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Acarospora stictica, a new yellow species containing stictic acid, from Mexico

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ABSTRACT. – *Acarospora stictica*, a yellow species of *Acarospora* containing stictic acid is described from Mexico.

INTRODUCTION

Except for the Sonoran area and Baja California the *Acarospora* of Mexico have been poorly collected and relatively few specimens are available. Species like *Acarospora rouxii* K. Knudsen, Elix & Reeb and *A. rhabarbarina* Hue present in both the United States and South America are not represented in the Mexican collections, but would be expected to occur in Mexico. While examining collections from The New York Botanical Garden, we were happy to find a new taxon, a member of a small group of apparently related yellow species. The most common member of the group is *A. chrysops* (Tuck.) H. Magn. which occurs from the Ozarks to Rocky Mountains, in Arizona south through Mexico, Central America (El Salvador and Costa Rica) and South America (Brazil, Columbia, Venezuela, and the Galapagos Islands) (Magnusson 1929; Knudsen 2007; Knudsen et al. 2008). A second member of the group, *A. affinis* K. Knudsen is known from the Sonoran Desert region of Mexico and Arizona and from New Mexico (Knudsen 2007). These species have a similar morphology comprising a dispersed thallus of thin yellow areoles with distinct rims, areoles which are usually less than 0.5 mm wide and rarely exceed 1.0 mm in width.

METHODS

The type specimen was studied using HPLC (Elix et. al. 2003) and normal light microscopy in water and 10% KOH, the amyloid reaction tested with Lugol's solution (I) and with I with pretreatment with 10% KOH, and the ascospores measured in water. Other measurements were made both in water and 10% KOH with dilute I used as stain. 32-36% HCl was used to clear the areoles for the study of the medulla and cortical structure.

THE SPECIES

Acarospora stictica K. Knudsen & Elix, **sp. nov.**

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FIGURE 1.

Similis *Acarosporae chrysopsis* et *A. affinis*, sed acidum sticticum continente differt.

TYPE: MEXICO: 80 km from Mexico City, 2300 m, on volcanic rock, with *Xanthoparmelia* and *Caloplaca* species, 16.vii.1956, *C.L. Kramer 1987* (NY, holotype).

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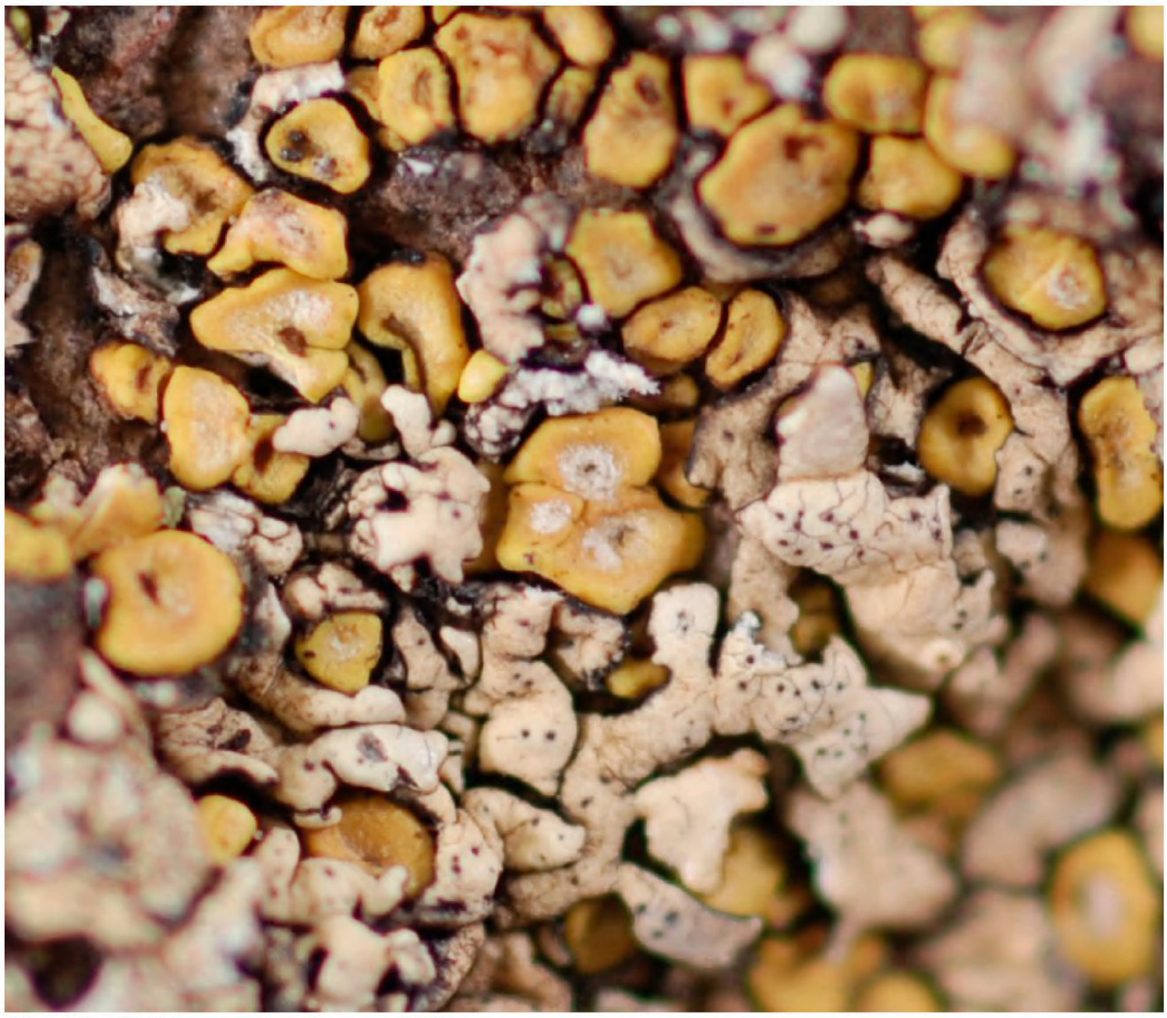

Figure 1. *Holotype of Acarospora stictica.*

Description. – Thallus areolate. Areoles (0.2-)0.3-0.5(-1.0) mm wide, thin (to 0.6 mm thick), round to irregular in shape, usually slightly undulate, rim up-turned or down-turned, concolorus with thallus or black-margined, dispersed or contiguous through vegetative division. Upper surface yellow, somewhat glossy, often with patches of pruina in center. Lower surface yellow in a narrow margin beneath rim, corticate, with prosoplectenchyma parallel to substrate but becoming dark brown or black and carbonized in older specimens, possibly due to interaction with the substrate. Upper cortex 60-90 µm thick, ±obscure; upper syncortex uneven, of hyaline, gelatinized hyphae, 5-10 µm thick or absent; eucortex with obscure hyphae, comprising a paraplectenchymatous yellow upper layer, cells c. 5 µm in diam, 40-70 µm thick, ± a narrow, hyaline lower layer, 10-20 µm thick, the cortex cleared by addition of HCl. Photobiont a chlorococcoid green alga, to 12 µm in diam., algal layer even in cross-section, with no obvious hyphal bands interrupting stratum, 80-100 µm thick. Medulla 200+ µm thick, paraplectenchymatous, cells round to angular, variable in size, from 5-6 µm wide, to 2-4 µm wide and 3-5 µm long, thin-walled, derived from prosoplectenchymatous tissue attached to the rhizohyphae. Rhizohyphae c. 3 µm wide, obscured by crystals but cleared by addition of HCl, broadly attached, not forming a stipe but becoming gomphate by elongation of the medulla. Apothecia 1-3 per areole, round, immersed, punctiform, 0.1-0.3 mm wide; disc yellow, paler than the thallus, sometimes vaguely reddish, lacking a thalline collar or parathecial crown, smooth to very slightly roughed, epruinose. Parathecium to 30 µm thick, of thin, hyaline prosoplectenchyma. Epihymenium 20-25 µm thick, conglutinated in a thick yellow gel. Hymenium 100-140 µm tall, yellow in upper part, hyaline below, coherent, IKI+ deep blue. Paraphyses sparingly branched, 1.0-1.7(-2.0) µm wide

at mid-level, septate, rarely constricted at the septa, cells to 7 µm long, shorter in upper part, apices unexpanded or barely swollen to 2.5 µm wide. Asci 80-100 x 16-20 µm, 100+spores per ascus. Ascospores hyaline, simple, c. 4 x 2 µm. Pycnidia not seen. Spot tests: K+ yellow (best seen on microscope slide), P+ orange. Secondary metabolites (HPLC): epanorin (major), rhizocarpic acid (trace), stictic acid (major), cryptostictic acid (minor), peristictic acid (minor), norstictic acid (trace).

ETYMOLOGY. – The epithet refers to the presence of stictic acid (major) in this species.

DISCUSSION. – Currently *Acarospora stictica* is known only from the type collection but we expect it to be more widespread in the mountains of central Mexico. At present it is the only species of *Acarospora* known to contain stictic acid whereas epanorin and rhizocarpic acid are widespread in the genus. The related species, *A. chrysops,* exhibits two chemotypes, one containing epanorin (major) and ±rhizocarpic acid (trace), the second with rhizocarpic acid (major) and ±epanorin (trace).The other member of this group, *A. affinis*, contains the pigment rhizocarpic acid (major) together with acaranoic acid (major), hypoprotocetraric acid (major) and 4-*O*-demethylnotatic acid (minor). These three species are best distinguished by thin-layer chromatography since yellow species of *Acarospora* sometimes produce a misty yellow coloration on treatment with K (due to rhizocarpic acid or epanorin) which could be mistaken for a positive reaction for stictic acid. However, stictic acid is P+ orange. It is concentrated in the lower layer of the cortex.

Morphologically these three species appear very similar and often have a thick, distinctive white patch of pruina in the center of areole. Thus we consider their secondary chemistry as the prime character for distinguishing these species. *Acarospora affinis* generally has larger areoles than *A. stictica* [0.3- 2 mm vs. (0.2-)0.3-0.5(-1.0)mm] and a prosoplectenchymatous rather than a paraplectenchyamatous medulla, but this character may be variable. *Acarospora chrysops* is even more similar to *A. stictica,* differing only in having a prosoplectenchymatous medulla. However, this character may intergrade between the species because the medulla appears to derive from rhizohyphae. Undoubtedly the morphological and molecular variation between the *A. chrysops, A. affinis,* and *A. stictica* needs further study. Culberson's theory that chemical evolution may occur before morphological differentiation may provide a credible explanation for the chemical diversity of this group (Culberson & Culberson 1970).

Acarospora stictica (Fig. 1) occurs on volcanic rock with a *Xanthoparmelia* containing fumaprotocetaric acid. There was no evidence of parasitic behavior.

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