

SPANISH RUST AND SMUT FUNGI

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The present account deals with a collection of rust and smut fungi which I made while accompanying an undergraduate expedition in the summer of 1956. To the members of the expedition and its organizer, D. W. Dresser, I am indebted for many facilities and some of the collections.

In a group of highly specialized obligatory parasites, as are the rust and smut fungi, it is axiomatic that the richness of the host flora determines that of the fungal. The intermingling of species rich associations is particularly favourable for heteroecious rust fungi. The two areas visited in Spain emphasized these points.

In July, ten days were spent in the Sierra de Gredos, a granitic mass lying north-west of Madrid. The flora of these mountains is not particularly rich in phanerogamic species. A marked feature of the upper slopes from the treeline is a *Cytisus-Genista* scrub association merging into extensive *Nardus* grassland. Only on rocky outcrops, summit detritus and scree slopes are there rich flowering-plant associations. Consequently the rust fungus flora is in general rather poor.

In marked contrast to the Sierra de Gredos are the Picos de Europa Mountains in northern Spain. On the limestone rocks, gorges and grasslands species-rich associations occur and as a consequence fungi are more numerous. Three days were spent collecting in the Refugia Aliva area above Espinama between 5000 and 7000 ft. The lowlands in the neighbourhood of Potes proved similarly rich in rust and smut fungi. The only association poor in species was the *Erica* heath (*Erica multiflora* and *Daboecia cantabrica*) and *Erica* shrub (*Erica arborea* and *Juniperus oxycedrus*) communities.

The collection is deposited in the Herbarium, Royal Botanic Garden, Edinburgh.

UREDINALES

Gymnosporangium clavariiforme (Pers.) DC.

On *Crataegus monogyna* Jacq., Picos de Europa Mts., Potes, 1000 ft. *Juniperus communis* community in vicinity, 13 viii 56, E.1939.

Hyalopsora polypodii (Diet.) Magn.

On *Cystopteris fragilis* L., Sierra de Gredos; El Arenal, 3200 ft., II only, 30 vii 56, E.1927; Club Alpino hut, 6400 ft. II only, 3 vii 56, E.2013. Picos de Europa, Refugio Aliva, 5700 ft., II only, 17 viii 56, E.1995. The uredospores of this rust are very common in Spain but no teliospores could be found in any collections.

Melampsora epitea (K. & S.) Thuem.

On *Salix caprea* L., Picos de Europa Mts., Espinama, 3000 ft., II only, 20 viii 56, E.2065.

Melampsora larici-populina Kleb.

On *Populus nigra* L., Picos de Europa Mts., nr. Espinama, II and III, 20 viii 56, E.2066.

Phragmidium bulbosum (Strauss) Schlecht.

On *Rubus caesius* L., Sierra de Gredos, El Arenal, 3000 ft., 5 viii 56, E.1990.

Phragmidium fragariae (DC.) Rabh.

On *Potentilla sterilis* L., Picos de Europa Mts., Espinama, 2500 ft., II and III, 20 viii 56, E.2062.

Phragmidium sanguisorbae (DC.) Schroet.

On *Poterium magnoli* Spach, Picos de Europa Mts., Potes, 1200 ft. 12 viii 56, E.1932.

On *Poterium sanguisorba* L., Picos de Europa Mts., Espinama, 3000 ft. 19 viii 56, E.2041.

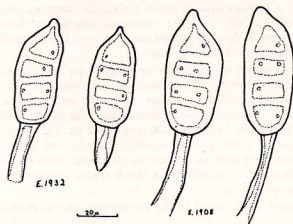


FIG. 1. *Phragmidium sanguisorbae*, teliospores. Left, ssp. *mediterraneum*, right, ssp. *sanguisorbae*.

***Phragmidium sanguisorbae* (DC.) Schroet. subsp. *mediterraneum* D. M. Henderson subspecies nova.**

A subspecies typica sporis majoribus, stipitibus distincte longioribus (34-) 63 (-114) μ , differt.

Type. On *Poterium polygamum* Waldst. & Kit., Sierra de Gredos, El Arenal, 3200 ft., 7 viii 56, E.1908.

That the rust on *Poterium* species in southern Europe differs appreciably from that in northern Europe has been noticed by a number of authors. Although Sydow (1915) mentions that Balkan material is somewhat intermediate between the northern European and Mediterranean types, the general distribution of variation seems a clear case of geographical differentiation probably accompanied by host specialisation. The general facies of the two types is quite different (Fig. 1).

Table 1.

Teliospores of *Phragmidium sanguisorbae* ssp.

Collection ssp. <i>sanguisorbae</i>	teliospore dimensions (means of 30 spores)		
	Length	Breadth	Stipe Length
E.1932 . . .	59	24.9	31.2
E.2041 . . .	52	24	24
Sydow 2642 . . .	50.6	26.6	28
Petrak 418 . . .	55.5	24.8	23

ssp. *mediterraneum*

E.1908 . . .	66.8	31.6	63.4
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***Pileolaria terebinthi* Cast.**

On *Pistacia terebinthus* L., Picos de Europa Mts., Potes, 13 viii 56, E.1933.

***Puccinia acetosae* Körn.**

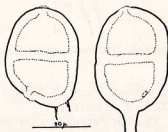
On *Rumex acetosa* L., Sierra de Gredos, El Arenal, 1200 ft., 8 viii 56, E.1919, II only, with two supra-equatorial pores and scattered spines.

***Puccinia annularis* (Str.) Rohl.**

On *Teucrium scorodonia* L., Picos de Europa Mts., Espinama, 20 viii 56, E.2054.

***Puccinia aristolochiae* (DC.) Wint.**

On *Aristolochia boetica* L., Sierra de Gredos, El Arenal, 1200 ft., 8 viii 56, E.1918.

FIG. 2. *Puccinia aristolochiae*. Teliospores on *Aristolochia boetica*. E.1918.

Telia only, hypophyllous, spores oblong-elliptic $37-40 \times 24-27\mu$ slightly constricted at septum, wall smooth, thick ($3-4\mu$), upper pore apical, lower pore half depressed. Stipe short. (Fig. 2). This rust has previously been recorded on *Aristolochia longa* from Spain.

***Puccinia behenis* Oth**

On *Silene cucubalus* L., Picos de Europa Mts., Potes, 1000 ft. II and III, 12 viii 56, E.1930.

***Puccinia calcitrapae* DC.**

On *Centaurea carpetana* Boiss. & Reut., Sierra de Gredos, El Arenal, 3000 ft. 5 viii 56, E.593. II and III. II with three equatorial pores.

On *Centaurea nigra* L. var. *pallida* Lge., Sierra de Gredos, El Arenal, 3200 ft., 5 viii 56, E.513. II spores with 2-3 equatorial pores.

On *Centaurea* sp., Picos de Europa Mts., nr. Potes, 2500 ft. 17 viii 56, E.2020. III only.

***Puccinia calthae* Link**

On *Caltha palustris* L., Picos de Europa Mts., Refugio Aliva, 5400 ft. 17 viii 56, E.2006.

***Puccinia cardui-pycnocephali* Syd.**

On *Carduus pycnocephalus* L., Picos de Europa Mts., gorge below Potes, 1800 ft., 15 viii 56, E.1970. II spores with three equatorial pores.

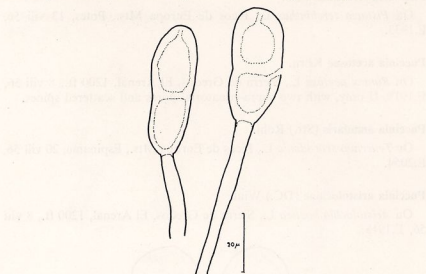


FIG. 3. *Puccinia chamaedryos*. Teliospores on *Teucrium pyrenaicum*. E.1934.

***Puccinia caricina* DC.**

On *Pedicularis mixta* Grenier, Picos de Europa Mts., Refugio Aliva, 5200 ft., 18 viii 56, E.2025a. I on leaves.

On *Carex pendula* L., Picos de Europa Mts., nr. Potes, 1200 ft., 12 viii 56, E.1931.

On *Carex ferruginea* Scop., Picos de Europa Mts., Espinama, 2500 ft. 20 viii 56, E.2049. III spores $56 \times 16 \mu$, II spores usually with three equatorial pores.

***Puccinia chamaedryos* Ces.**

On *Teucrium pyrenaicum* L., Picos de Europa Mts., nr. Potes, 1200 ft., 13 viii 56, E.1934.

Telia only, mostly hypophyllous, grey-brown, not causing deformations; teliospores in compact crust, sub-fusoid, pale brown, $39-45 \times 16-20 \mu$, wall smooth, thin, stipe long. (Fig. 3.).

This species belongs to the *P. annularis* complex characterised by non-pulverulent sori and light coloured teliospores. The teliospores of *P. annularis*, *sensu stricto*, rarely exceed 40μ in length, whereas this is the rule in the present species.

***Puccinia circaeae* Pers.**

On *Circaea lutetiana* L., Picos de Europa Mts., Espinama, 2500 ft., 20 viii 56, E.2058.

***Puccinia cnici* Mart.**

On *Cirsium vulgare* (Savi) Ten., Picos de Europa Mts., nr. Potes, 2500 ft., 17 viii 56, E.2021.

On *Cirsium eriophorum* (L.) Scop., Picos de Europa Mts., 2000 ft., 17 viii 56, E.2007.

***Puccinia cnidii* Lindr.**

On *Ligusticum lucidum* Miller., Picos de Europa Mts., nr. Potes, 2000 ft., 15 viii 56, E. 1979.

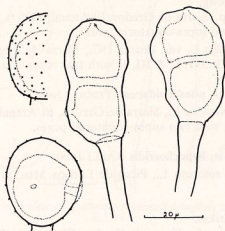


FIG. 4. *Puccinia cnidii* on *Ligusticum lucidum*. Teliospores and uredospores. E.1979.

Teliospores and uredospores in same sori, foliicolous, pulverulent. Uredospores broadly ovate with two equatorial pores with conspicuous hyaline caps, $28 \times 24\mu$, spore wall thickened at apex, echinulate overall. Teliospores oblong, scarcely constricted at septum, $39-44 \times 23-26\mu$, wall somewhat irregular in outline up to 3μ thick, closely punctate, upper pore apical, lower pore depressed half or more. (Fig. 4.).

***Puccinia coronata* Corda**

On *Rhamnus alpina* L., Picos de Europa Mts., Refugio Aliva, growing beside infected *Festuca rubra*, 5400 ft., 18 viii 56, E.2027.

On *Festuca rubra* L. *sensu lato*, Refugio Aliva, growing beside E.2027, E.2028.

On *Arrhenatherum elatius* (L.) J. & C. Presl var. *bulbosus* (Willd.) Spenn., Sierra de Gredos, El Arenal, 2800 ft., 5 viii 56, E.592.

***Puccinia eryngii* DC.**

On *Eryngium campestre* L., Sierra de Gredos, El Arenal, 3200 ft., 20 vii 56, E.506. Picos de Europa Mts., 4500 ft., 14 viii 56, E.1954.

***Puccinia graminis* Pers.**

On *Dactylus glomerata* L., Picos de Europa Mts., nr. Potes, 1500 ft., growing beside *Berberis vulgaris* bearing old aecidia, 15 viii 56, E.1974.

On *Cynosurus cristatus* L., Sierra de Gredos, El Arenal, 2800 ft., 5 viii 56, E.1900. II only, spores elliptic with equatorial pores.

On *Triticum vulgare* L., Sierra de Gredos, El Arenal, 3000 ft., 5 viii 56, E.1910.

***Puccinia hieracii* Mart.**

On *Chondrilla juncea* L., Sierra de Gredos, El Arenal, 3000 ft., 29 vii 56, E.512.

On *Taraxacum vulgare* L. agg., Picos de Europa Mts., Refugio Aliva, 5900 ft., 17 viii 56, E.2013. II spores only, with two supra-equatorial pores, spores up to 28μ long.

On *Hieracium* sp., Sierra de Gredos, El Arenal, 3000 ft., 2 viii 56, E.546. II & III, II with two supra-equatorial pores.

On *Centaurea alba* L. var. *deusta* DC., Sierra de Gredos, El Arenal, 3200 ft., 29 vii 56, E.511. II & III, II with two supra-equatorial pores.

***Puccinia hieracii* var. *piloselloidarum* (Probst.) Jørst.**

On *Hieracium pilosella* L., Sierra de Gredos, El Arenal, 3200 ft., 29 vii 56, E.514. II only, with two supra-equatorial pores.

***Puccinia hieracii* var. *hypochoeridis* (Oud.) Jørst.**

On *Hypochoeris radicata* L., Picos de Europa Mts., nr. Potes, 3000 ft., 20 viii 56, E.2048.

***Puccinia holcina* Erikss.**

On *Holcus lanatus* L., Sierra de Gredos, El Arenal, 3000 ft., 1 viii 56, E.544.; *ibid.*, 5 viii 56, E.595.

On *Holcus mollis* L., Sierra de Gredos, El Arenal, 3000 ft., 5 viii 56, E.594.

***Puccinia iridis* Rabh.**

On *Iris foetidus* L., Picos de Europa Mts., Potes, 1000 ft., 13 viii 56, E.640.

***Puccinia longissima* Schroet.**

On *Koeleria vallesiana* (Honck.) Bertol., Picos de Europa Mts., nr. Potes, 2000 ft., 15 viii 56, E.1998.

Uredinia epiphyllous, between leaf ridges, paraphysate, orange-brown, spores $25 \times 22\mu$, faintly echinulate with 8-10 scattered pores. Telia epiphyllous dark brown to black, pustular, teliospores fusoid to elongate, slightly constricted with very marked apical thickening $60-88 \times 22-24\mu$ (mostly $70 \times 20\mu$). (Fig. 5.).

***Puccinia malvacearum* Mont.**

On *Malva silvestris* L., Picos de Europa Mts., nr. Potes, 13 viii 56, E.1943.

***Puccinia menthae* Pers.**

On *Thymus mastachina* L., Sierra de Gredos, El Arenal, 3200 ft., 30 vii 56, E.526. II only.

On *Calamintha clinopodium* Benth., Picos de Europa Mts., 20 viii 56, E.2056; *ibid.*, Refugio Aliva, 5600 ft., 19 viii 56, E.2034. II only.

On *Mentha rotundifolia* Huds., Sierra de Gredos, El Arenal, 5 viii 56, E.597. II only.

On *Origanum vulgare* L., Picos de Europa Mts., nr. Potes, 1200 ft., 12 viii 56, E.1937.

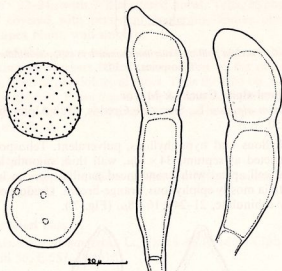


FIG. 5. *Puccinia longissima* on *Koeleria vallesiana* Teliospores and uredospores. E.1998.

***Puccinia mesneriana* Thuem.**

On *Rhamnus alaternus* L., Picos de Europa Mts., nr. Potes, 2500 ft., 12 viii 56, E.1929.

***Puccinia polii* Guyot**

On *Teucrium chamaedrys* ssp. *pinnatifidum* (Sennen) Rech. f., Picos de Europa Mts., Refugio Aliva, 5200 ft., 19 viii 56, E.2033.

Telia dark brown to almost black, pulverulent, causing distortion on stems and leaves. Teliospores, elliptic, medianly constricted, wall smooth, dark brown especially at the strongly thickened papillose apex, $38-47 (41) \times 16-21 (19) \mu$. Stipe persistent, hyaline, up to 90μ long. (Fig. 6.).

This species differs from those of the *P. annularis* complex in the dark-coloured spores and in the distortion produced on the host. From *P. constricta* (Lagerh.) Bubak and *P. istriaca* Syd., two members of this closely interrelated host-distorting dark-spored group, *P. polii* may be differentiated by its larger teliospores.

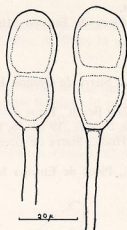


FIG. 6. *Puccinia polii* on *Teucrium chamaedrys* ssp. *pinnatifidum*.
Teliospores. E.2033.

***Puccinia polygoni-alpini* Cruch. & Mayor**

On *Polygonum alpinum* L., Sierra de Gredos, Club Alpino hut, 6200 ft.,
3 viii 56, E.550.

Telia epiphyllous and hypophyllous, pulverulent. Teliospores elliptic, slightly constricted at septum, $34 \times 18\mu$, wall thin, smooth, light brown. Pore in upper cell apical with pronounced papilla, pore in lower cell at septum. Uredinia mostly epiphyllous, orange-brown. Uredospores, broadly elliptic, finely echinulate, $21-24 \times 16-18\mu$. (Fig. 7.).

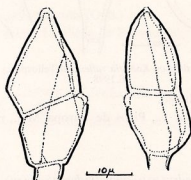


FIG. 7. *Puccinia polygoni-alpini*.
Teliospores on *Polygonum alpinum*.
E.550.

This species is closely allied to *P. septentrionalis*, differing from it in the less pronounced apical papillae of the teliospores as was noted by Cruchet and Mayor (1908) in their original description of the species from northern Italy. Fischer (1921) has shown by experiments that the aecidia occur on *Chaerophyllum silvestre* and *Carum carvi*. *Puccinia nitidula* Tranzsch., also occurring on *Polygonum alpinum*, differs in having basal pores in the lower cell of the teliospore and its aecidia on *Heracleum*.

***Puccinia punctata* Link**

On *Galium verum* L., Picos de Europa Mts., Pido, 3000 ft., 20 viii 56, E.2063.

On *Galium mollugo* L., Picos de Europa Mts., Refugio Aliva, 5400 ft., 19 viii 56, E.2032.

***Puccinia recondita* Rob. & Desm. (Syn. *P. rubigo-vera* DC., see Cummins & Caldwell, 1956).**

On *Agrostis alba* L., Sierra de Gredos, El Arenal, 3200 ft., 30 viii 56, E.525.

On *Aegilops ovata* L., Picos de Europa Mts., nr. Potes, 13 viii 56, E.1938.

Uredinia epiphyllous, irregularly scattered, paraphysate, orange, spores $24-26 \times 22-24\mu$ with 7-8 scattered pores. Telia, hypophyllous and epiphyllous, covered with persistent epidermis, spores oblong, slightly constricted, apex blunt, wall smooth.

The rusts of this group have been split into innumerable species by various continental workers, chiefly on account of the different aecidial hosts of a number of physiological races. Thus the rust on *Aegilops* would be referred by them to *P. aegilopsis* with aecidia on members of the Boraginaceae. Morphologically, however, it cannot be separated from typical *P. recondita* on *Secale*.

***Puccinia saniculae* Grev.**

On *Sanicula europaea* L., Picos de Europa Mts., Espinama, Potes, 3000 ft., 20 viii 56, E.2055.

***Puccinia schroeteri* Pass.**

On *Narcissus pseudonarcissus* L., Sierra de Gredos, Club Alpino hut, 6500 ft., 3 viii 56, E.557. II only.

***Puccinia sorghi* Schwein.**

On *Zea mays* L., Picos de Europa Mts., Pido, 3000 ft., 20 viii 56, E.2069. II only.

***Puccinia striiformis* West.**

On *Brachypodium sylvaticum* (Huds.) Beauv., Picos de Europa Mts., Pido, 20 viii 56, E.2068. II only, citron yellow, paraphyses absent.

***Puccinia valantiae* Pers.**

On *Galium verum* Scop., Sierra de Gredos, El Arenal, 3200 ft., 5 viii 56, E.598.

***Puccinia violae* DC.**

On *Viola riviniana* Rchb., Picos de Europa Mts., Potes, 1000 ft., 15 viii 56, E.1982.

On *Viola canina* L., Sierra de Gredos, El Arenal, 3000 ft., 2 viii 56, E.545.

Puccinia virgae-aureae (DC.) Lib.

On *Solidago virgaurea* L., Picos de Europa Mts., Refugio Aliva, 5700 ft., 17 viii 56, E.1987.

Pucciniastrum agrimoniae (Diet.) Tranz.

On *Agrimonia eupatoria* L., Picos de Europa Mts., Espinama, 3000 ft., 20 viii 56, E.2057.

Pucciniastrum guttatum (Schroet.) Hyl., Jørst. & Nannf.

On *Galium mollugo* L., Picos de Europa Mts., Potes, 2000 ft., 15 viii 56, E.2080.

Tranzschelia pruni-spinosae (Pers.) Diet.

On *Prunus domestica* L., Picos de Europa Mts., nr. Potes, 1000 ft., 15 viii 56, E.1981. II only.

Uromyces behenii (DC.) Unger

On *Silene cucubalus* L., Picos de Europa Mts., Espinama, 3000 ft., 20 viii 56, E.2047. I and III.

Uromyces armeriae (Duby) Lév.

On *Armeria cantabrica* Boiss. & Reut., Picos de Europa Mts., Refugio Aliva, 5700 ft., 17 viii 56, E.1993. II only. Uredospores with 2-3 pores.

Uromyces geranii (DC.) Lév.

On *Geranium molle* L., Picos de Europa Mts., Refugio Aliva, 5700 ft., 17 vii 56, E.2012. II only, with 1-2 pores.

Uromyces laburni (DC.) Otth

On *Genista hispanica* L., Picos de Europa Mts., Refugio Aliva, 5000 ft., 17 viii 56, E.2002.

On *Genista lobelii* DC., Picos de Europa Mts., Potes, 4000 ft., 14 viii 56, E.1953.

On *Sarothamnus scoparius* (L.) Wimmer, Picos de Europa Mts., Espinama, 3000 ft., 20 viii 56, E.2060.

All three collections consist of uredinia only. The species is largely independent of host alternation although certain races of *U. pisi*, *sensu lato*, form aecidia on *Euphorbia* spp. Uredospores $20-26 \times 18-24\mu$ with 3-4 equatorial pores.

Uromyces polygoni-aviculariae Pers.

On *Polygonum aviculare* L., Sierra de Gredos, El Arenal, 1200 ft., 5 viii 56, E.1902. II and III. II spores minutely and densely echinulate, with three pores.

Uromyces valerianae (DC.) Lév.

On *Valeriana montana* L., Picos de Europa Mts., nr. Espinama, 1200 ft., 20 viii 56, E.2059. II only, with two, rarely three, subequatorial pores.

USTILAGINALES

Sorosporium saponariae Rudolphi

On *Saponaria officinalis* L., Sierra de Gredos, Arenas de St. Pedro, 2000 ft., 10 viii 56, E.1923. Infecting and deforming flowers.

Urocystis floccosa (Wall.) Henderson

On *Helleborus viridis* L., Picos de Europa Mts., Refugio Aliva, 5400 ft., 17 viii 56, E.2008. The diagnostic features of this species and the one following have been discussed in a previous paper (Henderson & Wilson, 1952).

Urocystis syncocca (Kirchn.) Henderson

On *Anemone hepatica* L., Picos de Europa Mts., nr. Pido, 3000 ft., 20 viii 56, E.2067.

Ustilago bullata Berk.

On *Bromus sterilis* L., Sierra de Gredos, El Arenal, 3200 ft., 30 vii 56, E.528.

Ustilago cynodontis Henn.

On *Cynodon dactylon* L., Sierra de Gredos, El Arenal, 3000 ft., 10 viii 56, E.1924.

Ustilago maydis (DC.) Corda

On *Zea mays* L., Picos de Europa Mts., Pido, 3000 ft., common, 20 viii 56, E.2070.

Ustilago violacea (Pers.) Fuckel

On *Silene* sp., Picos de Europa Mts., Potes, 4000 ft., 14 viii 56, E.1949.

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