

## Rust fungi (Uredinales) from Iran and Afghanistan

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Zusammenfassung. – In dieser Arbeit über Rostpilze sind 74 Arten aus Iran und 15 Arten aus Afghanistan genannt. Unter den iranischen Arten sind *Puccinia balsamita*, *P. bithymica*, *P. hydrocotyles* und *Uromyces thellungii* neue Rostpilze für die iranische Flora, und *P. behenis*, *P. podospermi*, *Uromyces gypsophilae* und *U. muscari* sind neue Arten für Afghanistan. Neue Wirtspflanzen aus den beiden Ländern sind registriert.

### Introduction

On botanical excursions in Iran the now late Dr. Per WENDELBO and his assistants also collected rust fungi. The collection was submitted to me for identification. In 1979 I got an invitation to examine his collections of phanerogams from Iran and Afghanistan as well as some collections he had from other herbaria. A collection of Iranian rust specimens, mainly collected by Miss Jennifer LAMOND, and preserved at the herbarium of Royal Botanic Garden, Edinburgh (E), is also included.

In two papers, also based on material collected by Dr. WENDELBO, JØRSTAD (1961) and HENDERSON & JØRSTAD (1966) reviewed previous papers dealing with rust fungi in Iran and Afghanistan, respectively.

For Iran ERSHAD (1977) made a host/parasite list with references to literature for all groups of fungi. FAIZYAR (1971) made a similar list for plant pests and diseases of economic importance in Afghanistan. BRANDENBURGER & STEINER (1972) and DURRIEU (1975) contributed to our knowledge of the fungal flora of Afghanistan. VIENNOT-BOURGIN & ALÉ-AGHA (1985) described two new rust species from Iran.

In the present paper the following abbreviations are used

P. W. – P. WENDELBO  
H. F. – H. FOROUGH  
M. A. – M. ASSADI  
J. L. – Jennifer LAMOND

Specimens marked with E as well as those collected by J. LAMOND are kept in the herbarium of Royal Botanic Garden, Edinburgh. The rest of the material is kept at the herbarium of NPPI with duplicates of some of the specimens in the herbarium of the Botanical Institute of Iran, Tehran.

I am indebted to all the botanists mentioned above for allowing me to examine the material, and to the curators of the Botanical Museum of the University of Oslo (O) and Swedish Museum of Natural History, Stockholm (S) for lending me material for comparison.

I also want to express my sincere thanks to the Regius Keeper of the Royal Botanic Garden, Edinburgh, Prof. D. M. HENDERSON, and his assistant, Mr. A. P. BENNELL, for valuable discussions during a visit to the herbarium in March 1985. Prof. HENDERSON has also read the manuscript for which I am most grateful.

### Enumeration of species

#### IRAN

#### 1. *Aecidium euphorbiae* PERS., Syn. Meth. Fung., p. 211, 1801.

On *Euphorbia seguieriana* NECK. subsp. *niciciana* (BORB. EX NOVAK) RECH. (Euphorbiaceae).

Prov. Azarbaijan, Goja Bel-Pass, 1650 m, 29. 5. 1971, K. H. RECHINGER (5067, E); near village of Qareh Aghaj on road to Germi, 850 m, 23. 5. 1971, J. L. (3265), both with 0+I.

On *Euphorbia* sp.

Prov. Azarbaijan, Shibli-lake, c. 2000 m, 1. 6. 1971, K. H. RECHINGER (3661 E); Maki, 1300–1400 m, 5. 5. 1971, J. L. (2652), both with 0+I.

The fungus is systemic in all specimens, aecia covering the lower side of the leaves. The subsp. *niciciana* has been reported as a host for this aecial stage in Bulgaria [HINKOVA (1964), as *E. niciciana* BORB.], but it is a new host for it in Iran. For other Iranian hosts cfr. ERSHAD (1977).

HENDERSON (1964) discussed the possibility of connection of *A. euphorbiae* with heteroecious rust species having their aecial stage on *Euphorbia* spp.

#### 2. *Aecidium haussknechtianum* P. HENN., Mitteil. Thüring. Botan. Vereins, Neue Folge, Heft 13–14: 77, 1899.

Syn.: *A. teodorescui* TR. & O. SAVULESCU, Homm. Prof. Em. C. Teodorescu 4–6, 1937.

On *Berberis* sp. (Berberidaceae).

Prov. Gorgan, between Shah Pass and Shahrud, Khosh Yailagh, 1600 m, 18. 5. 1978. P. W. & M. A., 0+I.

This aecial stage has previously been reported from different areas of Iran on *B. vulgaris* L. Its aeciospores have thin walls while those of *P. graminis* PERS. are strongly thickened at apex. For the synonymy with *A. teodorescui*, cf. PETRAK (1961).

3. *Aecidium muscari* LINH., Fungi hungarici Cent. I, no 49, 1882, and Hedwigia 22: 22, 1883.

On *Muscari longipes* BOISS. (Liliaceae).

Prov. Kordestan, c. 15 km N of Sanandaj, 1700 m, 11. 5. 1975, P. W. & M. A. (16923), 0+I.

The present fungus corresponds well to the Iranian rust studied by JØRSTAD (1961; O), reported as probably belonging to *Uromyces fragilipes* TRANZ. However, the relationship of this aecial stage to other rusts seems not clarified yet. TRANZSCHEL (1939) placed it with *Puccinia festucina* H. & P. SYD. (= *P. sessilis* W. G. SCHNEIDER) referring to unpublished results from inoculation experiments conducted by Nevodovsky, but NEVODOVSKY (1956) did not mention them in his publication on rusts from Kazakhstan. VIENNOT-BOURGIN & al. (1969) found *A. muscari* in close vicinity of *Uromyces iranensis* VIEN.-BOURG. (= *U. turcomanicum* KATAJEV) and suggested a connection between the two rusts. ANIKSTER & WAHL (1967) who described *Uromyces christensenii* (= *U. turcomanicum*), reported *Muscari* spp. as its aecial hosts. According to CUMMINS (1971) *U. turcomanicum* has aecia on *Bellevalia* and *Muscari*, but for *U. fragilipes* he wrote "Aecia doubtless on Liliaceae but not yet recognized". HENDERSON (1964) pointed out that "observation and experiment are required to resolve the present confusion".

*M. longipes* seems to be a new host for this rust, but it has previously been listed as a host for *Uromyces muscari* (DUBY) LÉV. in Turkey [KARACA (1961), as *U. scillarum* (GREV.) WINT.].

4. *Aecidium ranunculacearum* DC., Fl. Fr. 6: 97, 1815.

On *Ranunculus* sp. (Ranunculaceae).

Prov. Lorestan, Khalilabad, c. 40 km SE of Aligudarz, 2300–2450 m, 3. 5. 1975, P. W. & M. A. (1621), I.

*U. rumicis* has previously been reported from Iran (ERSHAD, 1977). MAGNUS (1899) reported *A. ranunculacearum* on *R. oxyspermus* M. B. from Sultanabad and JØRSTAD (1961) did so on *R. kochii* LEDEB. from Haraz valley in Prov. Mazandaran.

5. *Coleosporium tussilaginis* (PERS.) BERK., Orbigny, Dict. Univ. Hist. Nat. 12: 786, 1849.

Syn.: *C. senecionis* KICKX, Fl. Crypt. Flandres 2: 53, 1867.

On *Senecio vernalis* WALDST. & KIT. (Asteraceae).

Prov. Gilan, Bandar-e Pahlavi, 25 m, 14. 5. 1971, J. L. (2900), II.

VIENNOT-BOURGIN & al. (1969) reported this rust on the same host from Prov. Mazandaran. They also reported the aecial stage of

*Puccinia opizii* BUB. on the same host while ERSHAD (1977) reported the aecial stage of *P. silvatica* SCHRÖT. (= *P. dioicae* P. MAGN.).

6. *Gymnosporangium* sp.

On *Sorbus boissieri* SCHNEID. (Rosaceae).

Prov. Azarbaijan, Kaleybar, c. 20 km SW of Kaleybar near Alibad, 2300–2500, 20. 7. 1976, J. L. (4889 a), O.

The only *Gymnosporangium* species recorded on *Sorbus* in Iran is *G. juniperinum* (L.) FR., reported by KHABIRI (1956) on *S. aucuparia* L. from Tchalouss. JØRSTAD (1961) reported. *G. fusisporum* F. FISCH. on *Juniperus macropoda* BOISS. (= *J. excelsa* M. B.) from Prov. Mazandaran. As only spermogonia are present, the specimen mentioned above cannot be identified to species.

7. *Hyalopsora polypodii* (DIET.) P. MAGN., Ber. D. Bot. Ges. 19: 582, 1901.

On *Cystopteris fragilis* (L.) BERNH. (Athyriaceae).

Prov. Azarbaijan, Doghrun Mt., 2500–2800 m, 13. 7. 1977, M. A. & SARDABI (24065 a), II+III.

This fern rust is widely distributed in the Northern Hemisphere, and it is also recorded in Africa and S. America. In Asia it is reported on several host genera including the present host. The specimen, which represents a new species to the Iranian rust flora, includes both types of urediniospores.

To my knowledge only one fern rust species has previously been reported from Iran, viz. *Hyalopsora adianthi-capillis-veneris* (DC.) H. & P. SYD., reported by GONZÁLES FRAGOSO (1916) from Bakhtiari on *Adiantum capillis-veneris* L.

8. *Melampsora capraearum* THÜM., Mitth. Forstl. Versuchsw. Oester. 2: 34 & 36, 1879.

Syn.: *M. farinosa* SCHRÖT. in Cohn, Krypt-Fl. Schles. III, 1: 360, 1887.

On *Salix* sp. (Salicaceae).

Prov. Mazandaran, Lar Valley, 2400 m, 30. 7. 1975, P. W. & H. VARNECKE (18646).

Paraphyses capitate, 14–27 µm in diameter, wall hyaline 3–4 µm thick, sometimes slightly thickened at apex, up to 4.5 µm. Urediniospores (13–)16–24 × 13–20 µm, ellipsoid to subglobose, rarely obovoid, wall 2.5–3(–3.5) µm thick, with scattered thinner points, probably pores, making the inner surface of the spores more or less stellate, hyaline, echinulate, spaced 2–2.5 µm.

This specimen has been placed with *M. capraearum* because of the stellate inner spore wall. *M. capraearum* has previously been reported from Iran as *M. farinosa* by KHABIRI (1956).

9. *Melampsora euphorbiae* (SCHUB.) CAST., Obs. Pl. Acotyl. 2: 18, 1843.

On *Euphorbia azerbaijdzhanica* BORDZ. (Euphorbiaceae).

Prov. Azarbaijan, c. 30 km to Tabriz on the road from Ahar, 1600–2000 m, 17. 7. 1977, M. A. & SARDABI (24400), II (+III).

On *Euphorbia cheiradenia* BOISS. & HOHEN.

Elburs Mts., S of Damavand, Imam Zade Hashim, 2700 m, 19. 7. 1959, P. W. (1390), II+III.

On *Euphorbia hebecarpa* BOISS.

Prov. Kerman, Zardan, Kuh-e Lalehzar, 3200 m, 18. 6. 1975, H. F. & M. A. (17879 A), II.

On *Euphorbia petiolata* BANKS & SOLAND.

Prov. Azarbaijan, 38 km N of Bonab on road to Tabriz, c. 1550 m, 8. 7. 1971, J. L. (4646), II.

On *Euphorbia* sp.

Prov. Azarbaijan, 20 km to Tehran-Tabriz road on the road from Ahar, 1450 m, 31. 5. 1978, leg. P. W. & M. A. (22976), II, 12 km NE Mahabad on road to Mvindowab, c. 1300 m, 15. 6. 1971, J. L. (4220), II+III; Prov. Kerman, Kuh-e-Hazar, 3000–3300 m, 15. 6. 1975, leg. H. F. & M. A. (16238), II.

*M. euphorbiae* is common in Iran, reported under different names on several *Euphorbia* spp. (JØRSTAD, 1961). *E. azerbaijdzhanica* and *E. petiolata* are new hosts for this rust.

10. *Phragmidium circumvallatum* P. MAGN., Ber. Deutsch. Bot. Gesellsch. 12: 84, 1894.

On *Geum kokanicum* REGEL & SCHMALH. (Rosaceae).

Prov. Tehran, Karaj Valley, Dezin, 3300 m, 15. 8. 1974, P. W. & G. COBHAM (14003), III.

The rust has been reported from Iran by BORNMÜLLER (1908), JØRSTAD (1961) and VIENNOT-BOURGIN & al. (1971) on the same host. Jørstad provisionally also listed *Potentilla poteriifolia* BOISS. as a host.

11. *Phragmidium iranicum* PETRAK & ESFANDIARI, Annl. mycol. 39: 207, 1941.

On *Rubus caesius* L. (Rosaceae).

Prov. Gilan, Bashm Lake, c. 7 km NW Bandar-e-Pahlavi, c. – 25 m, 14. 7. 1971, J. L. (2917), II.

Paraphyses clavate with hyaline wall. Urediniospores 22–27 × 16–22 µm, wall 1.5–2.5 µm thick, hyaline.

The urediniospores differ in wall thickness from those in *Phr. bulbosum* (STR.) SCHLECHT. and *Phr. violaceum* (C. F. SCHULTZ) WINT.

*R. caesius* is the only host known for this rust, described from Karaj and later reported also from Mashhad.

12. *Phragmidium potentillae* (PERS.) KARST., Bidr. Känned. Finl. Nat. Folk 31: 49, 1879.

On *Potentilla pedata* VESTLES (Rosaceae).

Prov. Gorgan, Almesh, 1750 m, 19. 6. 1974, P. W. & H. F. (12697), II+III.

The host is new to this rust which is previously reported from Iran on *P. elvendensis* BOISS. by WETTSTEIN (1885) and by JØRSTAD (1961) on *P. sp.*

13. *Phragmidium cf. mucronatum* (PERS.) SCHLECHT., Fl. Berol. 2: 156, 1824.

On *Rosa canina* L. (Rosaceae).

Prov. Lorestan, c. 40 km E of Kuh-e Dasht, 1350 m, 6. 5. 1975, P. W. & M. A. (16704), 0+I.

Aeciospores obovoid to ellipsoid, 20–28 × 13–20 µm, wall hyaline, 1.5–2 µm thick, verruculose, smooth near the base.

This rust has been reported several times from Iran, but *R. canina* seems to be a new host in this country.

14. *Phragmidium rosae-pimpinellifoliae* DIET., Hedwigia 44: 339, 1905.

On *Rosa pimpinellifolia* L. (Rosaceae).

Prov. Azarbaijan, between Khanil to Mahidi, 2000 m, 29. 5. 1977, M. A. & K. VOSOUGH (24970), 0+I.

Aeciospores obovoid to ellipsoid, 15–23 × 11–19 µm, wall hyaline, 1.5 µm thick.

This rust is widespread in N. America and Europe, and has also been reported from Caucasus, Kazakhstan, Kirgizia and Altai, but it seems to be new to Iran.

15. *Phragmidium sanguisorbae* (DC.) SCHRÖT. in Cohn, Pilze Schles. III, 1: 352, 1887.

On *Poterium sp.* (Rosaceae).

Prov. Azerbaijan, c. 13 km below Mianek to Zanjan, c. 1200 m, 6. 5. 1971, J. L. (2749), II.

*P. sanguisorbae* has been reported on *Poterium polygamum* WALD. & KIT. (= *Sanguisorba minor* SCOP. subsp. *muricata* (SPACH.) (BRIQ.) by VIENNOT-BOURGIN (1958) from different places in Iran and also by KHABIRI (1958) on the same hosts without stating any locality.

16. *Puccinia achilleae* COOKE, *Grevillea* 9: 13, 1880.

Syn.: *P. santolinae* P. MAGN., *Hedwigia* 39: 97, 1909.

On *Achillea vermicularis* Trin. (Asteraceae).

Prov. Fars, Chesmeh-Fil to ridge of Kuh-e Bamu, 1900–1650 m, 31. 5. 1975, P. W. & H. F. (17660, 17660 A), II+III).

The rust has been reported several times from Iran, partly as *P. santolinae*. Other Iranian hosts are *A. santolina* L., *A. talagonica* BOISS. and *A. tenuifolia* LAM.

17. *Puccinia aeluropodis* RICKER, *J. Mycol.* 11: 114, 1905.

Syn.: *P. tangkuensis* LIU & WANG, *Contr. Inst. Bot. Acad. Peiping* 3: 448, 1935.

On *Aeluropus littoralis* (GOUAN) FARL. (Poaceae).

Prov. Tehran, near Ainor-rashid, 1150 m, 9. 9. 1974, P. W. & H. F. (14619), II+III.

No urediniosori were found, but loose, very finely and densely verrucose urediniospores with 3–4 equatorial pores were scattered over the material. The shorter and broader teliospores were slightly darker at apex than the longer and narrower ones.

*P. aeluropodis* has been reported on *Aeluropus* species from N. Africa east to Siberia, India and China, but it seems to be a new member of the Iranian rust flora. Its aecial state (*Aecidium nitrariae* PAT.) has been reported on *Nitraria* spp. (Zygophyllaceae) in N. Africa.

18. *Puccinia alatafica* NEVODOVSKY, *Not. Syst. Sect. Crypt. Inst. Bot. Nom. V. L. Komarovii Acad. Sci. URSS* 6: 179, 1950.

On *Ferula* sp. (Apiaceae).

Prov. Kerman, Kuh-e Hazar, 3000–3300 m, 15. 6. 1975, H. F. & M. A. (16239), 0+III.

The teliospores vary considerably in size, 32–51 × 17–37 μm, matching well to the measurements given by JØRSTAD (1961) who reported it from Haraz Valley in Mazandaran Prov., also on *Ferula* sp.

19. *Puccinia annularis* (STR.) RÖHL., *Deutschl. Fl.*, Ed. 2, III, 3: 134, 1813.

On *Teucrium chamaedrys* L. (Lamiaceae).

Prov. Azarbaijan, Kaleybar, footpath SW to Aliabad, c. 2000 m, 19. 7. 1971, J. L. (4806), III.

In their treatise of the *Teucrium* rusts GUYOT & MASSENOT (1952) separated them in two groups, one with mainly foliicolous, compact reddish brown to brown telia, and another group with mainly caulicolous, dark brown to black telia, often causing malformations of the host. The former group was divided in three species, based on length of the spores, the ratio between total spore length and length of the upper cell, length of pedicels and wall and apex thickness. Also hosts were included. VIENNOT-BOURGIN (1956) followed the system based on spore length and hosts. HENDERSON (1964) following GUYOT & MASSENOT identified a Turkish specimen as *P. chamaedryos* CES., but made "the reservation that a better course may be to regard all the races they recognize at specific range as part of a large rather variable species, *P. annularis*". Separating them on a biometrical base seems difficult as they overlap very much, and variation in form and wall colour differ very much even in the same specimen. In my opinion it might be possible to keep the two groups separate, but include *P. chamaedryos* CES. and *P. teucrii* BIV.-BERNH. within *P. annularis*.

20. *Puccinia arenariae* (SCHUM.) WINT. var. *australis* PETRAK in K. H. RECHINGER, Ann. Nat.-hist. Mus. Wien 50: 420, 1940.

On *Dianthus crinitus* SM. (Caryophyllaceae).

Prov. Fars, Darreh Chap, 1650-1900 m, 30. 5. 1975, P. W. & H. F. (17556 a), III.

The var. *australis* was described from the Iranian province Khorasan, and later reported by VIENNOT-BOURGIN (1958) and JØRSTAD (1961) on *D. atomarius* BOISS. and *D. sp.*, respectively. Whether another specimen of *D. sp.*, reported by ESFANDIARI (1946), belongs to this variety, is uncertain as no description of the rust is given. *D. crinitus* seems to be a new host for this rust.

21. *Puccinia balsamitae* (STR.) RÖHL., Deutschl. Fl. Ed. 2,3: 133, 1813.

On *Chrysanthemum balsamita* L. (Asteraceae).

Prov. Tehran, Karaj Valley, Dezin, 3000 m, 15. 8. 1974, P. W. & G. COBHAM (14053), II+III.

Urediniospores occasionally among teliospores in dark brown telia on stems and leaves.

The rust is reported on the present host from Portugal and France eastwards to Azerbajdzhan SSR and Iraq, but seems to be new to Iran. Inoculation experiments (MAYOR, 1946) have shown that other, related hosts may become infected. KHABIRI (1956) has reported *P. chrysanthemi* ROZE on the same host from Kandovan.



22. *Puccinia bithynica* P. MAGN., Bull. Herb. Boiss. Ser. 2,3: 579, 1903.

On *Salvia multicaulis* VAHL (Lamiaceae).

Prov. Azarbaijan, c. 13 km below Mianeh on road to Zanjan, c. 1200 m, J. L. (2754), (II+) III.

Urediniospores with 4–5 scattered pores, easily separating it from *P. nigrescens* KIRCHN. having 2 equatorial pores in the urediniospores, and known from several localities in Iran.

*P. bithynica* seems to be a new member of the Iranian rust flora, but it is known from Spain and Morocco eastwards to Pakistan. The host has been reported with the same rust from Asia Minor (HENDERSON 1964).

23. *Puccinia brachypodii* OTTH var. *arrhenatheri* (KLEB.) CUMM. & H. C. GREENE, Mycologia 58: 709, 1966.

Syn.: *P. arrhenatheri* ERIKS., Beitr. Biol. Pfl. 8: 14, 1898.

On *Berberis vulgaris* L. (Berberidaceae).

Prov. Khamseh, Manjil to Zanjan, N side of Tarom Pass, 1800–2000 m, 31. 5. 1971, J. L. & M. IRANSHAHR (3533), I.

Systemic, aecia covering the lower leaf surface.

JØRSTAD (1961) reported the same rust as *P. arrhenatheri* on *Berberis* sp. from Mazandaran. He recognized this belonging to *P. poae-nemoralis* OTTH. CUMMINS (1971) made them separate varieties of *P. brachypodii*.

The var. *poae-nemoralis* has localized aecia as has also the var. *brachypodii* while in var. *arrhenatheri* they also are systemic.

*Aecidium haussknechtianum* P. HENN., reported from many localities in Iran, has localized aecia.

24. *Puccinia bulbocastani* FÜCK., Jahrb. Nass. Ver. Nat. 23–24: 52, 1870.

Syn.: *P. bunii* WINT. in Rabh. Krypt.-Fl., Ed. 2, 1 (1): 197, 1882.

On *Bunium* sp. (Apiaceae).

Prov. Azarbaijan, Marand, c. 10 km towards Tabriz, 1650 m, 6. 6. 1971, J. L. (3759), III.

This rust has previously been reported on *Bunium* sp. from Kermanshah (PETRAK, 1953) and also from Azarbaijan (PETRAK & LOHWAG, 1974). A report of *P. pimpinellae* on *B. elegans* (FENZL) C. FREYN from Ganjameh by WETTSTEIN (1885) might be doubtful.

25. *Puccinia bupleuri* RUD., Linnaea 4: 514, 1829.

Syn.: *P. bupleuri-falcati* (DC.) WINT., in Rabh. Krypt.-Fl., Ed. 2, I, 1: 212, 1882.

On *Bupleurum rotundifolium* L. (Apiaceae).

Prov. Azarbaijan, Ahar to Kaleybar, c. 25 km from Ahar, 18. 7. 1971, J. L. (4795), (II+) III.

Only a few urediniospores seen, all with 3 equatorial pores.

*B. rotundifolium* is a new host for the rust in Iran, previously reported only on *B. lancifolium* HORNEM. from Ramin in Khuzestan (ERSHAD, 1977).

26. *Puccinia calcitrapae* DC., Fl. Fr. 2: 221, 1805.

Syn.: *P. carduorum* JACKY, Zeitschr. Pfl. Krankh. 9: 288, 1899.

*P. cardui-pycnocephali* P. & H. SYD., Monogr. Ured. 1: 34, 1902.

*P. centaureae* DC., Fl. Fr. 5: 59, 1815.

*P. cirsii* LASCH in Rabh. Fungi Eur. 89, 1859 (non *P. cirsii* KIRCHNER).

*P. cousiniae* P. & H. SYD., Monogr. Ured. I: 62, 1902.

On *Carduus pycnocephalus* L. subsp. *cinereus* (RICH.) DAVIS (Asteraceae).

Prov. Gilan, several km above Manjil Lake, c. 425 m, 13. 5. 1971, J. L. (2877), II+III.

On *Carduus* sp.

Prov. Mazandaran, c. 88 km NW of Damghan on road to Sari, 1650 m, 16. 5. 1978, P. W. & M. A., II.

On *Cirsium* sp. (Asteraceae).

Prov. Azarbaijan, mts. SW of Khalkhal, on road to Kivi, 1800 m, 30. 5. 1978, P. W. & M. A. (27814), II; Prov. Kordestan, Kuti-e-Chebel Cheshmeh, 44 km from Dezh Shahpur (Marivan) on road to Saqqez, c. 2000 m, 7. 7. 1971, J. L. (4612), II+III.

On *Cousinia calcitrapa* BOISS. var. *calcitrapa* (Asteraceae).

Prov. Fars, Tang-e Chac Mahaki, near Cheshmeh Haji Mahrab, 1900 m, 1. 6. 1975, P. W. & M. A. (17706), II+III.

On *Cousinia farsistanica* BOISS.

Prov. Fars, Darreh Chap, 30. 5. 1975, P. W. & H. F. (17528), II+III.

On *Cousinia gigantolepis* RECH. F.

Prov. Azarbaijan, between Meshkin-Shah and Ahar, Nov-Duz, 100 m, 30. 5. 1978, P. W. & M. A. (27886) (II+) III.

On *Cousinia neurocentra* Bunge.

Prov. Gorgan, 65 km from Shah Pass on road to Shahrud, 2000 m, 21. 7. 1976, M. A. & MOZAFFARIAN (21508) (II+) III.

On *Cousinia* sp.

Prov. Semnan, c. 59 km from Semnan on road to Sari, 2400–2800 m, 25. 7. 1976, M. A. & MASOUMI (21536), III.

*P. calcitrapae* is an aggregate rust species embracing forms living on asteraceous genera belonging to the tribe *Cynareae* (JØRSTAD, 1959). In Iran it is quite common on *Centaurea*, *Cirsium* and *Cousinia* spp. and it has also been reported on *Carduus*. The four *Cousinia* spp., viz. *calcitrapa*, *farsistanica*, *gigantolepis* and

*neurocentra*, are new hosts for this rust species. JØRSTAD (op. cit.) and HENDERSON (1964) have both discussed *P. calcitrapae* and allied species.

27. *Puccinia caricina* DC., Fl. Fr. 5: 60, 1815.

On *Carex pendula* HUDS. (syn. *P. maxima* SCOP.) (Cyperaceae).

Prov. Gilan, Assalem to Khalkhal, 800–1000 m, 29. 5. 1978, P. W. & M. A. (22742), III.

The only reference to this rust from Iran known to me is that by JØRSTAD (1961) who reported it on *C. orbicularis* BOOTT. *C. pendula* is a new host for the rust in Iran, but it has been reported as such from Caucasia (e. g. WORONOW, 1910).

28. *Puccinia cesatii* SCHRÖT. in Cohn Beitr. Biol. Pflanzen 3: 70, 1879.

On *Bothriochloa ischaemum* (L.) KENG (Poaceae).

Prov. Mazandaran, Now Shar, 30 m, 8. 9. 1965, M. ZUMER, II.

*P. cesatii* seems to be fairly common on this host in Iran. KHABIRI (1956) recorded it on *Cymbopogon* sp., but CUMMINS (1971) did not list this genus as a host for *P. cesatii*.

29. *Puccinia circaeae* PERS., Syn. Meth. Fung. p. 228, 1801.

On *Circaea lutetiana* L. (Onagraceae).

Prov. Gilan, Fumen to Massuleh, 200–300 m, 18. 7. 1975, P. W. & M. A. (18584), III, Asalem-Khalkhal road, 200 m, 15. 7. 1975, P. W. & M. A. (18364), III.

*C. alpina* L. seems to be the most common host for this rust in Asia, but in Iran only *C. lutetiana* has been found infected.

30. *Puccinia coronata* CDA., Icon. Fung. 1: 6, 1837.

On *Rhamnus* sp. (Rhamnaceae).

Prov. Azarbaijan, S of Germi, c. 1450 m, 24. 5. 1971, J. L. (3304), 0+I.

The aecial stage of the crown rust has been reported on *R. cathartica* L. from Lahijan (KHABIRI, 1956) and on *R. kurdica* BOISS. & HOHEN. from Gonbad in Prov. Gorgan (VIENNOT-BOURGIN & al., 1969). Other stages of the rust have been recorded on *Alopecurus*, *Avena*, *Festuca*, *Lolium* and *Phleum* (cf. ERSHAD, 1977).

31. *Puccinia crepidis* SCHRÖT. in Cohn, Krypt.-Fl. Schles. III, 1: 319, 1887.

On *Crepis foetida* L. subsp. *foetida* (Asteraceae).

Prov. Khamseh, Manjil to Zanjan, c. 3 km W of Tashvir, c. 500 m, 31. 5. 1971, J. L. & M. TRANSHAHR (3456), III.

JÖRSTAD (1961) reported *P. crepidis* on the same host from Haraz valley in Prov. Mazandaran. Other Iranian hosts are *C. bureniana* BOISS., *C. parviflora* DESF., and *C. quercifolia* BORNM. & GAUBA (KHABIRI, 1956).

32. *Puccinia cyani* PASS. in Rabh., Fungi Eur. 1767, 1874, var. *cyani*.  
On *Centaurea* sp. (Asteraceae).

Prov. Mazandaran, Lar Valley, below Rudkaneh Sefid Ab, 2300 m, 28. 5. 1976, P. W. & al. (11836 A), II+III.

Urediniospores with two equatorial pores. – Teliospore wall distinctly verrucose.

This widely distributed rust on *Centaurea* spp. of which *C. cyanus* L. is the main host, is a new member of the Iranian rust flora. In Asia it has been reported from Lebanon and Syria, and from Azerbaijan, Nakhichevan and Turkmenia in USSR. Asiatic hosts are *C. cana* S. SM., *C. depressa* M. B., and *C. sessilis* WILLD.

33. *Puccinia eremuri* KOM., Script. Bot. Horti Univ. Petropol. 4: 262, 1895.

On *Eremurus olgae* REGEL (Liliaceae).

Prov. Zanjan, Alamout, Akbarabad, 28. 7. 1970, 1880 m, H. F., III; Prov. Azarbaijan, 30–35 km SE of Shahindez near Mahmud-Abad, 1500 m, 4. 6. 1974, P. W., M. A. & SHIRDELPUR (12155), III.

On *Eremurus persicus* (JAUB. & SPACH) BOISS.

Prov. Kerman, Gardaneh Khaneh Sorkh, N side, 98 km from Kerman, 2250 m, 11. 4. 1975, P. W. & H. F. (15873), III, Kerman, Lalehzar, Baghabad, 2600 m, 19. 6. 1975, H. F. & M. A. (17886), III; Prov. Yasd, Deh-Bala, Shirkuh Mt. 2800 m, 21. 6. 1975, H. F. & F. M. (17965), III; Prov. Khamseh, 55 km SE of Mianeh versus Zanjan, 1400 m, 6. 5. 1971, K. H. RECHINGER (39366), III.

On *Eremurus spectabilis* M. B.

Prov. Azarbaijan, 30–35 km SE of Shahindez near Mahmud-Abad, 1500 m, 4. 6. 1974, P. W., M. A. & SHIRDELPUR (12153), III; Prov. Kordestan, Kauleh, between Sanandaj and Sagez, 2070 m, 21. 5. 1966, J. C. ARCHIBALD (2131), III; Prov. Bakhtiari, Kuh-rang, 2400 m, 30. 5. 1959, P. W. (927), III; Elburs Mts., Damavand area, near Polur, 2400 m, 22. 6. 1959, P. W (2063), III.

On *Eremurus stenophyllus* (BOISS. & BUHSE) BALSER subsp. *stenophyllus*.

Elburs Mts., Polur, 1520 m, 4. 7. 1966, J. C. ARCHIBALD, III.

*P. eremuri* has been found on several *Eremurus* spp. from Crimea, Asia Minor and Israel eastwards to Turkestan and Pakistan. *E. stenophyllus* var. *stenophyllus* and *E. olgae* are new hosts for the rust in Iran.

34. *Puccinia frankeniae* LINK, *Observ. Ord. Plant* 2: 30, 1816.

On *Frankenia hirsuta* L. (Frankeniaceae).

- Prov. Azarbaijan, 7 km of Bonab on road to Tabriz, near Lake Urmia, c. 1350 m, 8. 7. 1971, J. L. (4632 a), II+III.

This rust has previously been reported on the host mentioned above, and on *F. pulverulenta* L. and *F. sp.* (ERSHAD, 1977).

35. *Puccinia gentianae* RÖHL., *Deutschl. Fl.*, Ed. 2, III, 2: 131, 1813.

On *Gentiana septemfida* PALL. (Gentianaceae).

- Prov. Chalus, above Siah Bisheh, 2200 m, 25. 8. 1974, M. A. & H. F. (14092), II+III; Prov. Tehran, Karaj Valley, Assemvarak, 2450 m, 25. 8. 1974, P. W., H. F. & M. A. (14480), II+III.

Previously *P. gentianae* is reported on *G. cruciata* L., *G. punctata* L. and *G. sp.* from Kojur in the Mazandaran Prov. *G. septemfida*, a new host for the rust in Iran, has been reported with this rust from Caucasia, Azerbajdzhan and Armenia in USSR.

36. *Puccinia hariotii* LAGERH., *Tromsø Mus. Aarsh.* 16: 135, 1894.

On *Stachys lavandulaefoliae* VAHL var. *glabrescens* GETTACHARGEE & HUBER MORATH (Lamiaceae).

- Prov. Azarbaijan, N side of Kuhhay Sabalan, 2000–2100 m, 10. 6. 1971, J. L. (3940).

On *Stachys setifera* C. A. MEY. subsp. *setifera*.

- Prov. Azarbaijan, c. 34 km from Marand on way to Tabriz, C. 1700 m, 6. 6. 1971, J. L. (3774), 0+I.

In Iran *P. hariotii* has been found on several *Stachys* spp. including both species mentioned above (ERSHAD, 1977).

37. *Puccinia heldreichiana* DIET., *Hedwigia* 28: 184, 1889.

Syn.: *P. barbeyi* (ROUM.) P. MAGN., *Bot. Zeit.* 41: 115, 1883.

On *Asphodelus tenuifolius* Cav. (Liliaceae).

- Prov. Khalij-e Fars, Bushehr to Bandar Lengeh, c. 11 km SE of Khormuj, 40 m, 19. 3. 1976, M. H. BOKHARI & P. W. (22 a), I.

This rust has been reported several times from Iran on this host, and also on *A. fistulosus* L.

38. *Puccinia hieracii* (RÖHL.) MART., *Prodr. Fl. Mosq.* Ed. 2 p. 227, 1817.

Syn.: *P. jaceae* OTTH, *Mitth. Naturf. Ges. Bern* 1865: 173, 1866.

On *Centaurea aucheri* (DC.) WAGNITZ (syn. *Phaeopappus aucheri* (DC.) BOISS.) (Asteraceae).

Prov. Azarbaijan, Shebli Lake, c. 2000 m, 14. 7. 1971, K. H. RECHINGER (5106 a).

On *Centaurea behen* L.

Prov. Tehran, pass between Qazvin and Manjil, 1500 m, 13. 7. 1975, P. W. & M. A. (18285 A), II+III.

On *Centaurea solstitialis* L.

Prov. Lorestan, Sheshom, 700–800 m, 6. 6. 1963, M. JACOBS (6811), II+III.

The urediniospores have two superequatorial pores.

This aggregate species seems to be rare on *Centaurea* in Iran.

The only reference known to me is that by KHABIRI (1958) who reported the rust on *C. behen*. *C. solstitialis* is a new host for this rust in Iran, but it has been reported as a host for this rust in S. Europe, Asia Minor, Syria and adjacent areas in USSR. Both hosts mentioned above are also hosts for *P. calcitrapae* DC. in Iran (ERSHAD, 1977). KHABIRI (1956) reported a *P. sp.* on *Phaeopappus aucheri* (= *C. aucheri*). This might be *P. hieracii*.

39. *Puccinia hordei* OTTH, Mitth. Naturf. Ges. Bern 1870: 114, 1871.

Syn.: *P. schismi* BUB., Ann. Naturhist. Hofmus. Wien 28: 193, 1914;

*P. fragosoi* BUB., Hedwigia 57: 2, 1915.

On *Lophochloa obtusiflora* (BOISS.) GONTSCH. (Poaceae).

Prov. Khalij-e Fars, Bushehr to Bandar Lengeh, c. 11 km SE of Khormuj, 400 m, 19. 3. 1976, M. H. BOKHARI & P. W. (55), II.

On *Lophochloa phleoides* (VILL.) REICHENB.

Prov. Khalij-e Fars, Bushehr to Bandar Lengeh, c. 7 km from Taheri along road to Jam, 450 m, 21. 3. 1976. M. H. BOKHARI & P. W. (211), II.

Both hosts have been previously reported as hosts for this rust in Iran, especially on the latter one (ERSHAD, 1977).

40. *Puccinia hydrocotyles* COOKE, Grevillea 9: 14, 1880.

On *Hydrocotyle vulgaris* L. (Hydrocotylaceae).

Prov. Mazandaran, c. 20 km E of Nowshahr, on shore of Caspian, 25 m, 30. 8. 1974, P. W. & M. A. (14584), II.

*P. hydrocotyles* which has a world wide distribution on *Hydrocotyle* spp., is a new member of the Iranian rust flora.

41. *Puccinia hydrophylli* PECK & CLINTON subsp. *mertensia* (PECK) HENNEN, Mycologia 59: 266, 1967.

Syn.: *P. mertensiae* PECK, Bot. Gazette 6: 227, 1881.

On *Omphalodes luciliae* BOISS. (Boraginaceae).

Prov. Bakhtiari, The Laieh Sabz, Zevd Kuh, 4140 m, 5. 8. 1966, J. C. ARCHIBALD (3008, E), III.

*O. luciliae* is a new host for this rust in Iran, but it was reported by HENDERSON (1961) from Turkey. It is known on *Mertensia dschagastanica* REG. from Tadzhikistan and Turkestan. In N. America it is known on several *Mertensia* spp. and also on *Hackelia floribunda* (LEHM.) JOHNSTON (= *Lappula floribunda* (LEHM.) GREENE). The subsp. *mertensiae* differs from subsp. *hydrophylli* in having warts with a more irregular, basal outline.

42. *Puccinia kurdistani* COOKE, Grevillea 4: 116, 1876.

Syn.: *P. decipiens* MASSEE, Kew Bull. 1899: 164, 1899;

*P. taraxaci-bithynici* MAIRE, Bull. Soc. Sci. Nancy 1906: 17.

On *Taraxacum* sp. (Asteraceae).

Prov. Semnan, highest pass between Semnan and Firuzkuh, 2450 m, 20. 5. 1978, P. W. & M. A. (29759), (II+) III; Prov. Azarbaijan, 50 km towards Ahar, Achi-Chai-valley, c. 1500 m, 29. 5. 1971, K. H. RECHINGER, (3679, E), II+III.

Very few urediniospores occur in the material, measuring 29–34 × 24–30 μm, wall 1.5–2.5 μm thick with two superequatorial pores. – Teliospores in No. 29759 37–48 × 30–36 μm, wall 2.5–3.5(–4) μm thick, in No. 3679 33–41 × 23–30 μm, wall 2–2.5 μm, the upper pore apical, the lower equatorial or more depressed.

In the specimen from Prov. Azarbaijan, (3679, E) some of the teliospores have the pedicel attached close to the septum, being diorchidioid.

This rust species has been reported several times from Iran, mainly under the name *P. decipiens*, especially on *T. montanum* Dc. which is the type host, but also on *T. officinale* WEBER EX WIGG. and *T. syriacum* BOISS. JØRSTAD (1961) considered *P. kurdistani* to be an adaptation of *P. taraxaci* FLOWR. (= *P. hieracii* MART.) to very dry climate. Cfr. also HENDERSON (1964).

43. *Puccinia lojkaiana* THÜM., Oesterr. Bot. Zeitschr. 26: 183, 1876.

On *Bellevalia longistyla* (MISZC.) GROSSH. (Liliaceae).

Prov. Lorestan, Khalilabad, c. 40 km SE of Aligudarz, 2300–2450 m, 3. 5. 1975, P. W. & M. A. (16432 A), III.

*Bellevalia* is a new host genus for this rust species, previously reported from Iran on *Ornithogalum persicum* HAUSSKN. by SYDOW (1908) and BORNMÜLLER (1911) and on *O. sp.* by JØRSTAD (1961). *Ornithogalum* is the main host genus, but also *Muscari* has been reported a few times, and HENDERSON (1964) reported it on *Hyacinthella lineata* (STEUD.) CHOURD from Asia Minor.

44. *Puccinia menthae* PERS., Syn. Meth. Fung. p. 227, 1801.

On *Mentha* sp. (Lamiaceae).

Prov. Kordestan, 100 km from Dezh Shahpur (Marivan) to Saqqez, c. 1580 m, 7. 7. 1971, J. L. (4616 a), II (+III).

The mint rust has been found on several species in Iran (ERSHAD, 1977).

45. *Puccinia pachyderma* WETTS., Hedwigia 26: 115, 1887.

On *Gagea gagioides* (ZUCC.) VVED. (Liliaceae).

Prov. Tehran, Arak area, Kuh-e Barf-Khaneh, 2300–2800 m, 4. 5. 1975, P. W. & M. A. (16486), I.

*G. gagioides* is a new host for this rust which has been reported from Iran on other *Gagea* spp. GOLOVIN (1956) discussing this species indicated that the extremely thick teliospore wall (in this specimen up to 10  $\mu$ m) is an adaptation to arid climatic conditions.

46. *Puccinia passerinii* SCHRÖT., Jahresber. schles. Ges. vaterl. Cult. 53: 117, 1876.

On *Thesium* sp. (Santalaceae).

Prov. Semnan, Shah Pass to Shahrud, after pass, 1950–1800 m, 18. 5. 1978, P. W. & M. A. (29700), 0+I.

Spermogonia globoid, 125–170  $\mu$ m in diameter. – Aecia in small clusters, pustulate, later cupulate with an upright, white peridia. – Aeciospores angular-globoid or broad ellipsoid, 15–21  $\times$  13–18  $\mu$ m, wall 1  $\mu$ m thick, hyaline, finely verruculose.

Three out of six species occurring on *Thesium* spp. are described with spermogonia. One of them, *P. stonemanniae* H. & P. SYD. & EVANS, has larger spores with thicker aeciospore wall than has the Iranian specimen studied here. The two other species, *P. passerinii* SCHRÖT. and *P. thesii* (DESV.) CHAILLET seem difficult to separate when only aecia are present. Judging from drawings given by FISCHER (1904) the peridial cells of *P. passerinii* are larger than those of *P. thesii* which GAUMANN (1959) measured up to 30  $\mu$ m high. In the specimen studied by me they are up to 40  $\mu$ m high. For that reason I place it with *P. passerinii*.

*P. passerinii* has previously been reported on *T. kotschyianum* BOISS. from Iran by JØRSTAD (1959).

47. *Puccinia picridis-strigosae* P. & H. SYD., Monogr. Ured. I: 131, 1902.

On *Picris strigosa* M. B. (Asteraceae).

Prov. Fars, Bamu protected area, near entrance to Tang-e Chah Mohaki, 1650 m, 1. 6. 1975, P. W. & M. F. (17777), (II+) III.



Very few urediniospores present, measuring  $32-33 \times 26-29 \mu\text{m}$ , wall  $2.3-2.8 \mu\text{m}$  with two superequatorial pores. — Telia  $41-54 \times 27-42 \mu\text{m}$ , wall  $4-4.5 \mu\text{m}$  thick. Upper pore depressed, sometimes nearly down to septum, the lower varies from near septum to one half depressed, covered with low hyaline papillae.

This rust is new to the flora of Iran, but it has been reported by PETRAK (1958) from the Aoroman mountains in Kurdistan on the Iraqi side of the border. Its relationship to *P. hieracii* (SCHUM.) MART. was discussed by URBAN (1966).

48. *Puccinia pimpinellae* (STR.) RÖHL., *Deutschl. Fl.*, Ed. 2, III, 3: 131, 1813.

On *Pimpinella aurea* DC. (syn. *Reutera aurea* (DC.) BOISS.) (Apiaceae).

Prov. Kordestan, c. 54 km N of Sanandaj, c. 2000 m, 2. 7. 1971, J. L. (4457 a).

On *Pimpinella tragium* VILL. subsp. *lithophila* (SCHISEHK) TUTIN.

Prov. Kordestan, Arez, 20 km on road from Sanandaj to Dezh Shahpur (Marivan), c. 2200 m, 4. 7. 1971, J. L. (4494), II+III.

On *Pimpinella peregrina* L.

Prov. Gilan, Hashtpar to Astara, c. 22 km from Hashtpar, 50–120 m, 16. 5. 1971, J. L. (2991 a), II+III.

Telia more or less compact, blackish brown. — Teliospores ellipsoid, sometimes irregular,  $31-40 \times (17-20)-28 \mu\text{m}$ , wall reticulate,  $2-3.5(-4) \mu\text{m}$  thick, pedicel up to  $90 \mu\text{m}$  long.

*P. pimpinellae* has previously been reported on *P. puberula* BOISS. and *P. tragium*, but *P. aurea* and *P. peregrina* are new hosts for the rust in Iran. Another rust, *P. pulvillulata* LINDR. has been reported on *P. kotschyana* BOISS. and *P. tragium* in Iran. This rust is at least closely allied to *P. pimpinellae*, said to have larger teliospores, with thicker wall and longer pedicel than has *P. pimpinellae*. However, in Norwegian specimens of *P. pimpinellae* on *P. saxifraga* I have found spores exceeding  $40 \mu\text{m}$  in length with wall up to  $3 \mu\text{m}$  thick and pedicel up to  $50 \mu\text{m}$ . When discussing the "common race" of *P. hieracii* (RÖHL.) MART. on *Taraxacum* sp. (*P. taraxaci* PLOWR.) with *P. kurdistani* COOKE from Iran, JØRSTAD (1961) considered the latter whose teliospores are more thick-walled than the former as an adaptation of *P. taraxaci* to a very dry climate. It might also be the case with *P. pulvillulata*, but more material is necessary for solving this problem (cfr. also HENDERSON, 1964).

49. *Puccinia pulvinata* RABH., Hedwigia 10: 20, 1871.

On *Echinops* sp. (Asteraceae).

Prov. Tehran, Karaj Valley, Khargoush Dareh, 2470 m, 11. 9. 1974, B. SANI (12698), (II+) III; Assemvarak, 2450 m, 25. 8. 1975, P. W., H. F. & M. A. (14457), (II+) III.

*P. pulvinata* has been reported many times on *Echinops* spp. from Iran. It is near the aggregate species *P. calcitrapae* Dc. incl. *P. echinopsis* Dc., but it has thicker teliospore wall (JØRSTAD, 1961). In the present specimens the wall is 2.5–3(–4) µm thick.

50. *Puccinia punctata* LINK., Mag. Ges. Naturf. Fr. Berlin 7: 30, 1815.

On *Galium* sp. (Rubiaceae).

Prov. Tehran, Karaj Valley, Assemvarak, 2450 m, 25. 8. 1974, P. W., H. F. & M. A. (14470), II+III.

This rust has previously been reported from Iran on *G. coronatum* SIBTH. & SM. and *G. verum* L. by VIENNOT-BOURGIN (1958), on the latter host also by PETRAK (1940).

51. *Puccinia* cf. *punctiformis* (STR.) RÖHL., Deutsch. Fl., Ed. 2, III, 3: 132, 1863.

Syn.: *P. suaveolens* ROSTR., Blomsterløse Planter p. 28, 1869; 11. Skand. Naturf. møde Kjøbenhavn p. 339, 1874.

On Asteraceae.

Prov. Gilan, N of pass from Qasvin to Rasht, c. 1300 m, 13. 5. 1971, J. L. (2824), II.

The urediniospores are similar to those of *P. punctiformis* on *Cirsium arvense* (L.) SCOP., but have much wider hyaline papillae over the two equatorial pores.

*P. punctiformis* has been reported as *P. suaveolens* from several localities in Iran on *C. arvense* and *C. sp.* (ERSHAD 1977).

52. *Puccinia recondita* ROB. EX DESM., Bull. Soc. Bot. Fr. 4: 798, 1857.

On *Aconitum cochlerae* VARSCH. (Ranunculaceae).

Prov. Azarbaijan, Kaleybar, c. 20 km SW Kaleybar near Aliabad, c. 2300–2500 m, 20. 7. 1971, J. L. (4886), 0+I.

On *Thalictrum foetidum* L. (Ranunculaceae).

Prov. Azarbaijan, Gardaneh Almas, road from Azalem to Khalkhal, 2350–2400 m, 16. 7. 1975, P. W. & M. A. (18499 A), 0+I.

On *Thalictrum* sp.

Prov. Gorgan, between Shah Pass and Shahrud, Khosh Yailagh, 1600–1800 m, 18. 5. 1978, P. W. & M. A. (29634), 0+I.

Both host genera are new hosts in Iran, probably belonging to *P. persistens* PLOWR., one of the many specialized forms or races of *P. recondita*.

53. *Puccinia rhapsodicum* P. & H. SYD., Monogr. Ured. 1: 139, 1902.

On *Rhaphiticum annae-bentiae* Rech. (Asteraceae).

Prov. Kordestan, 15–35 km from Dezh Shahpur (Marivan) on road to Saqqez, c. 1400 m, 6. 7. 1971, J. L. (4564).

*P. rhapsodicum* has previously been mentioned by PETRAK & LOHWAG (1974) on *R. sp.* from Prov. Kurdistan. *R. annae-bentiae* is a new host for this rust, elsewhere known from Lebanon, Syria and from Kirghisia in USSR.

54. *Puccinia sileris* VOSS, Verhandl. Zool.-bot. Gesellsch. Wien 26: 120, 1876.

On *Laser trilobum* (L.) BORKH. (syn. *Siler trilobum* (L.) CRANTZ) (Apiaceae).

Prov. Gorgan, forest S of Tang-e Gol, 700–1000 m, 21. 6. 1974, P. W. & H. F. (12765), (II+) III.

This rust has earlier been reported from Iran on the same host (ERSHAD, 1977).

55. *Puccinia smyrnii* BIV.-BERNH., Stirp. Pl. Sicil. 4: 30, 1816.

On *Smyrniium cordifolium* BOISS. (Apiaceae).

Prov. Fars, Tang-e Cheh Mahaki, 1800–2000 m, 1. 6. 1975, P. W. & H. F. (17740 A), III.

*P. smyrnii* is a new member of the Iranian rust flora. It is distributed in Central Europe north to England and Ireland, and in the Mediterranean from Portugal and Morocco east to Afghanistan and Azerbajdzhan in USSR, where *S. olusatrum* L. is the main host. HENDERSON (1970) reported *S. cordifolium* with this rust from Afghanistan.

56. *Puccinia stapfiana* PETRAK, Annal. naturhist. Mus. Wien 52: 307, 1941.

On *Phlomis armeniaca* WILLD. (Lamiaceae).

Prov. Kordestan, Salavatabad, 25 km on road from Sanandaj to Hamadan, c. 2300 m, 3. 7. 1971, J. L. (4486, E), III.

*P. stapfiana* was described on *P. persica* BOISS. from Shiraz (Iran), later also mentioned by GOLATO (1960). *P. armeniaca* is a new host for the rust in Iran, but reported on it from Iraq and Turkey. URBAN (1966) described 0+I on the same host from Iraq.

57. *Trachyspora intrusa* (GREV.) ARTH., Manual of Rusts p. 97, 1934.

On *Alchemilla hessii* ROTHM. (Rosaceae).

Prov. Tehran, Karaj Valley, Assemvarak, 2450 m, 25. 8. 1974, P. W., H. F. & M. A. (14460), III.

The telial sori are small, scattered and of the type of secondary telia. — Spores often irregular and with ridges rather than warts.

*A. hessii* is a new host for this rust which in Iran has been published on *A. acutiloba* STEV. s. lat. and *A. persica* ROTHM.

58. *Uromyces acantholimonis* H. & P. SYD., Annl. mycol. 4: 28, 1906.

On *Acantholimon cymosum* BUNGE (syn. *A. paniculatum* RECH. f.) (Plumbaginaceae).

Prov. Semnan, Semnan to Firuzkuh, c. 15 km from Semnan, 1400 m, 19. 7. 1974, P. W. & G. COBHAM (13692), I+II+III.

On *Acantholimon* sp.

Prov. Tehran, hills W of Mardabad (SW of Karaj), 1250 m, 20. 9. 1974, I. Hedge, P. W. & H. F. (14698), II+III; Prov. Semnan, c. 20 km from Damghan, Kalateh, 1600 m, 9. 7. 1976, M. A. & MASOUMI (21021) (II+) III, c. 35 km N of Damghan, above Tuyeh, 2000 m, 16. 5. 1978, P. W. & M. A. (29500), I+II+III.

In the original description only uredinia and telia are described. The aecia were described from Kashmir by ULBRICH (1938). Later they have been mentioned by HENDERSON (1970) and BRANDENBURGER & STEINER (1972). ULBRICH (op. cit.) stated the aeciospores to have smooth walls, but in all specimens seen by me, the spores are very finely verrucose. BRANDENBURGER & STEINER (op. cit.) have found two-celled teliospores of the *Puccinia* type.

The rust has been reported many times from both Iran and Afghanistan on a number of *Acantholimon* species. *A. cymosum* and *A. virens* (see p. 97) are both new hosts for this rust.

59. *Uromyces anthyllidis* SCHRÖT., Hedwigia 14: 162, 1875.

Syn.: *U. trigonellae* PASS. in Thüm., Herb. Myc. Oecon. p. 118, 1873;

*U. trigonellae* PAT., Tab. anal. Fung. p. 72 n. 695, 1889.

On *Medicago rigidula* (L.) ALL. var. *rigidula* (Fabaceae).

Prov. Gilan, several km above Manjil Lake, c. 425 m, 13. 5. 1971, J. L. (2856), III.

On *Trigonella* sp. (Fabaceae).

Prov. Gilan, several km above Manjil Lake, c. 425 m, 13. 5. 1971, J. L. (2868), III.

JØRSTAD (1961) published this rust on *M. rigidula* from Nezva Kuh [by ERSHAD (1977) cited as Kuhe nezva], and VIENNOT-BOURGIN (1958) published the rust as *U. trigonellae* on *T. foenum-graecum* L. from Khoy.

In his treatise on rusts on legumes, GUYOT (1957) placed *U. trigonellae* with *U. anthyllidis*. VIENNOT-BOURGIN (1958) kept them

separate, based e. g. on different numbers of pores in the urediniospores and the presence or lack of a papilla over the pores in the teliospores. In the present material uredinia are lacking and in both specimens there are teliospores with or without papilla, so I prefer to keep them under the same name. However, JØRSTAD (op. cit.) mentioned in a foot-note that *U. anthyllidis* "is hardly valid and should probably be replaced by *U. trigonellae* PASS.", but he preferred to use *U. anthyllidis* as this name had long been used for that type of rust.

60. *Uromyces behenis* (DC.) UNGER, *Einfl. Bodens* p. 216, 1936.

On *Silene* sp. (Caryophyllaceae).

Prov. Kordestan, Kuh-e-Hamzeh Arab, between Bijar and Hamadan, 2200-2600 m, 1. 7. 1971, J. L. and F. TERMÉ (4350, E), III.

PETRAK (1940) reported this rust on *S.* sp. from the Bashm-Firuzkuh area.

61. *Uromyces bornmülleri* P. MAGN., *Verh. Ges. Deutsch. Naturf. Ärzte* 61: 151, 1893.

Syn.: *U. vesicatorius* (BUB.) NATTRASS, *First list of Cyprus Fungi* p. 26, 1937; *Aecidium leontices* TRANZ., *Acta Hort. Bot. Univ. Imp. Jurjevensis* 2: 91, 1901.

On *Leontice armeniaca* BOIV. (Leonticeae).

Prov. Azarbaijan, c. 15 km SW of Jolfa on road to Evaghli, 1000 m, 22. 4. 1976, P. W. & M. A. (19231), 0+I.

This rust was reported from Iran as *A. leontices* on *L. leontopetalum* by VIENNOT-BOURGIN & al. (1960) and by EBRAHIMI & MINASSIAN (1975) while ESFANDIARI (1948) published it under *U. vesicatorius*. ESFANDIARI (1948) and VIENNOT-BOURGIN & al. (1960) published also *U. bornmülleri* on *Bongardia chrysogonum* (L.) BOISS. RAYSS (1951) included *A. leontices* in *U. vesicatorius* while VIENNOT-BOURGIN & ALE-AGHA (1985) made *U. vesicatorius* (including *A. leontices*) synonymous with *U. bornmülleri* which has the priority.

*L. armeniaca* is a new host for the rust.

62. *Uromyces dianthi* NIESSL, *Verh. Naturf. Ver. Brünn*, 10: 162, 1872.

Syn.: *Uromyces caryophyllinus* WINT., *Hedwigia* 19: 35, 1880.

On *Gypsophila bicolor* (FREYN & SINT.) GROSSH. (Caryophyllaceae).

Prov. Tehran, pass between Qazvin & Manjil, 1500 m, 13. 7. 1975, P. W. & M. A. (18292), (II+) III.

This rust has previously been reported from Iran as *U. caryophyllinus* on *G. bicolor* by PETRAK (1957) and on *G. pulchra* STAPP by H. & P. SYDOW (1908). Other Iranian hosts are *Dianthus* spp. and *Buffonia macrocarpa* SER.

63. *Uromyces glycyrrhizae* (RABH.) P. MAGN., Ber. Deutsch. Bot. Ges. 8: 383, 1890.

On Fabaceae, cf. *Glycyrrhiza* sp.

Prov. Azarbaijan, Serow, 50 km W of Rezaieyeh, Turkish frontier post, 14. 7. 1971, J. L. (4162), 0+I.

Spermogonia between uredinoid aecia which densely cover the lower side of the leaves, on upper side sori more or less scattered. – Spores with 2 equatorial pores.

The rust has been reported from many localities in Iran on *Glycyrrhiza glabra* L., and also on *G. sp.* (ERSHAD, 1977). HENDERSON (1964) discussed the life cycle.

64. *Uromyces gypsophilae* COOKE, Hedwigiae 9: 14, 1880.

Syn.: *U. stellariae* H. & P. SYD. Anns mycol. 6: 526, 1908.

On *Gypsophila bicolor* (FREYN & SINT.) GROSSH. (Caryophyllaceae).

Prov. Kordestan, foot of Kuh-e-Hamzeh Arab, Bijar to Hamadan, c. 2000 m, 1. 7. 1971, K. H. RECHINGER (4391, E), III; Prov. Azarbaijan, near Amirabad between Mianeh and Herowabad (Khalkhal), 1800–2000 m, 14. 7. 1971, K. H. RECHINGER (5119 a, E) II+III, 34 km S of Rezaieyeh, between Balanish and Rasbakan, 1350 m, 15. 6. 1971, K. H. RECHINGER (4180 a, E), III.

On *Gypsophila* sp.

Prov. Tehran, SW of Firuzkuh on road to Damavand, P. W. & G. COBHAM (13654 A) III; Prov. Azarbaijan, c. 30 km to Tabriz on the road from Ahar, 1600–2000 m, 17. 7. 1977, M. A. & SARDABI (24408 A), III; Prov. Kordestan, Sanandaj, 1800 m, 17. 6. 1963, M. JACOBS (6932), III.

Previously *U. gypsophilae* has been reported on *G. elegans* BIEB., *G. haussknechtii* BOISS. and *G. polyclada* FENZL. as well as on *G. sp.* (ERSHAD, 1977). *G. biocolor* is a new host for this rust in Iran.

65. *Uromyces hippomarathri* LINDR., Acta Soc. Fauna Fl. Fennica 22: 147, 1902.

Syn.: *Aecidium jurisicii* BUB. in JURISIĆ, Anns mycol. 34: 57, 1936.

On *Hippomarathrum microcarpum* (M. BIEB.) B. FETSCH. (Apiaceae).

Prov. Azarbaijan, 32 km from Qareh Aghaj to Germi, c. 600 m, 24. 5. 1971, J. L. (3275) I+III.

Teliospores with hyaline papillae, wall not thickened at apex.

JØRSTAD (1961) reported *U. hippomarathri* on *H. crispum* PERS. from Prov. Mazandaran. In USSR it is reported on the same host from Gruzia and Azerbajdzhan and on *Cachrys macrocarpa* LEDEB. from Kazakhstan. GUYOT & MALENÇON (1963) brought a record from Morocco on *Hippomarathrum libanotica* (L.) KOCH (= *Cachrys pterochlaena* Dc., cf. RIEUF, 1971).

*A. jurisicii* was described from Yugoslavia on *Seseli tortuosum* L., but LINDTNER (1959) identified the host as *H. crispum* and made *A. jurisicii* synonymous with *U. hippomarathri*.

66. *Uromyces minor* SCHRÖT. in Cohn, Krypt.-Fl. Schles. III, 1: 310, 1887.

On *Trifolium ambiguum* M. B. (Fabaceae).

Prov. Azarbaijan, Qotur Su, N side of Kuhhaye Sabalan SE of Khiyav (Meshkin Shahr), 2300–2500 m, 13. 7. 1971, J. L. (4694), I+III.

The rust is new to the flora of Iran, but the host has been reported from this rust from Armenia, Azerbajdzhan and Nakhichevan in USSR.

67. *Uromyces muscari* (DUBY) GRAVES, Cat. p. 280, 1857.

Syn.: *U. scillarum* (GREV. EX BERK.) WINT. in Rabh., Krypt.-Fl. 1: 142, 1881.

On *Bellevalia longistyla* (MISZC.) GROSSH. (Liliaceae).

Prov. Lorestan, Khalilabad, c. 40 km SE of Aligudarz, 2300–2450 m, 3. 5. 1975, P. W. & M. A. (16432 AB), II+III.

On *Bellevalia* aff. *longistyla* (MISZC.) GROSSH.

Prov. Azarbaijan, 27 km S of Khoy on road to Shahpur, 1500 m, 24. 4. 1976, P. W. & M. A. (19276), III.

On *Bellevalia pycnantha* (C. KOCH) A. LOS.

Prov. Mazandaran, Lar Valley, below Rudkaneh Abru (Sefid Ab), 2300 m, 28. 5. 1974. P. W. & al. (11818), III.

Urediniospores with low, hyaline papillae over the pores.

JØRSTAD (1961) reported this rust for the first time on *Bellevalia* sp. in Iran, but it had previously been reported several times on *Muscari* spp. (ERSHAD, 1977). *B. longistyla* has been reported as a host for this rust in Nakhichevan ASSR (AKHUNDOV, 1979), but *B. pycnantha* is a new host for this rust.

*Uromyces oliveirae* ANIKSTER & WAHL is similar to *U. muscari*, but lacks the papillae over the urediniospore pores.

68. *Uromyces polycnemi* (LIBOSCH.) TRANZ., Mem. Soc. Nat. Moscou 5: 76, 1817.

Syn.: *U. salsolae* REICH., Verk. k. k. Zool.-Bot. Ges. Wien 27: 842, 1877.

On *Salsola* sp. (Chenopodiaceae).

Prov. Azarbaijan, 60 km NW of Bonab, E side of Lake Rezayeh, 1350 m, 24. 10. 1974, P. W. & SHIRDELPUR (14943), (II+) III.

This rust has been reported as *U. salsolae* on *S. glauca* BIEB. by PETRAK (1958), on *S. rigida* PALL var. *tenuifolia* BOISS. by VIENNOT-BOURGIN (1958), and on *Halocharis sulphura* MOQ. by EBRAHIMI & MINASSIAN (1975).

PETRAK (1953) reported also *U. nidificans* TRANZ., on *Salsola* spp. in Iran.

69. *Uromyces polygoni-avicularis* (PERS.) KARST., Bidr. Känned. Finl. Nat. Folk 4: 12, 1879.

Syn.: *U. polygoni* (RABH.) FUECK., Jahrb. Nass. Ver. Nat. 23-24: 64, 1870.

On *Polygonum cognatum* MEISSNER (syn. *P. alpestre* C. A. MEY.) (Polygonaceae).

Prov. Mazandaran, Lar Valley, 2450-2550 m, 2. 7. 1974, P. W. & M. A. (1332), II+III; Prov. Khamseh, S of Zanjan, c. 1200 m, 22. 7. 1971, J. L. (4254), (II+) III.

Judging from the literature *P. cognatum* is commonly infested with this rust species, also found on *P. aviculare* L., *P. persicaria* L. and *P. rottboellioides* JAUB. & SPACH (syn. *P. tubulosum* BOISS.) in Iran.

70. *Uromyces striatellus* TRANZ., Annl. mycol. 8: 24, 1910.

On *Euphorbia* sp. (Euphorbiaceae).

Prov. Kerman, Kuh-e-Hezar, 3000-3300 m, 15. 6. 1975, H. F. & M. A. (16238), III.

Teliospores 22-30 × 17-23 µm, wall c. 1.5 µm thick and with very fine, longitudinal ridges some of them broken with warts.

VIENNOT-BOURGIN & al. (1971) reported the rust on *E. virgata* WALDST. & KIT. from Jakrom in Prov. Fars.

In the specimen 16238 uredinia of *Melampsora euphorbiae* (SCHUB.) CAST. also occur.

71. *Uromyces striolatus* TRANZ., Annl. mycol. 8: 23, 1910.

On *Euphorbia boissieriana* (WORON.) PROKH. (Euphorbiaceae).

Prov. Kordestan, foot of Kuh-e-Hamzeb Arab, c. 2000 m, 1. 7. 1971, K. H. RECHINGER (4407, E), III.

Teliospores ellipsoid, ovoid or pyriform, wall 1.5(-2) µm thick with longitudinal ridges.

On *E. sp.* PETRAK & ESFANDIARI (1941) reported the rust from the Faschand in Elburz, and ESFANDIARI (1946) and ERSHAD (1977) from the Tehran area. *E. boissieriana* is a new host for this rust.

*U. striolatus* is closely allied to *U. striatellus* TRANZ. and also to *U. undulatus* TRANZ. (JØRSTAD, 1952).



72. *Uromyces thellungii* MAIRE, Bull. Soc. Hist. Nat. Afr. Nord 8: 147, 1917.

On *Rumex vesicarius* L. (Polygonaceae).

Prov. Bandar-Abbas, c. 15 km W of Rudan, 400 m, 7. 4. 1975, P. W. & H. F. (15614), II+III.

This rust is new to the flora of Iran. On *R. vesicarius*, its main host, it has been found in the Canary Islands, Morocco, Algier, Pakistan, and India. From Israel also *R. roseus* L. is recorded as a host (RAYSS, 1951).

73. *Uromyces tuberculatus* FÜCK., Jahrb. Nass. Ver. Nat. 23-24: 64, 1870.

On *Euphorbia densa* SCHRENK. (Euphorbiaceae).

Prov. Kerman, Shirinale, between Garyalot-Arab and Lalebzar, 2700 m, 17. 6. 1975, H. F. & M. A. (16273 A), III; Prov. Qom, to Tehran, SW of Daryache (Qom lake), 900 m, 16. 9. 1974, P. W. & H. F. (11566), III.

Teliospores subglobose to globose, 20-25 × 20-23 µm, wall (2-2.5 µm thick, chestnut-brown, roughly verrucose, papilla when seen low, flat.

This rust has previously been reported from Iran on *Euphorbia* sp. (PETRAK & ESFANDIARI, 1941) and on *E. condylocarpa* M. B. (KHABIRI, 1958). *E. densa* might be a new host for this rust.

Three other specimens of *Euphorbia* are studied, viz.

On *Euphorbia* cf. *cheiradenia* BOISS. & HOHEN.

Prov. Azarbaijan, Kaleibar protected area region from Makidi to Veinagh, 1000-1700 m, 14. 5. 1975, P. W. & M. A. (17074), III.

On *Euphorbia macroclada* BOISS.

Prov. Kermanshah, Tang-e Dalkushiar W of Kerend, 1450 m, 8. 7. 1975, P. W. & M. A. (16770), III.

On *Euphorbia microsciadia* BOISS.

Prov. Baluchistan, 35 km from Zahedan on the road to Khash, 1600 m, 23. 4. 1977, M. A. (22698), III.

Telia dark brown, covering more or less the lower side of the leaves. - Teliospores ellipsoid to subglobose, in No. 17074 they are smaller (19-22 × 16-20 µm) than in the two other specimens (20-27 × 17-23 µm). No. 22698 has a brown spore wall, while in the two others it is dark brown, verrucose, in all specimens with a low, hyaline or pale yellowish papilla. - Pedicel hyaline, broken short under the spore.

Compared with *U. tuberculosus*, the teliospores in these three specimens are not so roughly verrucose. I have also compared them with some other *Euphorbia* rust species without finding any match-

ing them. As I do not want to describe a new species, I prefer to discuss them in relation to *U. tuberculatus*.

74. *Uromyces verruculosus* SCHRÖT., Jahres-Ber. Schles. Ges. Vaterl. Cult. 50: 140, 1873.

Syn.: *U. schroeteri* DE TONI in Sacc., Syll. fung. 7: 551, 1888.

On *Melandrium persicum* (BOISS. & BUHSE) BORNM. (Caryophyllaceae).

Prov. Mazandaran, Lar Valley, Gosaldareh, 2400 m, 13. 8. 1974, M. A. & SANI (14141), II+III.

On *Silene* sp. (Caryophyllaceae).

Prov. Azarbaijan, Ghóje Dag, near Bazargan, c. 2200–2250 m, 1. 8. 1971, J. L. (5010 a), II+III; Prov. Kordestan, c. 90 km from Sanandaj to Dezh Shahpur (Marivan), 1650–1800 m, 6. 2. 1971, J. L. (4549), III.

*M. persicum* seems to be a new host for this rust. In Iran it has previously been reported on *M. album* (K.) GARCKE and *Gypsophila pulchra* STAPP.

*U. verruculosus* has not been reported on *Silene* from Iran, but a closely allied rust, *U. silenes-chloraeifoliae* VIENNOT-BOURGIN, has been described on *S. chloraeifolia* SM. from Damavand. Judging from descriptions and drawings teliospores of the latter seem more coarsely verrucose.

#### AFGHANISTAN

1. *Puccinia arenariae* (SCHUM.) WINT., Hedwigia 19: 38, 1880.

On *Minuartia* sp. (Caryophyllaceae).

Prov. Parvan, Panjshir Valley, 2 km above Gulbarhar, 1700 m, 4. 5. 1962, I. HEDGE & P. W. (2970), III.

The material is very scanty, consisting of only two small, dark brown sori. The teliospores measured  $37\text{--}52 \times 15\text{--}18 \mu\text{m}$ , rounded or attenuated at the thickened apex. DURRIEU (1975) published *P. hysteriiformis* PECK on *M. cf. foliosa* from Salang. JØRSTAD (1932) discussed the forms of *P. arenariae* s. lat. and found that *P. hysteriiformis*, which is a true microform, not leptosporic as are most forms of *P. arenariae*, could deserve varietal rank as *P. arenariae* var. *hysteriiformis* (PECK) JØRST.

2. *Puccinia aristidae* TRACY, J. Mycol. 7: 281, 1893, var. *aristidae*.

On *Aristida pennata* TRIN. (Poaceae).

Prov. Maymana, half way between Maymana and Andkhui, 400 m, 1. 6. 1962, I. HEDGE & P. W. (3837), II+III.

Urediniospores with distinct equatorial spores. – Telia linear, black.

CUMMINS & HUSAIN (1966) reported this var. on *A. plumosa* L. from Afghanistan. *A. pennata* is a new host for this rust in Afghanistan, but it has been found with the same rust in USSR. Its aecial stage *Aecidium caspicum* JACZ. occurs on *Heliotropium europaeum* L. (Boraginaceae).

3. *Puccinia behenis* OTTH, Mitth. Naturf. Ges. Bern 1870: 113, 1871.

On *Cerastium* sp. (Caryophyllaceae).

Prov. Parvan, Panjshir Valley, Mukeni 2400 m, 19. 7. 1962, I. Hedge & P. W. (5279), II+III.

*P. behenis* is widespread in Europa and Asia on caryophyllaceous hosts, mainly on *Silene* spp., but seems to be very rare on *Cerastium*, reported only from Siberia (TRANZSCHEL, 1939), Pakistan (AHMAD, 1960; 1969) and China (JØRSTAD, 1959). The rust is new to the flora of Afghanistan.

4. *Puccinia calcitrapae* DC., Fl. Fr. 2: 221, 1805.

Syn.: *P. carduorum* JACKY, Zeitschr. Pfl. Krankh. 9: 288, 1899;

*P. centaureae* DC., Fl. Fr. 5: 59, 1815;

*P. cirsii* LASCH in Rabh. Fungi Eur. 89, 1859 (non *P. cirsii* KIRCHNER);

*P. cousinia* P. & H. SYD., Monogr. Ured. I: 62, 1902.

On *Centaurea iberica* TREV. (Asteraceae).

Prov. Balkh, Mazar-i-Sharif, 400 m, 5. 6. 1962, I. HEDGE & P. W. (3848), (II+) III.

On *Centaurea* sp.

Prov. Kunduz, 25 km N of Kunduz, 8. 6. 1969, L. EKBERG (9029), III.

Previously this rust species has been reported from Afghanistan e. g. by HENDERSON & JØRSTAD (1966) who in addition to *C. iberica* also mentioned *C. bruguieriana* (DC.) HAND. MASS. and *C. pulchella* LEDEB. as hosts. They also reported the rust on species belonging to *Acroptilon* and *Cousinia*.

5. *Puccinia eremuri* KOM., Script. Bot. Horti Univ. Petropol. 4: 262, 1895.

On *Eremurus aitchisonii* BAKER (Liliaceae).

Prov. Kabul, Darje-e-Chap-e Paghman, 2750-3200 m, 21. 6. 1970, O. ANDERS (4073), III.

On *Eremurus bactrianus* WENDELBO.

Pov. Badakhshan, Gawarzan, c. 30 km S of Queshm, 1800 m, 1. 7. 1969, I. HEDGE & P. W. (9380), III.

On *Eremurus comosus* O. FEDTSCH.

Prov. Takhar, Farkhar, 1400-1650 m, 14. 5. 1977, D. PODLECH & K. JARMAL (30150), III.

On *Eremurus kaufmannii* REGEL.

Prov. Bamian, Kotal-e-Devali Pass, between Yakaulang and Kotal-e-Shahtu, 3100 m, 30. 6. 1962, I. HEDGE & P. W. (4850), III.

On *Eremurus korshinskii* O. FEDTSCH.

Prov. Bamian, Kotal-e-Shahtu, 3050 m, 18. 7. 1970, O. ANDERS (4600), III.

On *Eremurus persicus* (JAUB. & SPACH) BOISS.

Prov. Kabul, Sher Darvasa, 1900 m, 2. 5. 1962, I. HEDGE & P. W. (2983), III.

On *Eremurus roseolus* VOLD.

Prov. Balkh, Mazar-i-Sharif, near Samangan (Aybak), 1200 m, 23. 5. 1962, I. HEDGE & P. W. (3561), III.

On *Eremurus spectabilis* M. B. subsp. *regelii* (VOED.) WENDELBO.

Prov. Wardak, 28 km S of Kabul on Ghazni road, 2200 m, 1. 5. 1971, C. GREY-WILSON & F. F. HEWER (693), III; Prov. Qataghan, near Dushi, 1100 m, 22. 5. 1962, I. HEDGE & P. W. (3507), III.

On *Eremurus stenophyllus* (BOISS. & BUHSE) BALSER subsp. *aurantiacus* (BALSER) WENDELBO.

Prov. Bamian, Darja-e-Bariki-Tal near Kadalak, 16. 7. 1970, O. ANDERS (4409), III; Sabzac Pass, 96 km E of Herat Paropamisas Range, 1950 m, 3. 6. 1966, P. FURSE (7688), III; N side of Salang Pass (Hindu Kush), 1500 m, 12. 6. 1966, P. FURSE (78421).

On *Eremurus stenophyllus* (BOISS. & BUHSE) BALSER subsp. *stenophyllus*.

Without locality and date, F. NEUBAUER (1832), III.

On *Eremurus* sp.

Prov. Baghis, Chapchal Valley near Gala-i Chasma at the road Bala Murghal-Ghormach, 480 m, 6. 5. 1977, D. PODLECH & K. JARMAL (29916), III.

New hosts for this rust are *E. stenophyllus* subsp. *aurantiacus*, *E. bactrianus* and *E. roseolus*, and new hosts for the rust in Afghanistan are *E. regelii* and *E. olgae*.

6. *Puccinia gymndrae* TRANZ., Scripta Bot. Hort. Univ. Imp. Retrop. 3: 137, 1891.

On *Lagotis* sp. (Scrophulariaceae).

Prov. Wardak, 20 km S of Markas (Behsud), 2600 m, 13. 6. 1969, I. HEDGE & P. W. (8806), III.

Teliospores 32–37 × 21–25 µm, densely verrucose, wall 2.5–3 µm thick, at apex thickened up to 4 µm. Upper pore apical, the lower ½–¾ depressed, sometimes more.

SAVILLE (1968) split this species into four subspecies. Judging from his diagnosis, the present specimen corresponds fairly well to subsp. *yunnanensis* SAVILE, though its spore wall is slightly thinner (1.2–2.5 µm). HENDERSON (1970) has reported *P. gymndrae* from Afghanistan, but he stated the upper pore to be lateral.

7. *Puccinia litvinovii* TRANZ. & EREM. in Tranzschel, *Conspectus Uredinalium URSS* p. 306, 1939.

On *Ferula* sp. (Apiaceae).

Prov. Fariab, between Kato Qala and Zarshoy, c. 15 km NW of Belcheragh, 900 m, 23. 5. 1969, I. HEDGE, P. W. & L. EKBERG (W. 8323), III.

HENDERSON & JØRSTAD (1966) reported this rust on *Bunium cabulicum* BORNH. from the Kabul area. *Ferula* is a new host genus in Afghanistan, but it has been recorded on *Ferula* spp. from adjacent areas of USSR.

8. *Puccinia menthae* PERS., *Syn. Meth. Fung.* p. 227, 1801.

On *Mentha longifolia* (L.) HUDS. (Lamiaceae).

Prov. Ghazni, Ghazni-Qarabagh Karezi, 28. 6. 1968, P. JØRGENSEN (632), II+III.

On *Origanum* sp.

Prov. Baghlan, Khinjan Valley, N side of Salang Pass, 1500 m, 27. 6. 1969, I. HEDGE, P. W. & L. EKBERG (9242) II.

*P. menthae* has been reported from many localities, esp. on *M. longifolia* (including *M. sylvestris* L.), while *Origanum* seems to be a new host genus for this rust species in Afghanistan.

9. *Puccinia phlomidis* THÜM., *Bull. Soc. Imp. Natur. Moscou* 53: 216, 1878.

On *Eremostachys loasifolia* BENTH. (Lamiaceae).

Prov. Badghis, Khusmargh in Darrah Tagab Laman near Qala Nau, 1140 m, 18. 5. 1969, I. HEDGE, P. W. & L. EKBERG (W. 8110), III.

On *Eremostachys* sp.

Prov. Herat, below Chesmeh Obek, 1600 m, 12. 5. 1969, I. HEDGE, P. W. & L. EKBERG (W. 7894), III.

To my knowledge the only record of this rust in Afghanistan is given by HENDERSON (1970) who found it on *E. gymnoclada* RECH. f. & KOEIE, also from prov. Badghis. *E. loasifolia* seems to be a new host for this rust whose main host genus is *Phlomis*.

10. *Puccinia podospermi* DC., *Fl. fr. ed.* 3, 2: 595, 1805.

On *Scorzonera songorica* (KAR. & KIR.) LIPSCH. & VASS. (Asteraceae).

Prov. Bamian, W side of Shibar Pass, 2800 m, 14. 6. 1972, I. HEDGE & P. W. (4237), (II+) III.

Urediniospores with two equatorial pores. – Teliospores rounded at ends, 37–43 × 30–34 µm, wall 3–4 µm thick, verrucose.

The rust is new to the flora of Afghanistan, but the host has been

reported with the same rust from Nakhichevan ASSR (AKHUNDOV, 1979). It is known only on *Scorzonera* spp. belonging to the sect. *Podospermum* (JØRSTAD, 1961 a; HENDERSON, 1964).

11. *Puccinia recondita* ROB. EX DESM., Bull. Soc. Bot. Fr. 4: 798, 1857.

Syn.: *P. bromina* ERIKS., Ann. Sci. Nat. Bot. VIII, 9: 271, 1899.

On *Bromus lanceolatus* ROTH. (syn. *B. macrostachys* DESF.) (Poaceae).

Prov. Qataghan, Mirza Atbili Pass, SE of Samangan, 1350 m, 10. 6. 1962, I. HEDGE & P. W. (4037 a), (II+) III.

On *Bromus sterilis* L.

Prov. Qataghan, half-way between Pol-i-Khomri and Samangan (Aybak), 900 m, 23. 5. 1962, I. HEDGE & P. W. (3527), III.

On *Bromus tectorum* L.

Prov. Qataghan, half-way between Pol-i-Khomri and Samangan (Aybak), 900 m, 23. 5. 1962, I. HEDGE & P. W. (3225), (II+) III.

HENDERSON & JØRSTAD (1966) recorded this aggregate rust species from Afghanistan on *B. sterilis* and *B. tectorum*. *B. lanceolata* is a new host for the rust in Afghanistan, but it has been reported from many places as *P. bromina* on *B. macrostachys*.

12. *Puccinia tulipae* SCHRÖT., Jahresber. Schles. Ges. 53: 117, 1875.

On *Tulipa* sp. (Liliaceae).

Prov. Bamian, Band-i-Amir, Kohe Jak Ruya, 3500 m, 24. 6. 1970, DIETERK (586), III; Prov. Kabul, Estalef, 1850 m, 15. 4. 1977, D. PODLECH (28580), III.

*P. tulipae* has been reported many times from Afghanistan on *Tulipa* spp.

13. *Uromyces acantholimonis* H. & P. SYD., Annls mycol. 4: 28, 1906.

On *Acantholimon virens* CZERNIAK (Plumbaginaceae).

Prov. Baghlan, N side of Salang Pass, 2500 m, 22. 7. 1969, P. W. & L. EKBERG (9843 b), I+II+III.

For comments see under Iran (p. 87).

14. *Uromyces gypsophila* COOKE, Grevillea 9: 14, 1880.

On *Gypsophila* sp. (Caryophyllaceae).

Prov. Erzincan, 1250 m, 30. 7. 1957, DAVIS & I. HEDGE (31842), E), (II+) III.

Telia scattered or in concentric rings around a central sorus. – Urediniospores with 3 equatorial pores intermixed in telia. – Teliospore wall 2–2.5 µm thick, verrucose and with warts more or less in longitudinal rows.

This species has not previously been reported from Afghanistan.

15. *Uromyces muscari* (DUBY) GRAVES, Cat. p. 280, 1857.Syn.: *U. scillarum* (GREV. EX BERK.) WINT. in Rabh. Krypt.-Fl. 1: 142, 1881.On *Bellevalia saviczii* WORON. (Liliaceae).

Prov. Baghis, 2 km E of Qades, 1320 m, 4. 5. 1977, D. PODLECH &amp; K. JARMAL (29815), (II+) III.

*U. muscari* is a new member of the rust flora of Afghanistan, but *B. saviczii* has been reported as a host for the rust from Turkmenia (MELNIK, 1980).

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