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shift the planting guide and plant the alternate rows (Figure 2). At closer spacings, however, where there is not room to walk easily between rows, it is desirable to plant both species concurrently and thus have completely clear footing on one side of the planting guide. Color coding helps avoid errors, especially when planting mixed plots. We used a red spray paint to color alternate pegs on the side rails, and one set of holes in the planting guide, i.e., so red holes went over red pegs. A square partitioned polyethylene cleaning bucket works well for carrying two species of seedlings in making mixed plantings.

Grateful acknowledgment is made to Mr. Ronald Parkison, Student Research Assistant, who helped in construction of the original jig, and subjected it to the acid test.

A Preliminary Survey of the Iowa Species of Hypocreaceae and Clavicipitaceae[1]

Lois H. Tiffany and Joseph C. Gilman

Abstract. Recent unusual Iowa collections of members of the Hypocreaceae and Clavicipitaceae are reported. *Scoleconectria polythalama* (Berk.) Seaver on Syringa and Fraxinus, *Nectria coccinea* Fr. on *Juglans nigra* L., *Nectria verrucosa* (Schw.) Sacc. on *Morus alba* L., *Calonectria diminuta* (Berk.) Berl. & Vogl., *Hypocrea citrina* (Pers.) Fr., *Hypocrea patella* Cke. and Pk. are reported for the first time. *Thyronectrioidea chrysogramma* (Ell. and Ev.) Seaver on *Ulmus americana* L. is the first report of this species on this host from Iowa. In addition observations on the life cycles of *Scoleconectria scolecospora* (Bref.) Seaver and *Cordyceps clavulata* Schw. are made.

The Hypocreaceae and Clavicipitaceae were formerly members of the order Hypocreales at the time that the members of this order were those fungi with bright-colored perithecial walls. Seaver, (1909a, 1909b, 1910a, 1910b, 1911) whose treatment of the group recognized two families, the Nectriaceae for those forms in which the perithecia were non-stromatic or formed upon a reduced stromatic cushion; and the Hypocreaceae with the perithecia submerged in a stroma.

As the emphasis in mycology changed from the condition of the perithecial wall to the type of the centrum of the perithecium, the Nectriaceae and Hypocreaceae were united into a single family and the Clavicipitaceae were transferred to the Xylariales

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or following the suggestion of Nannfeldt (1932) raised to the rank of separate order, Clavicipitales.

The Hypocreaceae are characterized by an aparaphysate centrum with pseudoparaphyses growing down from the apex of the ascoma. The ascomatal wall is thin and difficult to see, hence has been the subject of controversy, several investigators having denied its existence. Miller, (1949) however, affirms the presence of a wall in Nectria, Hypocrea, Thyronectria and Hypomyces. His findings were confirmed by Hanlin (1961) in his study of *Nectria gliocladioides* Smalley and Hansen.

The Clavicipitaceae have perithecia with the paraphyses arising laterally from the walls but disappearing prior to the maturing of the ascospores. The ascospores are thread-like, septate, and often break up into separate cells. The asci have a thickened cap, with a pore through which the spores may be discharged. Miller (1949) states that they more frequently are discharged by the tearing off of the entire cap. The common genera are Claviceps, Cordyceps and Epichloe.

The Iowa Hypocreales were summarized by Miss Fitzgerald (1949). Since that publication collections have been made from several new hosts and of several hitherto uncollected species.

Problems of nomenclature and synonymy are also rather frequent at both the generic and specific levels. Seaver (1909a etc.) has placed *Thyronectria xanthoxylii* (Pk.) Ell. & Ev. and *Thyronectria virens* Hark. in synonymy with *Thyronectria pyrrhochlora* (Auers.) Sacc. Our specimens on *Prunus serotina* and on *Rhus* sp. have been referred to *T. pyrrhochlora.* A second species of *Thyronectria, T. berolinensis* (Sacc.) Seaver was collected from *Prunus americana* Marsh and *Prunus* sp.

In this paper *Nectria* has been accepted for those species with the perithecia clustered on a reduced stroma in contrast to *Dialonectria* of which the species have the perithecia produced singly.

Other species that have not hitherto been collected from Iowa are *Scoleconectria polythalama* (Berk.) Seaver on Syringa and Fraxinus (Fig. 3); *Nectria coccinea* Fr. on *Juglans nigra* L. (Fig.13) and *Nectria verrucosa* (Schw.) Sacc. on *Morus rubra* L. (Fig. 10, 11), *Calonectria diminuta* (Berk.) Berl. & Vogl. (cf. N. A. F. 2548) (Fig. 4, 5), *Hypocrea citrina* (Pers.) Fr. (Fig. 12,14) *Hypocrea patella* Cke. and Pk. (Fig. 15,16). *Thyronectrioidea chrysogramma* (Ell. & Ev.) Seaver (Fig. 7,8) was collected on *Ulmus americana* L., a new host for this fungus in Iowa.

Observations worthy of comment were made on the life cycles of *Scoleconectria scolecospora* (Bref.) Seaver (Fig. 1) and

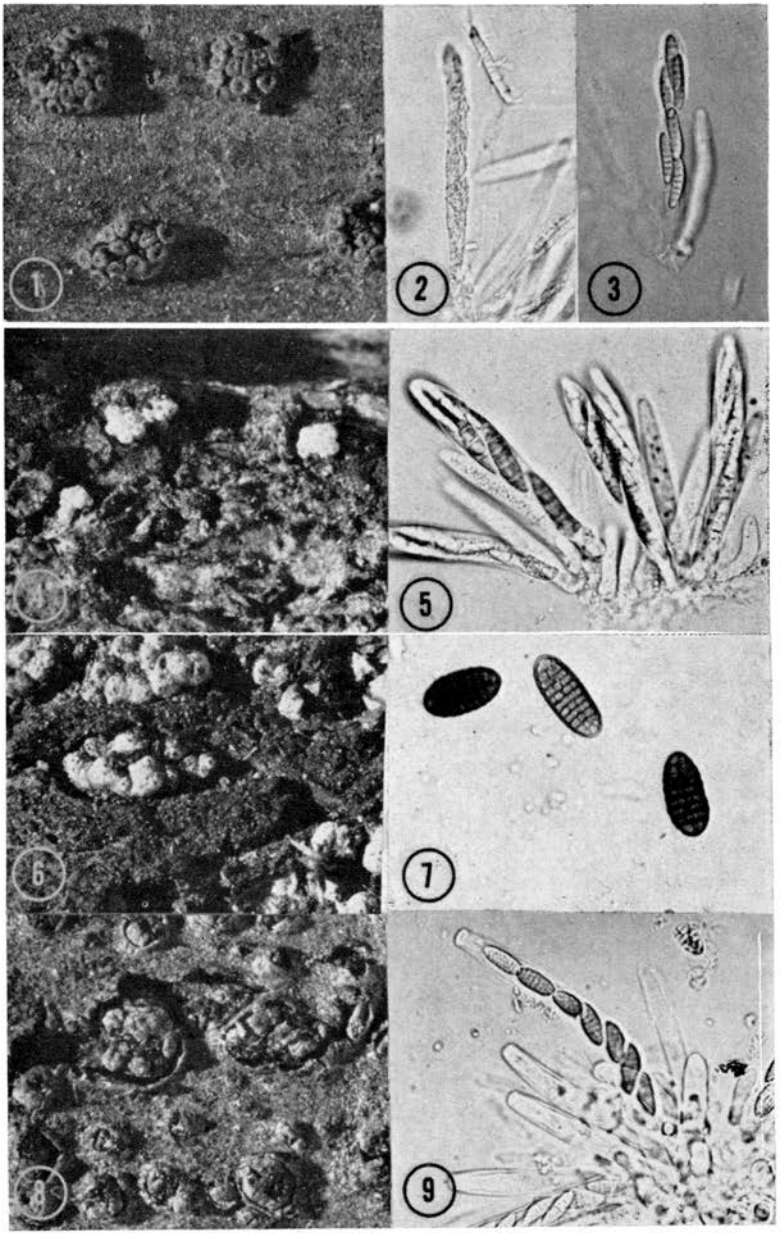

Figure 1. *Scoleconectria scolecospora* perithecia.
Figure 2. *Scoleconectria scolecospora* ascus and budding ascospore.
Figure 3. *Scoleconectria polythalama* ascus.
Figure 4. *Calonectria diminuta* perithecia.
Figure 5. *Calonectria diminuta* asci.
Figure 6. *Thyronectroidea chrysogramma* perithecia.
Figure 7. *Thyronectroidea chrysogramma* ascospores.
Figure 8. *Thyronectria pyrrhochlora* perithecia.
Figure 9. *Thyronectria pyrrhochlora* asci.

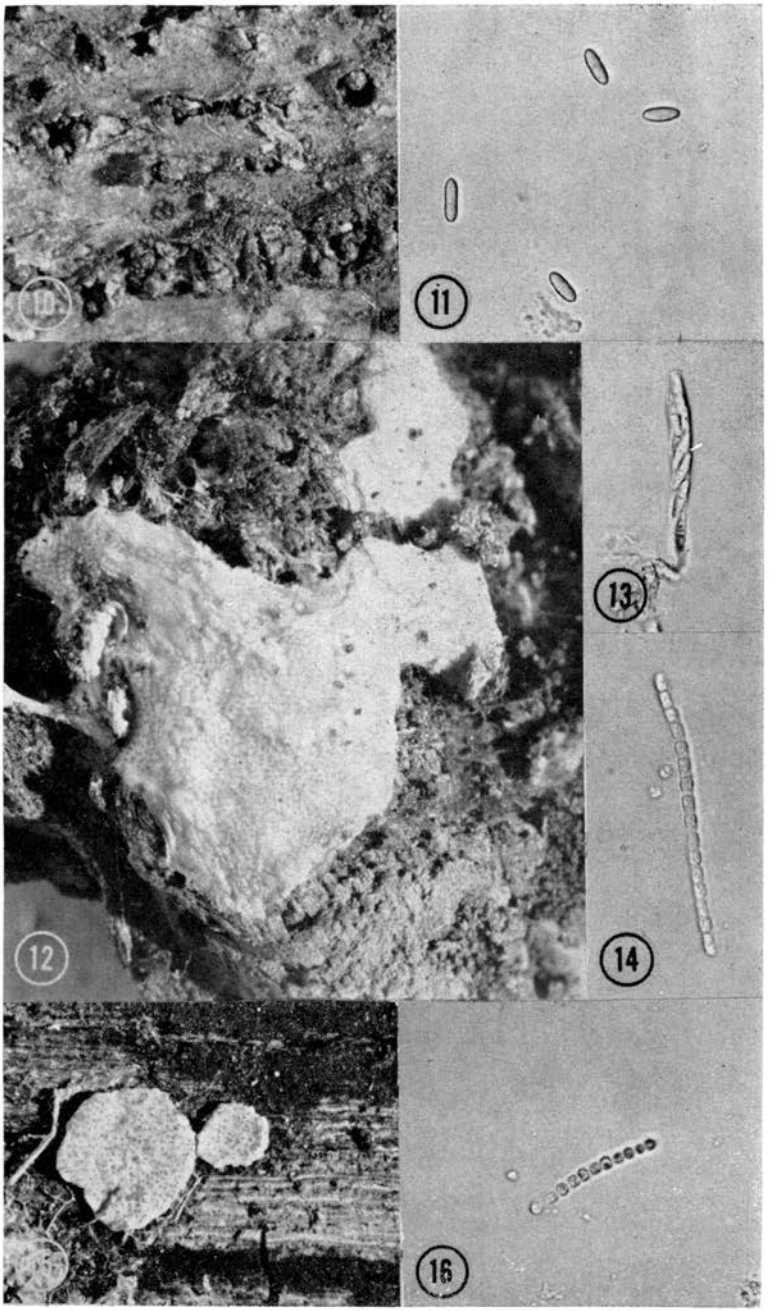

Figure 10. *Nectria verrucosa* perithecia.
Figure 11. *Nectria verrucosa* ascospores.
Figure 12. *Hypocrea citrina* stroma.
Figure 13. *Nectria coccinea* ascus.
Figure 14. *Hypocrea citrina* ascus.
Figure 15. *Hypocrea patella* stroma.
Figure 16. *Hypocrea patella* ascospores.

Cordyceps clavulata Schw. The ascospores of the former are illustrated in Ellis and Everhart (1892) as large four-celled spores, each cell filled with numerous very small allantospores. Our observations (Fig. 2) would indicate that these allantospores are external rather than internal and arise as blastospores from the ascospore cells. In the second case Seaver describes the clavate stroma of *C. clavulata* as sterile. One collection of this fungus showed the club-shaped stromata covered with a layer of conidiophores producing conidia. This stage would be referrable to the imperfect genus *Isaria,* as described by Pettit (1895).

Fitzgerald (1949) considered *Hypocrea sulphurea* (Schw.) Sacc. and *H. citrina* (Pers.) Fr. as synonymous. Our collections include specimens sufficiently different from one another to convince us of the reality of the two species.

We have followed Seaver in the case of *Hypomyces apiculatus* Peck. Our specimen closely conforms to the description in his treatment of the species. *Hypomyces ochraceus* (Pers.) Tul., a species whose description closely resembles that of *H. apiculatus,* cannot be used since the material upon which the species is based has been lost.

In 1952 Dingley (1952) transferred *Calonectria polythalama* (Berk.) Sacc. (*Scoleconectria polythalama* (Berk.) Seaver) to *Thyronectria pseudotrichia* (Berk.) Seeler but states "material determined by Seaver (1909) as *Scoleconectria polythalama* appears to be a different species." Our collection agrees with the Seaver material.

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