First record of a smut fungus on *Byblidaceae*: *Yelsemia lowrieana*, a new species from Australia

Roger G. Shivas[1*] and Kálmán Vánky[2]

[1]Queensland Department of Primary Industries, Plant Pathology Herbarium, 80 Meiers Road, Indooroopilly, Queensland 4068, Australia
[2]Herbarium Ustilaginales Vánky (HUV), Gabriel-Biel-Str. 5, D-72076 Tübingen, Germany

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Yelsemia lowrieana sp. nov. (Ustilaginomycetes) is described and illustrated from *Byblis rorida* collected in northwestern Western Australia. Infected plants had galls filled with spores on stems and pedicels. The spores were unusual in that each could be separated from a dark outer spore wall. This is the first record of a smut fungus on the dicotyledonous host family *Byblidaceae*.

Key words: *Byblis*, taxonomy, Ustilaginomycetes

Introduction

Our continuing study of Australian Ustilaginomycetes has resulted in the discovery and description of several new species in recent years (Shivas and Vánky, 1997, 2001, 2002, 2003; Vánky, 1997, 2001; Walker and Shivas 1998; Vánky and Shivas 2001a,b). An unusual smut on *Byblis*, (dicotyledonous carnivorous plants in *Byblidaceae*) has now been discovered. The carnivorous nature of *Byblis* is characterised by vegetative plant surfaces that are covered in glandular hairs, which capture and digest small insects. All northern Australian species of *Byblis*, namely *B. aquatica* Lowrie & Conran, *B. filifolia* Planch., *B. liniflora* Salisb. and *B. rorida* Lowrie & Conran, are fibrous rooted annual plants which die back at the end of the dry season, regenerating by seed at the beginning of the next wet season (Lowrie and Conran, 1998). The two *Byblis* species from southeast Western Australia, *B. gigantea* Lindl. and an as yet undescribed species (Mr Allen Lowrie, pers. comm.), are both perennial plants.

Byblis rorida is restricted to the Kimberley region in the northwest of Western Australia. In April 2002, Mr Allen Lowrie noticed small pustules containing spores on the stems of *B. rorida* from specimens collected from Lake Campion near Broome, and forwarded specimens to the senior author for study. The specimen was found to represent an undescribed species of smut, which is described and illustrated as follows.

*Corresponding author: R.G. Shivas; e-mail: roger.shivas@dpi.qld.gov.au

Taxonomy

Yelsemia lowrieana R.G. Shivas & K. Vánky, **sp. nov.** (Figs. 1-12)

Typus in matrice *Byblis rorida* Lowrie & Conran, Australia, Western Australia, Roebuck Plains, shores of Lake Campion, 60 km E Broome, 17° 51' S, 122° 44' E, alt 30 m.s.m., 27 February 2002, A. Lowrie 2742 et S. Giesen. **Holotypus** in BRIP 28869 (designated here), **isotypi** in HUV 20081 et PERTH 06084605.

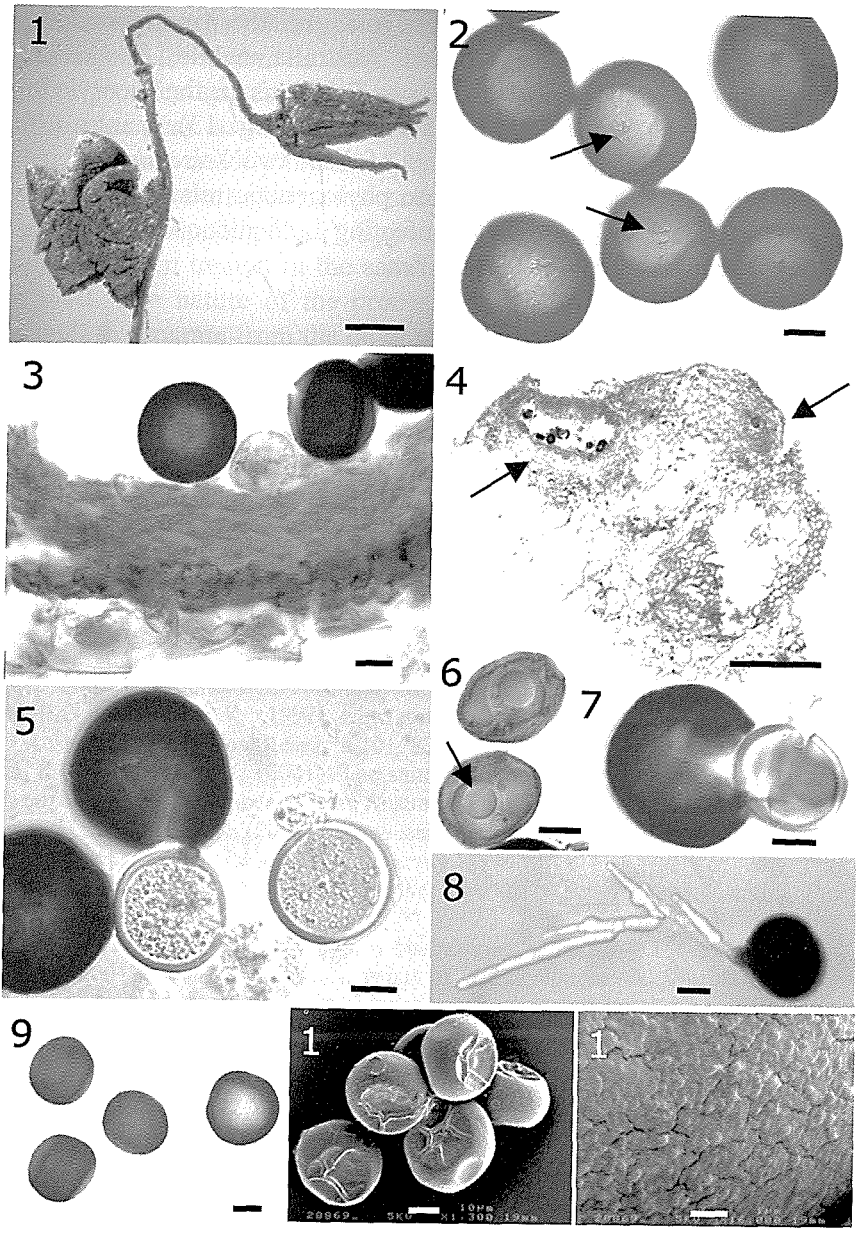
Sori sicut intumescentiae pustuliformes ad caules, pedicella floralia, sepala, flores vel in glandibus, globosi, ellipsoidales vel pressu mutuali irregulares, in glandibus 0.3 mm, ad caules 3 mm vel propter confluentiam majores, saepe polycystici, pustulares, cum caule brevi, tenui vel lato, initio membrana tenui, viridi, flava vel brunnea, origine matricali cooperti, qua irregulariter rupta massam sporarum nigram, granulosopulveream ostendentes. *Sporae* subglobosae, ellipsoidales vel parum irregulares, 26-32 × 28-38 µm, cum zona aequatoriali unica, atro-rubrobrunnea, 14-21 µm lata et pileis 2 pallidis, flavidobrunneis, 4-7 µm altis, 20-25 µm latis, polaribus instructae; pariete inaequali, ad zonam aequatorialem 2.5-4 µm crasso, infra pileos polares tenuiore (1-1.5 µm); superficies sporarum pileis polaribus inclusis tenuiter, dense verruculosa; imago obliqua sporarum aspera.

Sori (Figs. 1,4,12) as blister-like swellings on the stems, floral pedicels, sepals, flowers or in the glands, globose, ellipsoidal or irregular by mutual pressure, 0.3 mm in the glands, 3 mm on the stalks or larger by confluence, often polycystic, pustular, with a short, narrow or wide stalk, at first covered by a thin, green, yellow or brown membrane of host origin which ruptures irregularly disclosing the black, granular-powdery mass of spores. *Spores* (Figs. 2, 9) subglobose, ellipsoidal or slightly irregular, 26-32 × 28-38 µm, with a dark reddish-brown, 14-21 µm wide equatorial band and two, pale, yellowish-brown, 4-7 µm high, 20-25 µm wide polar caps; wall uneven, 2.5-4 µm thick at the equatorial band, thinner beneath the polar caps (1-1.5 µm); spore surface finely, densely verruculose, including the polar caps, spore profile rough.

On *Byblidaceae*: *Byblis rorida* Lowrie & Conran. Australia. Known only from the type collection.

Remarks: This smut was placed in *Yelsemia* because of the similarity of the spores and sorus characters with those of the other two species of this genus. *Yelsemia lowrienana* produced blisters containing powdery masses of spores that were often produced on a sporogenous hyphal layer (clearly seen on sori produced on stems) and covered with a peridium of host cells. Occasionally a few spores were seen in the gland cells without trace of a layer of sporogenous hyphae. The spores had small hila and two opposite polar caps. The spores of *Y. lowrieana* are larger than those of the two known species, *Y. arthropodii* J. Walker with spores of 20-26 × 16-22 µm, and *Y. specularie* (J.A. Stev.) Vánky & R. Bauer with spores 21-27 µm.

Walker (2001) noted that the relationship between *Yelsemia arthropodii* and *Y. specularie* was unresolved as the two species are disparate in host range and geographic distribution. *Yelsemia arthropodii* infects *Arthropodium* and *Dichopogon* in the monocotyledonous



Figs. 1-11. *Yelsemia lowrieana* (from holotype). **1.** Stem galls on *Byblis rorida*. **2.** Spores with hyaline polar caps and hilar scars (arrowed) in LM. **3.** Immature spore between two mature spores on layer of sporogenous hyphae. **4.** Transverse section of galls (arrowed) on stem of *B. rorida*. **5, 7.** Spores (light) liberated from outer spore walls (dark). **6.** Immature spores showing inner spore wall containing a vacuole (arrowed). **8.** Germination (?abnormal) of spore through outer spore wall on potato dextrose agar after 5 days at room temperature. **9.** Spores in LM. **10.** Spores in SEM. **11.** Surface ornamentation of spore in SEM. Bars: 1 = 1 mm; 2 = 10 μm; 3 = 10 μm; 4 = 500 μm; 5-10 = 10 μm; 11 = 1 μm.

disparate in host range and geographic distribution. *Yelsemia arthropodii* infects *Arthropodium* and *Dichopogon* in the monocotyledonous *Anthericaceae* in temperate southern Australia, while *Y. specularіae* (*Ustilago specularіae* J.A. Stev.) infects *Triodanis* in the dicotyledonous *Campanulaceae* (Asterales) in North America (Fig. 13). Vánky (2002a) suggested that the unrelated host plants of these two *Yelsemia* species was not entirely unusual as there is a close phylogenetic relationship between *Yelsemia* and *Urocystis*; the latter infecting both monocotyledonous and dicotyledonous hosts in 21 plant families.

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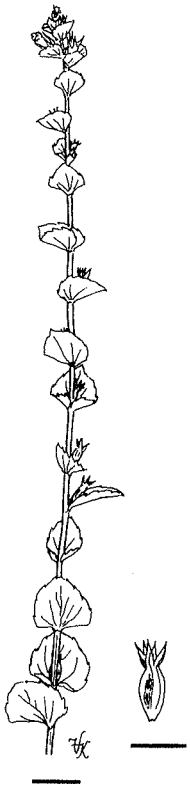

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Fig. 12. *Yelsemia lowrieana* on the stems, floral pedicels and sepals of *Byblis rorida*. Bar = 1 cm.
Fig. 13. *Yelsemia specularіae* in the capsules of *Triodanis perfoliata*. Habit (left) and opened capsule with spore mass inside (right). Bars: left = 1 cm; right = 5 mm.

Walker (2001) showed that the germination of spores of *Y. arthropodii* had characteristics of the *Tilletiales*. We were unable to induce spores of *Y. lowrieana* to germinate despite having fresh material and using similar techniques. Occasionally less than two percent of spores were found to

produce a germ tube without producing cells that could be identified as basidiospores (Fig. 8). This type of germination was considered abnormal.

Yelsemia lowrieana is only the second smut fungus that has been shown to produce spores that separate from the ruptured outer spore wall (cf. *Kuntzeomyces ustilaginoideus* (Henn.) Henn., illustrated in Vánky, 2002b). This was readily observed by placing spores of *Y. lowrieana* in a drop of 3% KOH on a glass microscope slide and applying gentle pressure to a glass coverslip (Figs 5, 7). Spores of the holotype (DAR 63312) of *Y. arthropodii* when treated in the same way did not separate from the outer spore wall. The nature of the process by which KOH enables the inner spore wall to separate from the outer wall of *Y. lowrieana* is not known.

Acknowledgements

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