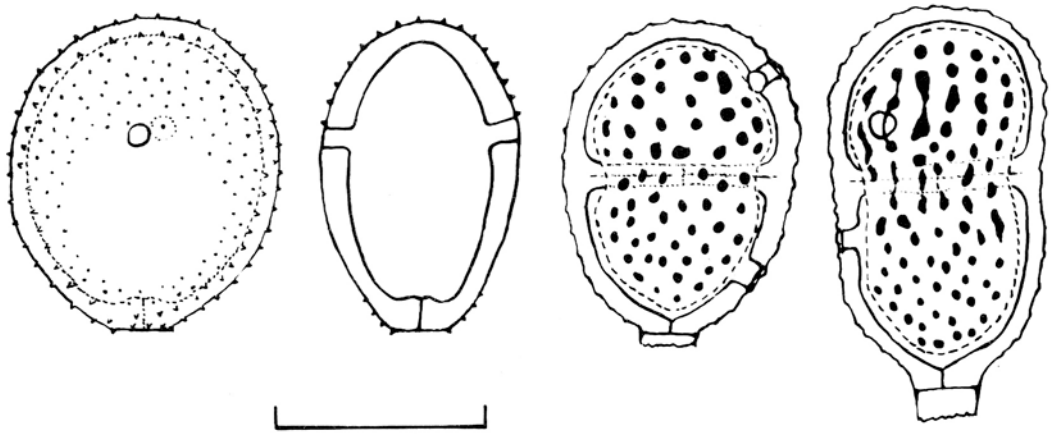
PUCCINIA ARNICALIS



Urediniospore (left) in surface view and optical section; teliospores (right) in partial surface view and partial optical section, separated by broken line. Scale = 20μ.

Puccinia arnicalis Peck, Bot. Gaz. 6: 227. 1881.

PYCNIA and AECIA unknown, probably lacking. UREDINIA and TELIA amphigenous and petiolicolous, dark brown to chestnut and chestnut respectively. UREDINIOSPORES slightly to strongly flattened, (22-)24-34(-38)μ long × (20-)22-30(-32)μ wide × (16.5-)17-21.5(-23)μ thick; walls 1.5-2.5μ on rim, 2.5-3.5μ at base and on flattened faces near pores, yellow-brown to light chestnut, with small echinulations 0.3-0.6μ diam. at (1.2-)1.5-2.8μ spacing, lacking on nearly circular tonsure 12-18(-20)μ diam. below each pore; hilum ca. 4.5-5.5μ diam., apparently smooth; pores normally 2, (slightly-) moderately (-strongly) superequatorial on flattened faces, approximately at tops of tonsures, without appreciable papilla; rare teratological spores with one or three pores generally not flattened. TELIOSPORES (25.5-)27-43(-45) × 18-27(-29.5)μ, not (-slightly) constricted at septum; walls 1.3-2.3μ, increasing to 2.3-3.0(-3.3)μ at pores, light to medium chestnut, with distinct warts ca. 0.3-0.7μ high × (0.5-)0.7-1.5(-1.8)μ diam., circular and randomly dispersed, or often tending to be in longitudinal rows on part of spore and then often elongate (rarely to 5μ long); germ pores (apical-) 1/6-1/2(-2/3) depressed, and (septal-) 1/4-3/4 depressed or rarely basal, often with shallow yellow cap to 0.7μ high; pedicels hyaline, delicate, generally irregularly deciduous near spore, basal to slightly (-strongly) offset. Mesospores rare.

HOSTS: *Arnica* spp.

DISTRIBUTION: Yukon, Northwest Territories, British Columbia and Alberta.

COLLECTIONS: *Arnica cordifolia* Hook.: **B.C.**: Above Silvern Mine, 1220 m., Hudson Bay Mtn., near Smithers, DAOM 157832 (Calder, Savile & Ferguson 12918); south of Southbank, François L., ca. 1000 m., 157831 (C, S & F 13519). **Alta.**: ca. 1950 m., Mt. Norquay, Banff Natl. Park, 157833 (C & S 12217A). *A. frigida* Meyer (*A. louiseana* ssp. *frigida*): **N.W.T.**: Mackenzie Dist., Mt. Coty, 60°18′N 123°30′W, 90408 (Cody & Spicer 11798A). *A. lessingii* (T. & G.) Greene: **Yukon**: Head of Kandik R., 65°41′N 140°28′W, 114554 (O. Hughes); 34 mi. W of Dawson, 64°40′N 140°12′W, 25060 (Calder & Billard 3749). *A. mollis* Hook.: **B.C.**: Above Quinescoe L., 2210 m., 49°04′N 120°12′W, 54311 (Calder, Parmelee & Taylor 19708).

NOTES: The Canadian collections in DAOM are from central Yukon, southwest Mackenzie, north central and extreme south British Columbia, and montane southwest Alberta. The full recorded range of *P. arnicalis* is from central Alaska on *A. frigida* (Anderson, Iowa State Coll. J. Sci. 26: 511. 1952), through the cordilleran region to Colorado, Utah and California. It seems to be adapted to cool temperatures, being generally alpine or subalpine in the southern half of its range; hence, presumably, our failure to find it on the ubiquitous *A. cordifolia* in southern British Columbia.

The above description is based on the cited Canadian specimens and nine from Oregon, Wyoming, Colorado and Utah on the same hosts and on *A. chamissonis* Less. There is some random variation between collections but no indication of host or geographic differences. The type, on *A. cordifolia* from an unspecified site at 10,000 ft. (3050 m.) in Colorado, has not been seen.

Seven specimens, covering most of the host and geographic range, yielded small numbers of dwarf teliospores 20-28 × 14.5-17.5μ with thinner walls than normal. The average cell volume in such spores seems to be less than half that for normal spores, which suggests that they are monokaryotic. Dwarf urediniospores may also occur; but small urediniospores among normal ones tend to lie obliquely or on end, which makes accurate size determination impossible. These dwarf spores are regarded as teratological and are excluded from the description.

Arthur (Manual. 1934) suggested that *P. arnicalis* may be systemic, but I find no such indication although sori occur down in the litter on leaf bases. Examination of intact plants, available in the three cited specimens on *A. cordifolia*, shows the occurrence of active uredinia and telia on winter-green leaves and petioles. There are neither pycnia nor grouped primary uredinia or telia on the new leaves, but only scattered sori. It appears that both urediniospores and teliospores may overwinter and initiate uredinia on the new leaves and petioles. The occasional heavy infection noted by Arthur results from the new growth emerging past these wintering sori. It is doubtful whether pycnia are ever produced.

Hennen and Cummins (Mycologia 61: 354. 1969) submerged *P. arnicalis* in *P. hieracii* (*sensu latissimo*). These rusts are advanced members of the large *P. dioicae–P. hieracii* lineage, whose species occur mainly on members of Cichorieae and Cardueae (Savile, Can. J. Bot. 48: 1555. 1970). On each of these host tribes there are several morphologically distinct and host-limited rusts in the lineage. *P. arnicalis* does not match any known to me. It differs from populations of *P. hieracii* (on *Hieracium* spp.) in its large urediniospores, large and fully developed urediniospore tonsures, and markedly more conspicuous teliospore warts.

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