragalus* (sect. *Myobroma*) Prov. Herat: between Obeh and Khodja Chisht, near latter, Pardu Khan, 1850 m, scree, 10 v 1969, *H.W.&E.*, *W.* 7787.

On *Astragalus* (sect. *Ammodendron*). Ibid., 1430 m, stony slopes, 9 v 1969, *H.W.&E.*, *W.* 7763.

On *Colutea* sp. Ibid., 1430 m, 9 v 1969, *H.W.&E.*, *W.* 7758. [Uredinia only].

On *Astragalus* (sect. *Christiana*). Ibid., 1500–1900 m, stony slopes, 10 v 1969, *H.W.&E.*, *W.* 7778.

On *Astragalus* (sect. *Oxyglottis*). Ibid., 1600 m, stony slopes, 10 v 1969, *H.W.&E.*, *W.* 7826.

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