

***Synchytrium eremocaryae, eremocarpae, or eremocarpi?* - A case study of the intersection of taxonomy, nomenclature, and community science**

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ABSTRACT

The primary purpose of taxonomy is to provide a universal and useful means of categorizing and communicating about organisms. To meet these goals, taxonomists must carefully consider appropriate species boundaries and follow the various international nomenclatural codes. Occasionally, mistakes happen and are perpetuated, potentially hindering our collective efforts to document and understand the biodiversity around us. One such example involved correctly identifying a record of a fungus parasitizing *Cryptantha* on the community science database iNaturalist. What transpired was an exploration of orthographical variants and the discovery that incorrect changes were made to the holotype label of a *Synchytrium* species. This example highlights the importance of digitizing collections, careful annotation of specimen labels, duplicate specimens, and science being an open and accessible activity beyond the domain of experts. Here, we give a brief account of the events and indicate the correct name and host for *Synchytrium eremocarpi* Karling. *Published online www.phytologia.org Phytologia 103(1): 1-4 (March 22, 2021). ISSN 030319430.*

KEY WORDS: chytrid, citizen science, community science, *Eremocarpus*, nomenclature, taxonomy

The goal of any taxonomy is to provide a useful means of categorizing and communicating about the diversity of organisms on Earth. As Western societies colonized other lands and began cataloguing the biodiversity present, Western scientists developed the binomial system of taxonomy in use by the scientific community today. While the binomial system provides a taxonomy for communicating about biodiversity, it was developed without input from the cultures/communities that the Western world invaded. The result was the erasure of many local taxonomies and an inability to communicate the knowledge those cultures/communities already had about the biodiversity around them (Yoon 2009). Science today still suffers from insulation from community input. For example, most descriptions of fungal species were found to be written toward other taxonomists; information that non-taxonomists (e.g., a school teacher, a Wikipedia editor, or a policy maker) would use (e.g., locality, habitat, macro-morphology) was either missing or difficult to extract from the majority of the descriptions (Durkin et al. 2020). This comes at a time when many taxonomists bemoan the lack of resources available to them; thus, taxonomy as a science needs to become a diverse community rather than the domain of specialized experts. An example of how taxonomists can benefit from wider involvement is discussed here. However, the goals of community

science should be reciprocity and cooperation, that is, wider involvement should not result in the benefit of a few (i.e., experts) but everyone involved (Vohland et al. 2019).

How taxonomists, and scientists in general, can benefit from wider community input is in catching errors. One challenge for taxonomists is to engage the wider community in such a way that everyone involved benefits. In naming and categorizing organisms, scientists carefully consider species boundaries and follow the rules set forth in one of the international nomenclatural codes. The vast scale of taxonomy leads to inevitable errors that may be perpetuated. In the case of taxonomic and nomenclatural errors concerning taxa for which there are few experts/researchers, such errors may go unnoticed for long periods of time and become impediments to establishing accurate taxonomy. This hinders the collective effort to document and understand the biodiversity of Earth. An example involving an observation of *Synchytrium* (Chytridiomycota) parasitizing *Cryptantha* is discussed.

On March 4, 2019, Marion Anthonisen posted an observation of an individual of *Cryptantha* infected with an unknown fungus to iNaturalist.org (<https://www.inaturalist.org/observations/21021907>). iNaturalist.org is a joint initiative by the California Academy of Sciences and the National Geographic Society that is open to anyone and serves as a platform for identifying and documenting the biodiversity of Earth. The observation was initially submitted as a possible *Pucciniales* species but was later corrected to the genus *Synchytrium* by Christian Schwarz (username leptonia), a regional mycologist. Schwartz suggested it was *Synchytrium eremocaryae* based on the host plant *Cryptantha* (= *Eremocarya*) citing collections from Griffith Park, Los Angeles, California. James Bailey (username silversea_starsong) proposed *Synchytrium myosotidis* as the correct taxon name, citing that *S. myosotidis* at the time was the only species formally described as occurring on Boraginaceae. The dataset on iNaturalist at time of writing includes observations of *Synchytrium myosotidis* on *Pectocarya*, *Cryptantha*, and *Plagiobothrys*. The potential of a second entity affecting Californian Boraginaceae prompted further research into *S. eremocaryae* by James Bailey and William Davis (username daviswj), but literature soon revealed loose ends in the taxonomy and biology of said species. *Synchytrium eremocaryae*, *eremocarpace*, and *eremocarpi* were all species names that various sources attributed to the same taxonomic entity. The roots of the epithets *eremocaryae* and *eremocarpace* refer to the host plants *Eremocarya* (syn. *Cryptantha*) and *Eremocarpus* (syn. *Croton*), two plant species from the unrelated families Boraginaceae and Euphorbiaceae, respectively. Many species of *Synchytrium* are assumed to be host specific, though there are some species with wide host ranges (Karling 1964). Therefore, it is unlikely for one species to occur on hosts from two unrelated plant families. In this instance, the resolution of whether only one or two species of *Synchytrium* occurred on *Eremocarya* was crucial for settling on a correct identification.

Synchytrium eremocaryae is a *nomen nudum* (Art. 38.1–2, Ex. 1, Shenzhen Code, Turland et al. 2018) as it appears only on the specimen label of UC 266329 (<https://mycoportal.org/uc/mycology/UC266/UC266329.JPG>) and on a list of types located at the University of California at Berkeley herbarium (UC; Tavares et al. 1997; https://ucjeps.berkeley.edu/fungal_types.html). This name, lacking a formal description, is not listed as an accepted name in Index Fungorum, MycoBank, or the U. S. National Fungus Collections Database (<https://nt.ars-grin.gov/fungaldatabases/>). The label of UC 266329 is annotated with “consider this an inadvertent spelling error” and “Spelling errors in publication: *S. eremocarpace* on *Eremocarpus*.” These notes suggest that *S. eremocaryae* is the correct name for the species and that *S. eremocarpace* is an orthographical variant that mistakenly appeared in the original species description.

However, the specific epithet *eremocarpace* and the host *Eremocarpus* are what appear in the original Latin description (Karling 1956) and a later monograph (Karling 1964). Thus, it is the label and the subsequent list of types that are in error. In other words, *Synchytrium eremocarpace* was validly and effectively published (Art. 38.1, 39.1, 40.1, Shenzhen Code) and therefore has priority (Art. 11.4, Shenzhen Code). Karling (1956) described *Synchytrium eremocarpace* using a specimen collected on *Eremocarpus* sp. March 4, 1922 from Griffiths Park, Los Angeles, California, USA by M. S. Clemens that was deposited in UC. In his monograph, Karling (1964) notes the specimen as “Clemens, no. 10800, in UC”, and the university would later relabel it as UC 266329. On the label of UC 266329 is the annotation “*Synchytrium eremocarpace* Det. J. Karling 9-27-55”. Therefore, from at least 1955 to 1964, Karling considered the

specific epithet to be *eremocarphae*; otherwise, he would have corrected it to *eremocarya* in his 1964 monograph. In the vicinity of Karling's 1955 annotation it is written "*eremocarya* on *Eremocarya*(?)", but this annotation is in a different handwriting and does not include a name or a date. The annotation differs visually from Karling's handwriting and likely was added after Karling's 1964 monograph. One explanation is that Karling's "p" in *eremocarphae* is not very legible and could easily be mistaken for a "y". In addition, *Eremocarya* (= *Cryptantha*) was another plant genus at the time, and since no genus appears on the label and the "p" looks like a "y", it would be easy to assume *Eremocarya* was the host. Therefore, we think what happened is that someone misread the "p" for a "y" while trying to transcribe Karling's annotation; they then added the "on *Eremocarya* (?)". The ambiguous annotation "consider this an inadvertent spelling error" was added as a third annotation, again with no name or date. This was likely interpreted by later transcribers to mean the specific epithet *eremocarphae* was a mistaken orthographical variant. Regardless, the descriptions of Karling (1956) and Karling (1964) are clear that the correct specific epithet is *eremocarphae* and the host is *Eremocarpus* (Euphorbiaceae); thus, the later adjustment to *eremocarya* and *Eremocarya* was incorrect.

The presence of an isotype in the U. S. National Fungus Collections Herbarium (BPI) provides additional evidence that the epithet Karling meant was *eremocarphae*. Specimen BPI 793212 was originally labelled as *Synchytrium* sp. on *Eremocarpus* sp. from Griffiths Park, Los Angeles, California by Clemens no. 10800. That means the host is indeed *Eremocarpus* and not *Eremocarya*, and the appropriate epithet is *eremocarphae* and not *eremocarya*. However, under the rules of nomenclature, since the specific epithet is a masculine noun being used in the genitive case, the correct spelling is *eremocarpi* (Art. 23.5, 32.2 Shenzhen Code; pers. comm. P. Kirk & S. Pennycook), which is the name listed in Index Fungorum and MycoBank. Under the rules of nomenclature, *eremocarphae* is considered an orthographical error that can be corrected by later authors (Art. 60.1) without changing the date of valid publication (Art. 33.2). Therefore, the correct name for the species described using specimen UC 266329 is *Synchytrium eremocarpi* Karling 1956, and the specimen label and list of types in UC should be corrected accordingly.

TAXONOMY

Synchytrium eremocarpi Karling [as '*eremocarphae*'], Sydowia 10(1–6): 20 1957 [1956].

HOLOTYPE: United States of America: California, Los Angeles, Griffiths Park, on *Croton* sp. (= *Eremocarpus* sp.), 04 March 1922, M. S. Clemens no. 10800, UC 266329.

ISOTYPE: United States of America: California, Los Angeles, Griffiths Park, on *Croton* sp. (= *Eremocarpus* sp.), 04 March 1922, M. S. Clemens no. 10800, BPI 793212.

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