Monographic and floristic treatments of the Inocybaceae

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OUTLINE

- A monograph of the Inocybaceae in Australia

- Prospects for North American flora (Inocybaceae)

- Molecular annotation of North American types of Agaricales
1. A monograph of the Inocybaceae in Australia
A monograph of the Inocybaceae in Australia

Scope: family level assessment across a continent, roughly same size as the U.S.

Collections: most collected by research team:
Brandon Matheny, Neale Bougher, Martin Ryberg

and collaborators:
Genevieve Gates, Roy Halling, Nigel Fechner, Tim Baroni, Sandra Abel, Jim Trappe, Teresa Lebel, Tom May

Herbaria and staff at AD, BRI, CANB, HO, MEL, PERTH

Travel and research support provided UTK, NSF
A monograph of the Inocybaceae in Australia

28 species described from Australia prior to 2010
- 5 Auritella
- 23 Inocybe

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Since 2010:

17 species accepted after type studies (Matheny & Bougher, Muelleria 2010)

2 introduced species documented in Western Australia (Bougher & Matheny, Nuytsia 2011)

4 new species described (Bougher, Matheny, & Gates, Nuytsia 2012)

23 accepted species of Inocybaceae from Australia as of 2012

Major challenge: Australia may contain up to 120+ species in the family
A monograph of the Inocybaceae in Australia

Long-term goal (within next two years) to produce descriptions, illustrations, and keys for ca. 50-60 species as volume of Fungi of Australia series

Support for research and to publish book by ABRS (Australian Biological Resources Study) and matching funds from The Western Australian Naturalist’s Club (Perth)

Other long term goals: produce taxonomic papers of topical interest:
- secotioid forms
- trans-Tasman species
- species associated with Allocasuarina (Fagales)

Development of inocybaceae.org, online taxonomic resource
Data gathering

Field photos for most species

High quality line art

ITS, LSU, rpb2 sequences

Lack sequence data from types (most collected by J.B. Cleland between 1917-1930)

Plan to fix application of Cleland names to robust monophyletic groups

Descriptions are narratives, made into composite descriptions for publications, the Fungi of Australia volume, inocybaceae.org, FloraBase (db of the Western Australian flora)
Challenges

Hyper-diversity
- 70 Australian phylogenetic species (out of 86) in a single subantarctic clade reinforced by morphological and/or ecological differences

Numerous taxonomic novelties to describe

Must consider taxonomy of New Zealand and other Australasian spp (several trans-Tasman spp)
Rewards

8 productive undergraduates
- DNA extractions
- sequencing
2. Prospects for a North American flora (Inocybaceae)

Last monograph for NA, Kauffman (1924), *North American Flora*
- 105 species treated, keys and descriptions

333 names recorded from North America
- update with current names
- sort species into artificial groups to prepare keys
North American flora (Inocybaceae), an exercise

Kauffman (1924), *North American Flora*
- 4 species treated in sect. *Cervicolores* (Inosperma)

12 species now recognized

Type studies, two types sequenced:
*I. apiosmota* Grund & D.E. Stuntz,
*I. mucidiolens* Grund & D.E. Stuntz

Keys and descriptive part
in prep
Inocybaceae of North America, an exercise

Taxonomic key

KEY TO SPECIES OF SECTION CERVICOLORES (INOSPERMA CLADE, INOCYBE SENSU LATO) FROM NORTH AMERICA

1a. Stipe surface fibrillose, with loose fibrils, or fibrillose-streaked ........................................... 2
1b. Stipe surface with recurved scales or fibrillose-scaly .................................................. 5

2a. Fruitbodies small, pileus 3-4 mm, stipe 20-30 x 1 mm, known only from the type in New York ........
................................................................................................................. I. tenerrima G.F. Atk.
2b. Fruitbodies medium-sized to robust, pileus >10 mm and stipe >1 mm, known more widely from eastern North America or Alaska ................................................................. 3

3a. Odor spermatic, known only from Nova Scotia ......................................................... I. hirsuta sensu Grund & Stuntz
3b. Odor not spermatic ........................................................................................................ 4

4a. Pileus with fine reddish fibrils, fruitbodies small, pileus <30 mm wide, stipe <30 mm long, associated with Salix in Yukon and Alaska, odor not recorded ........................................................................ I. bongardii (Weinn.) Quel. sensu O.K. Miller
4b. Pileus with russet brown coarse scales, fruitbodies larger than above, pileus 15-45 mm wide, stipe >30 mm long, associated with stands of mixed hardwoods or in stands with Tsuga in eastern North America. ............................................................................. I. cervicolor (Pers.: Fr.) Quel. (=I. subrubescens G.F. Atk.)

5a. Odor like ripe pears ........................................................................................................ I. apiomota Grund & D.E. Stuntz
5b. Odor fishy, like Pelargonium, or green corn .................................................................... 6

6a. Fruitbodies large, stipe 55-120 x 6-14 mm long, odor fishy or fishy mixed with Pelargonium .......... 7
6b. Fruitbodies medium, stipe 20-85 x 2.5-5 mm, odor as above or like green corn ....................... 9

7a. In high-elevation Quercus forests of Costa Rica ............................................................. I. aff. calamistrata group II
7b. In conifer forests of temperate regions ...................................................................... 8

8a. Pileus with reddish brown scales against pale brown to light yellowish brown ground color, green sometimes absent from stipe base, spores 9-11 x 5-6 μm ....................................................................................................................... I. maxima (A.H. Sm.) Matheny, comb. nov.
**DESCRIPTIVE PART**


Pileus 20-35 mm, convex expanding with broad umbo, disc squarrose, margin lacerate-fibrillose, reddish brown or Argus Brown (6E7), context buff, odor aromatic of pears. Lamellae adnate, subdistant, Argus Brown, broad. Stipe 40-55 x 3-4 mm, equal, slightly enlarged below, surface densely and coarsely squarrose, apex fibrillose, Raw Umber, context hollow, buff with slight greenish cast. Spores 10-12 x 5.5-6.5 μm, mostly 11 x 6 μm from 4-sterigmate basidia, larger 13-14.5 x 6.5-8 μm from 2-sterigmate basidia, phaseoliform. Basidia 2- and 4-sterigmate. Pleurocystidia none. Cheilocystidia 40-50 x 12-17 μm, clavate, thin-walled, brown.

**TYPE LOCALITY:** Waterville Mountain, Kings County, Nova Scotia (AU10560). Type sequences: HQ201336 (ITS), JN975022 (nLSU-rRNA).

**HABITAT:** Host vegetation includes *Tsuga*, while the type is recorded from a “swamp”, July to September.

**DISTRIBUTION:** Widely distributed in eastern North America—Nova Scotia, Pennsylvania, east Tennessee but rarely recorded.

**ILLUSTRATIONS:** Grund & Stuntz, Mycologia 67: 21 (1975).

**NOTES:** The description above is from the protologue. I have encountered this species in Pennsylvania and east Tennessee but missed examination for the pear-like odor. If a consistent feature, the dimorphic spores might also be a diagnostic. Data on whether the context is rubescant is lacking. The species is not very well known but is widespread in eastern North American and probably misinterpreted as *I. calamistrata*.

*Inocybe atrovirescens* Matheny, sp. nov.

Pileus 25-40 mm, conical to plano-convex, densely matted fibrillose, with recurved squamules in age, grayish brown to brown or Saccardo’s Umber (5D4-D5D-5E5), context thick, odor strong like trout or fish. Lamellae adnate to uncinate, close, light brown to brown (5D5-5E6) with olivaceous tinge on Orange.
3. Molecular annotation of type specimens from North America: pilot study

Sampled 97 types of Agaricales (TENN, WTU)

*Clavaria, Clitocybe, Clitopilus, Crepidotus, Cystoderma, Entoloma, Gymnopilus, Hebeloma, Hygrophorus, Inocybe, Pholiota, Ramariopsis, Rhodocybella*

80 complete or partial ITS sequences (82%)
- 66 collections >40 yrs old, oldest 75 yrs old
- 46 (58%) are novel seqs on GenBank
- 12 match insufficiently identified seqs

Selected LSU-rRNA sampling (LR0R-LR16/LR5)

105 sequences from types produced
(released on GenBank)
Other monographic works at UTK

- Clavariaceae in the Pacific Northwest
  - *Camarophyllum*, *Hodophilus*, global
    Joshua Birkebak, PhD student

- Leucopaxilleae (Tricholomataceae)
  - *Leucopaxillus*, *Porpoloma*, *Dennisiomyces*
    Marisol Sanchez Garcia, PhD student

- *Auricularia* of the southeast United States
  Brian Looney, PhD student

“The best way to know what a species is... is to know what it is”

J.F. Ammirati