Historical Note

Neurospora perithecia: The first sighting

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When Shear and Dodge (1927) observed perithecia in laboratory cultures of *Monilia sitophila*, they concluded on the basis of ascospore ornamentation that the fungus merited diagnosis as a new genus, Neurospora. Prior to this, there had been reports of perithecia and ascospores formed in nature by orange fungi that must have been Neurospora. Neurospora perithecia were not found again in nature until 1996..

Before the sexual phase was recognized, the orange mold now called Neurospora was known for many decades as *Monilia sitophila*. In 1927, following discovery of perithecia in laboratory cultures, Shear and Dodge published a detailed description of the complete life cycle and designated Neurospora as a new genus characterized by distinct ornamentation of the grooved ascospores. They said that, to their knowledge, this was the first report of the sexual phase of *Monilia sitophila*, either in nature or in culture. Their literature search had, in fact, revealed three earlier publications that reported perithecia, asci, and ascospores in cultures of an orange Monilioid fungus that must have been Neurospora. The authors of these reports did not recognize that the ascospores were grooved.

The first report of Neurospora perithecia was by Alfred Möller (1901), who found the brightly colored mold on corn bread and burned tree stumps in Brazil. He called the fungus *Melanospora erythraea*. On the basis of his published description and of preserved herbarium material, Shear and Dodge (1927) renamed Möller's fungus *Neurospora erythraea*. From our present perspective, it may well have been *N. tetrasperma*, perhaps in mixed culture with an eight-spored species.

The next report of Neurospora perithecia was by Kimizo Kitazima, who cultured.an orange fungus that blanketed Tokyo following the devastating earthquake and fire of 1923. Shear and Dodge acknowledge receiving a culture from Kitazima and they reported that it was identical in appearance to their Neurospora cultures. Kitazima (also spelled Kitajima and Kitasima) found perithecia not only in the laboratory but also in nature, under the bark of fire-damaged trees (Kitazima, 1924, 1925). The first paper, in Japanese, included drawings of mycelia, conidia, perithecia, asci, ascospores, and paraphyses (reproduced here as Figures 1, 2). Although he succeeded in recovering progeny from a germinated ascospore, Kitazima apparently did no further experimental work with the orange fungus. He recorded ascospore measurements, but apparently did not notice that the spores were grooved. Kitazima called the vegetative phase of his mold *Monilia aurea*, and on the basis of sexual-phase characteristics, he tentatively assigned the fungus to the genus Anthostomella. Shear and Dodge (1927) include Kitazima's papers in their *Literature Cited*. However, they state 'Original not seen" and refer to the abstracts that were their source of information, in *Japanese Journal of Botany* and *Review of Applied Mycology*. Even the abstracts make it clear that Kitazima found perithecia both in the laboratory and in nature.

Ample indirect evidence was later obtained for sexual reproduction in natural populations of Neurospora, and ascospores were inferred to have been present in heat-treated soil samples from which Neurospora was recovered. However, Neurospora perithecia were not observed again outside the laboratory until seven decades later, when Pandit and Maheshwari (1996) succeeded in finding perithecia in epidermal tissue of sugar cane stubble. Perithecia were also found on discarded corncobs (Pandit *et al.* 2000). Finally, Donald Natvig and David Jacobson (personal communication) have once again found perithecia under the bark of a fire-damaged tree, this time in New Mexico (Jacobson *et al.* 2001).. Failure to observe perithecia in nature is perhaps not surprising. Neurospora is most commonly seen on burned substrates, where detecting the small black perithecia can be expected to require deliberate, careful search.

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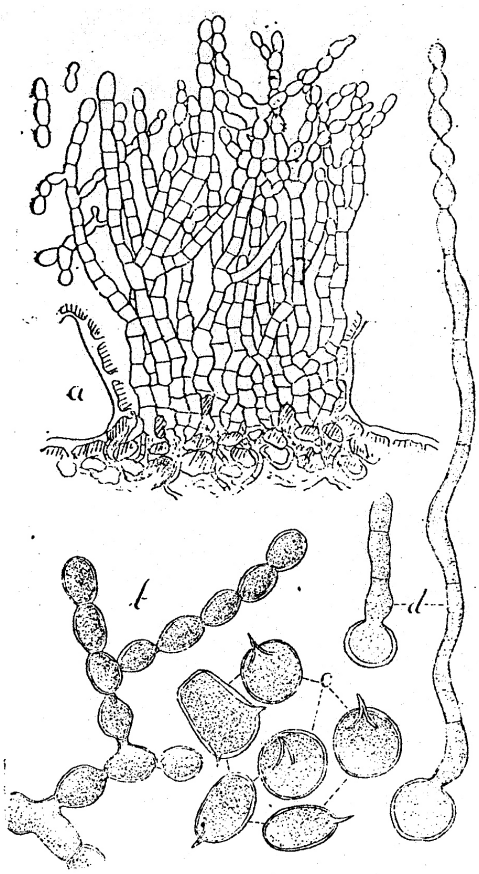
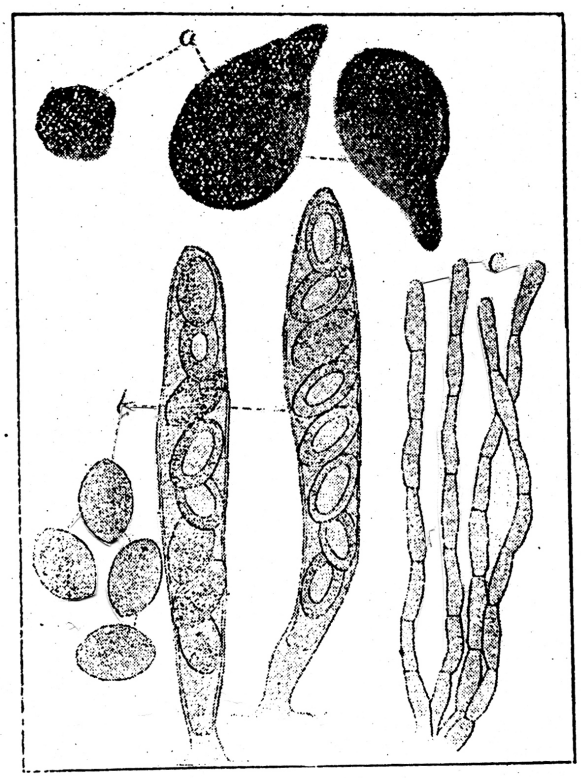


a. 胞子層ノ横斷面(×80 Service)
b. 連鎖狀ヲナシテ形成サレタル分生胞子 (×488 Service)
c, 成熟セル分生胞子(×840 Service)
d. 發芽セル分生胞子(×840 Service)

Figure 1. **a**. Cross section of a layer of spores. **b**. Connected chain of conidia. **c**. Mature conidia. **d**. Germinated conidia.



a. 松ノ樹皮内ニ形成サレタル子嚢殻 (×80 Service)
b. 子嚢及子嚢胞子 (×488 Service)
c. 絲狀體 (×488 Service)

Figure 2. **a**. Perithecia that developed inside the bark of a pine tree. **b**. Asci and ascospores. **c**. Protonema (trichome) [Paraphyses].