

Population Genetics and Development of *Lentinus tigrinus*, the "Tiger Sawgill" a Semi-Aquatic Mushroom of Riparian Forests



David Hibbett, Clark University, Worcester MA, USA





Gasteromycetes form spores internally:



Geastrum saccatum Geastrales



Calvatia gigantea Agaricales (Manfred Binder)

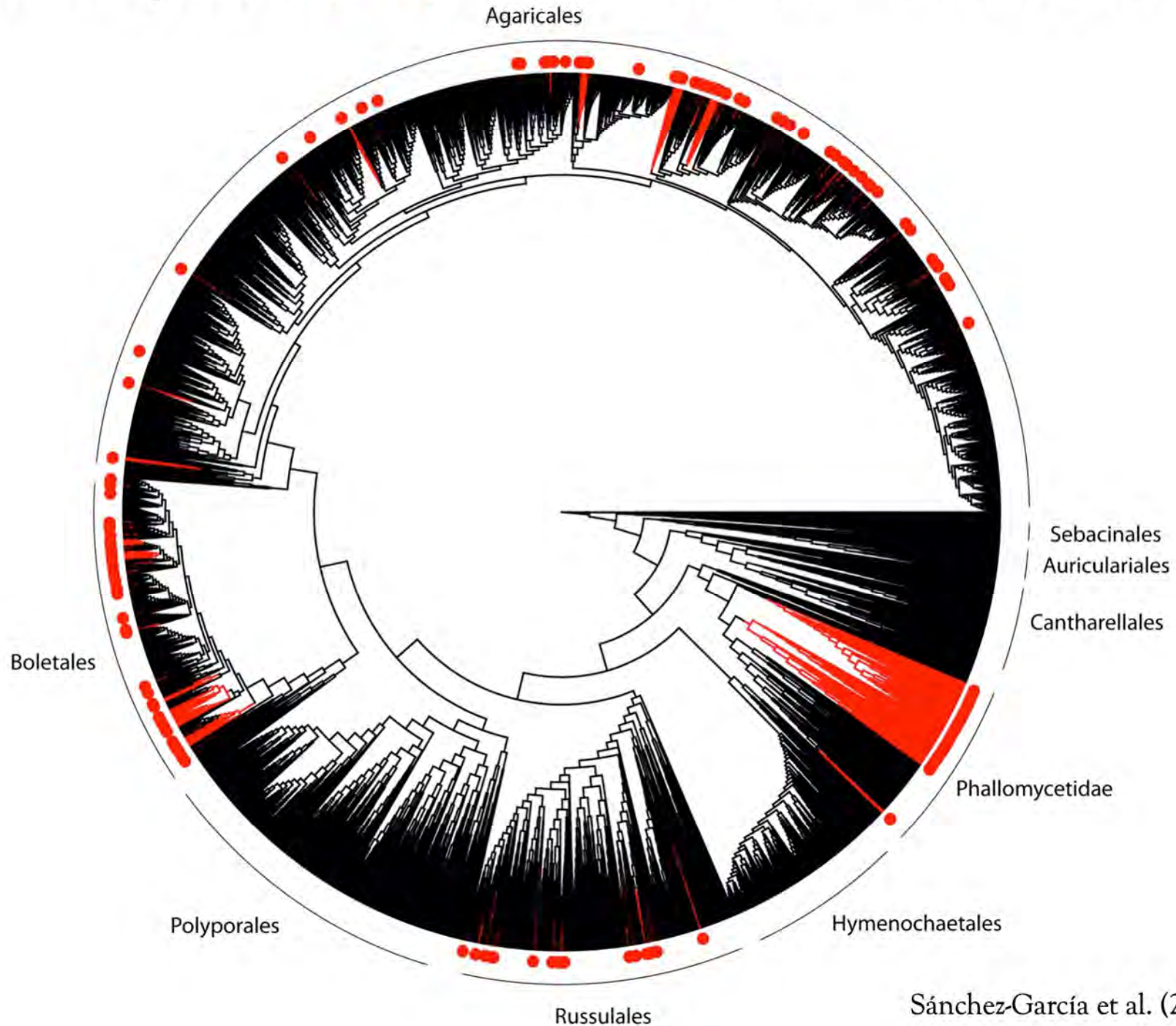


Calostoma cinnabarina Boletales (Roy Halling)



Phallus tenuis Phallales

Gasteromycetes (red) have evolved at least 123 times:



Secotioid fungi are gasteromycetes that resemble closely-related hymenomycetes:



Nivatogastrium nubigenum
(mushroomobserver.org)



Pholiota aurivella
(Michael Wood, MykoWeb)



Podaxis pistillaris
(Heino Lepp)



Thaxterogaster sp.
(Greg Mueller)

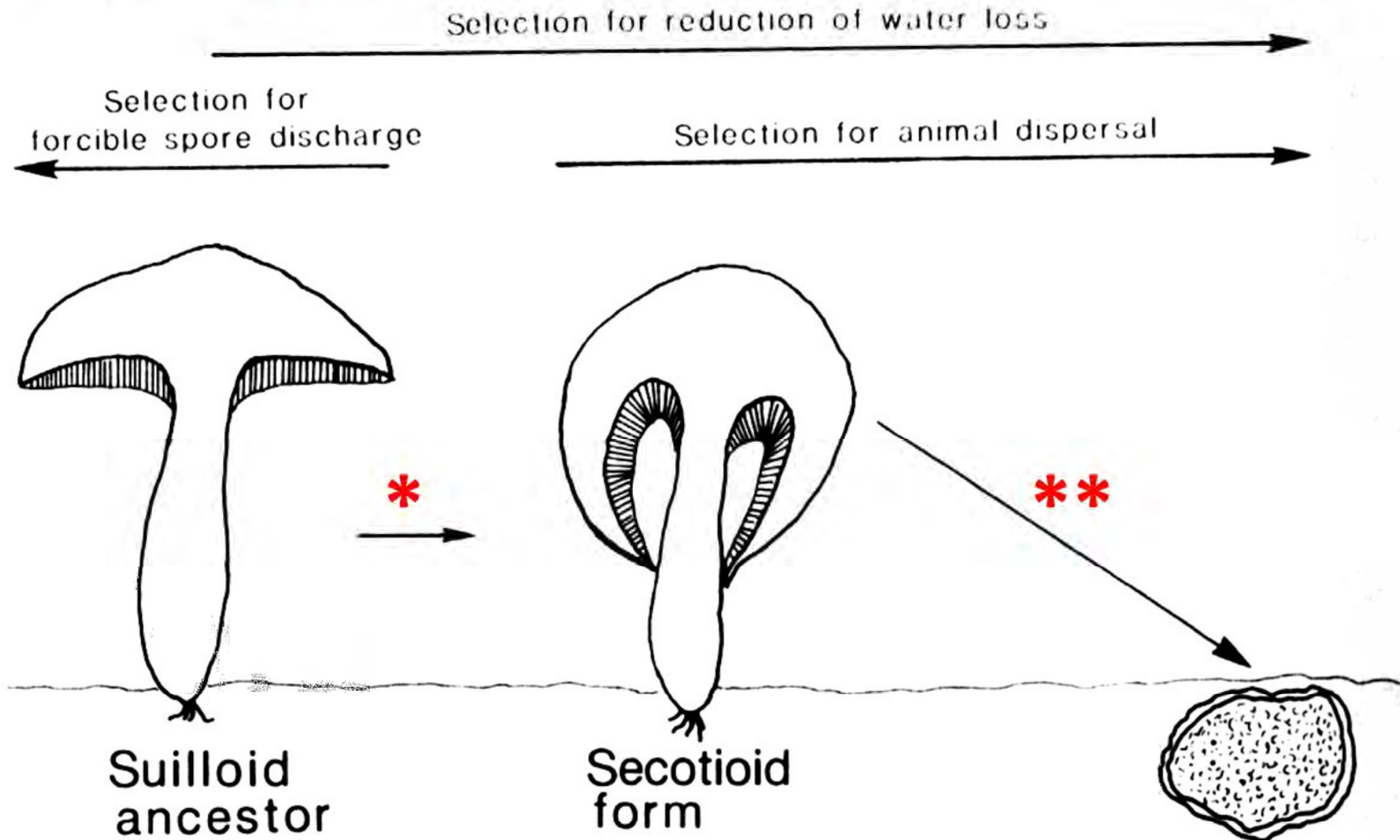


Cortinarius vanduzerensis
(Boleslaw Kuznik, MykoWeb)

Coprinus comatus
(Michael Wood)



Secotioid forms may arise from mutations with large phenotypic effect (*), followed by selection for refinement (**) of gasteroid forms:



Suilloid
ancestor

Secotioid
form

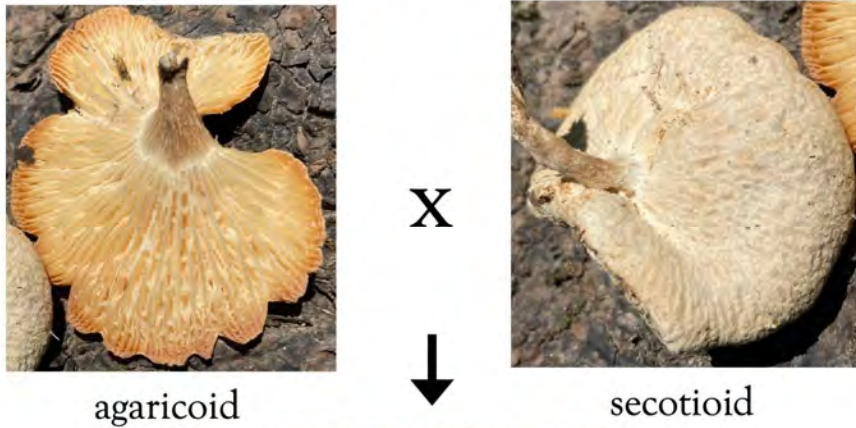
Rhizopogon

Bruns et al. (1989) *Nature*





The secotioid form has simple Mendelian inheritance as a recessive trait:



F₁



F₂



| | agaricoid | secotioid |
|-----------------------------|-----------|-----------|
| F₁ n = 48 | 47 | 0 |

| | agaricoid | secotioid |
|--|------------|-----------|
| F₂ backcross 1 n = 100 | 49 | 47 |
| F₂ backcross 2 n = 200 | 109 | 84 |

Hibbett et al. (1994) *Am J Bot*
 Wu et al. (2018). *Genome Biol Evol*

Lentinus tigrinus (Bull.) Fr.

Published in: Fr. In: Syst. orb. veg. (Lundae) 1: 78. (1825). source: Species Fungorum Plus

Basionym: *Agaricus tigrinus* Bull.

OVERVIEW METRICS REFERENCE TAXON

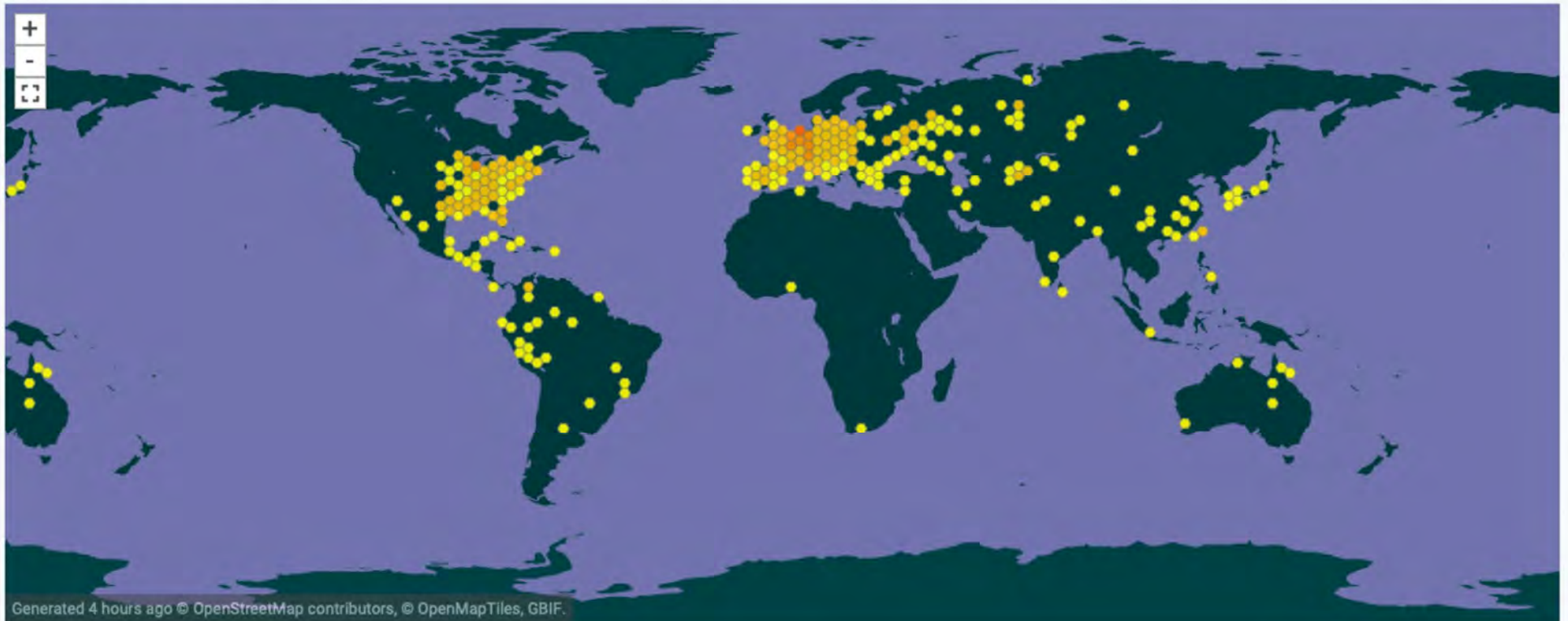
4,318 OCCURRENCES

10 INFRASPECIES

1,913 OCCURRENCES WITH IMAGES



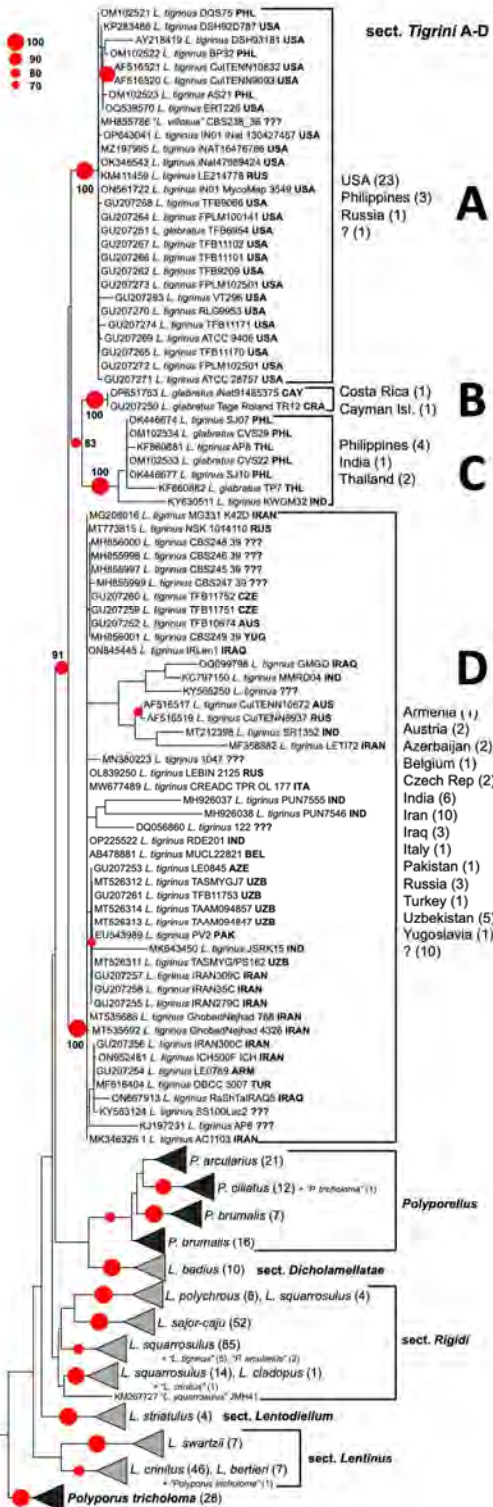
3,436 GEOREFERENCED RECORDS



Generated 4 hours ago © OpenStreetMap contributors, © OpenMapTiles, GBIF.

Any year 1791 - 2023

EXPLORE 



Lentinus phylogeny

- Four lineages in sect. *Tigrini*
- Groups A and D have both been called “*Lentinus tigrinus*”

100
90
80
70

OM192521 *L. tigrinus* DQ575 PHL
 KP283488 *L. tigrinus* DSHR20787 USA
 AV218419 *L. tigrinus* DSHR3181 USA
 OM102622 *L. tigrinus* BP32 PHL
 AF516321 *L. tigrinus* CuITENN10832 USA
 AF516320 *L. tigrinus* CuITENN98093 USA
 OM102523 *L. tigrinus* AS21 PHL
 OQ238970 *L. tigrinus* ER1226 USA
 MH85576E *L. villosus* CBS238_36 ???
 QP643041 *L. tigrinus* IN01 04d 130427457 USA
 MZ197965 *L. tigrinus* NAT16476786 USA
 OK348542 *L. tigrinus* Nat47989424 USA
 KMA114350 *L. tigrinus* LE214778 RUS
 OMS17222 *L. tigrinus* P01 MjyocMag 3549 USA
 GU207258 *L. tigrinus* TFB0606 USA
 GU207264 *L. tigrinus* FPLM100141 USA
 GU207261 *L. tigrinus* TFB9994 USA
 GU207267 *L. tigrinus* TFB11102 USA
 GU207266 *L. tigrinus* TFB11101 USA
 GU207262 *L. tigrinus* TFB9209 USA
 GU207273 *L. tigrinus* FPLM102501 USA
 GU207283 *L. tigrinus* VT296 USA
 GU207270 *L. tigrinus* RL59953 USA
 GU207274 *L. tigrinus* TFB11171 USA
 GU207269 *L. tigrinus* ATCC 9406 USA
 GU207265 *L. tigrinus* TFB11170 USA
 GU207272 *L. tigrinus* FPLM102501 USA
 GU207271 *L. tigrinus* ATCC 24752 USA
 OPR51793 *L. glaberrima* Ane41485375 GAY
 GU207250 *L. glaberrima* Tege Roland TR12 CRA
 OK446674 *L. tigrinus* SJ07 PHL
 OM102534 *L. glaberrima* CV529 PHL
 KF298051 *L. tigrinus* AP8 THL
 OM102533 *L. glaberrima* CV7522 PHL
 OK446677 *L. tigrinus* SJ10 PHL
 KF660882 *L. glaberrima* TP7 THL
 KY630511 *L. tigrinus* NVGM32 IND

sect. *Tigrini* A-D

USA (23)
Philippines (3)
Russia (1)
? (1)

A

Costa Rica (1)
Cayman Isl. (1)

B

Philippines (4)
India (1)
Thailand (2)

C

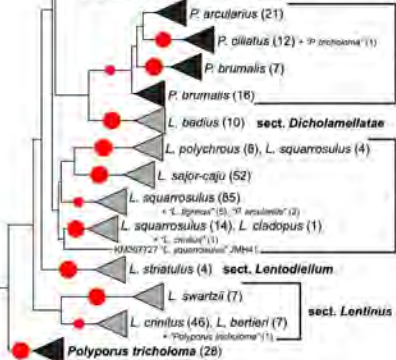
D

Armenia (1)
Austria (2)
Azerbaijan (2)
Belgium (1)
Czech Rep (2)
India (6)
Iran (10)
Iraq (3)
Italy (1)
Pakistan (1)
Russia (3)
Turkey (1)
Uzbekistan (5)
Yugoslavia (1)
? (10)

Polyporellus

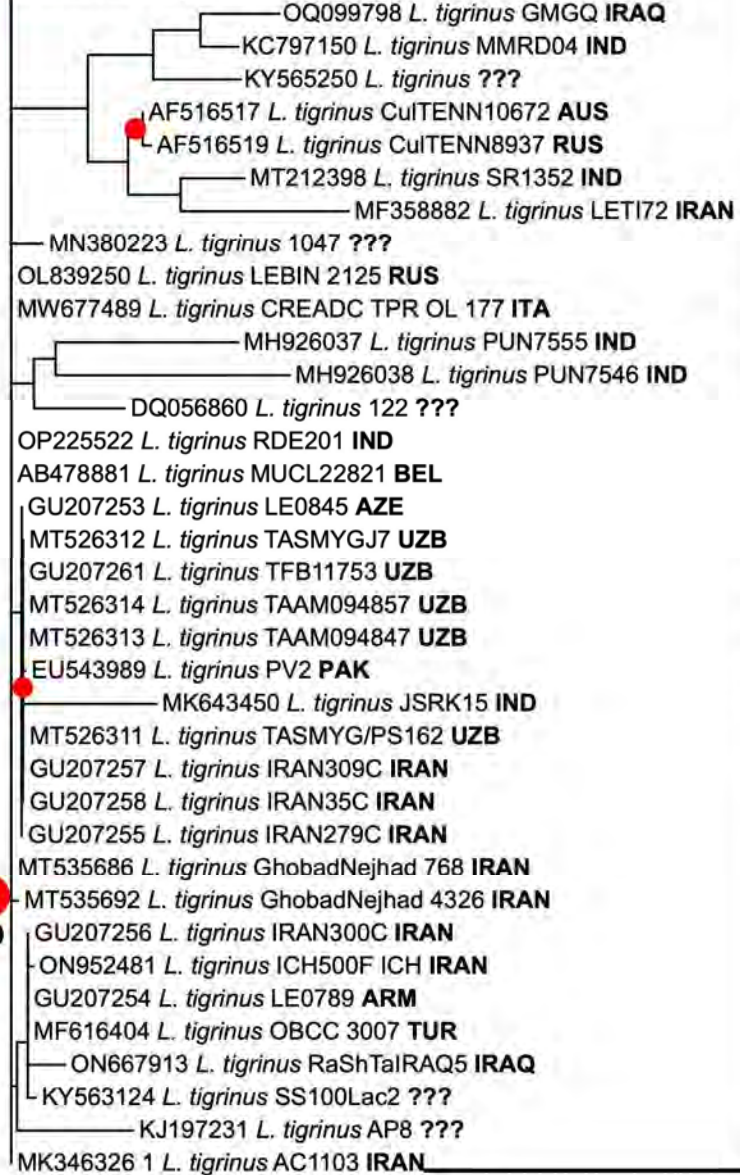
sect. *Rigidii*

sect. *Lentinus*



91

MG208016 *L. tigrinus* MG331 K42D IRAN
 MT773615 *L. tigrinus* NSK 1014110 RUS
 MH856000 *L. tigrinus* CBS248 39 ???
 MH855998 *L. tigrinus* CBS246 39 ???
 MH855997 *L. tigrinus* CBS245 39 ???
 -MH855999 *L. tigrinus* CBS247 39 ???
 GU207260 *L. tigrinus* TFB11752 CZE
 GU207259 *L. tigrinus* TFB11751 CZE
 GU207252 *L. tigrinus* TFB10674 AUS
 MH856001 *L. tigrinus* CBS249 39 YUG
 ON845445 *L. tigrinus* IRLen1 IRAQ

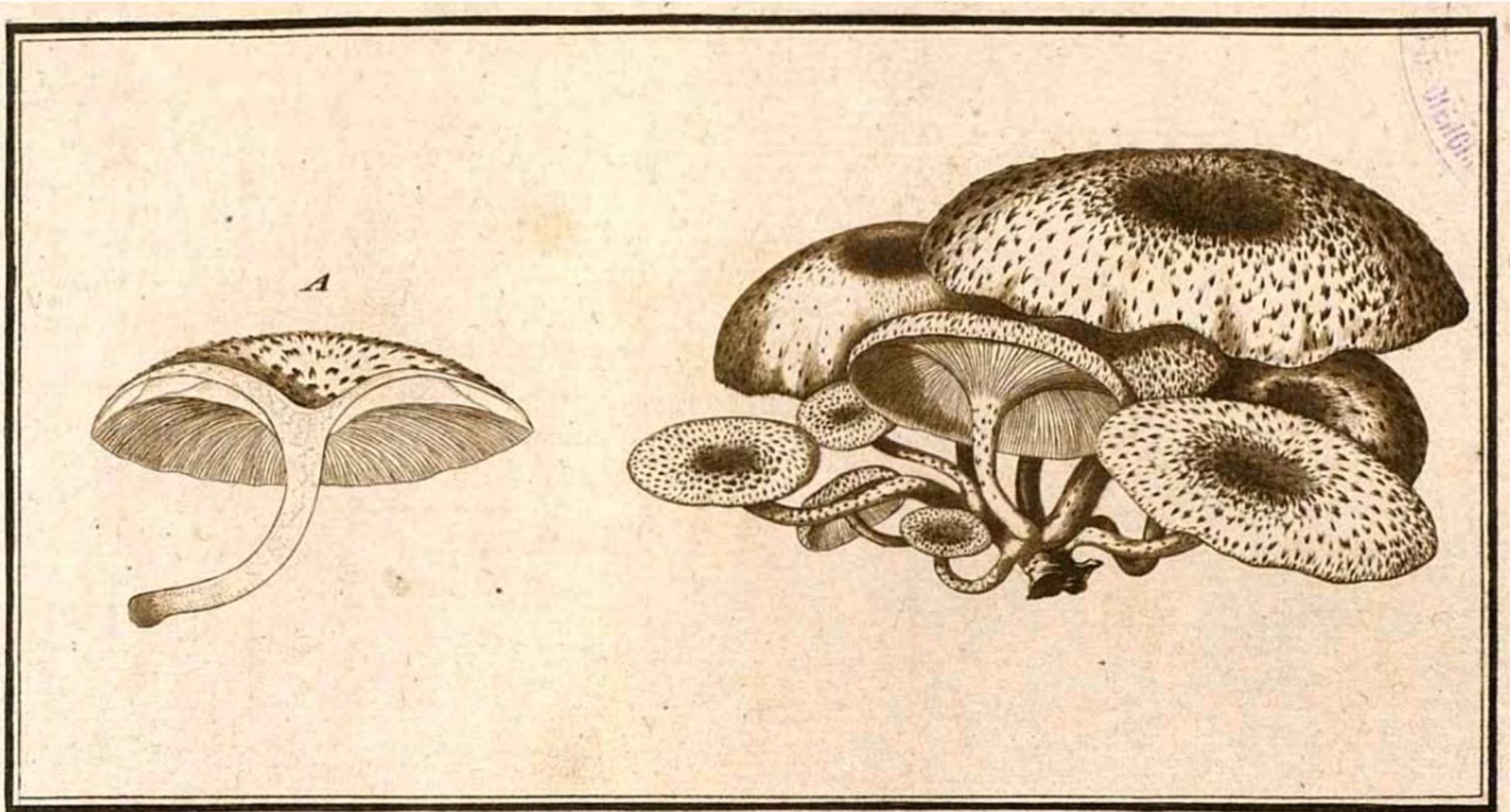


D

Armenia (1)
Austria (2)
Azerbaijan (2)
Belgium (1)
Czech Rep (2)
India (6)
Iran (10)
Iraq (3)
Italy (1)
Pakistan (1)
Russia (3)
Turkey (1)
Uzbekistan (5)
Yugoslavia (1)
? (10)

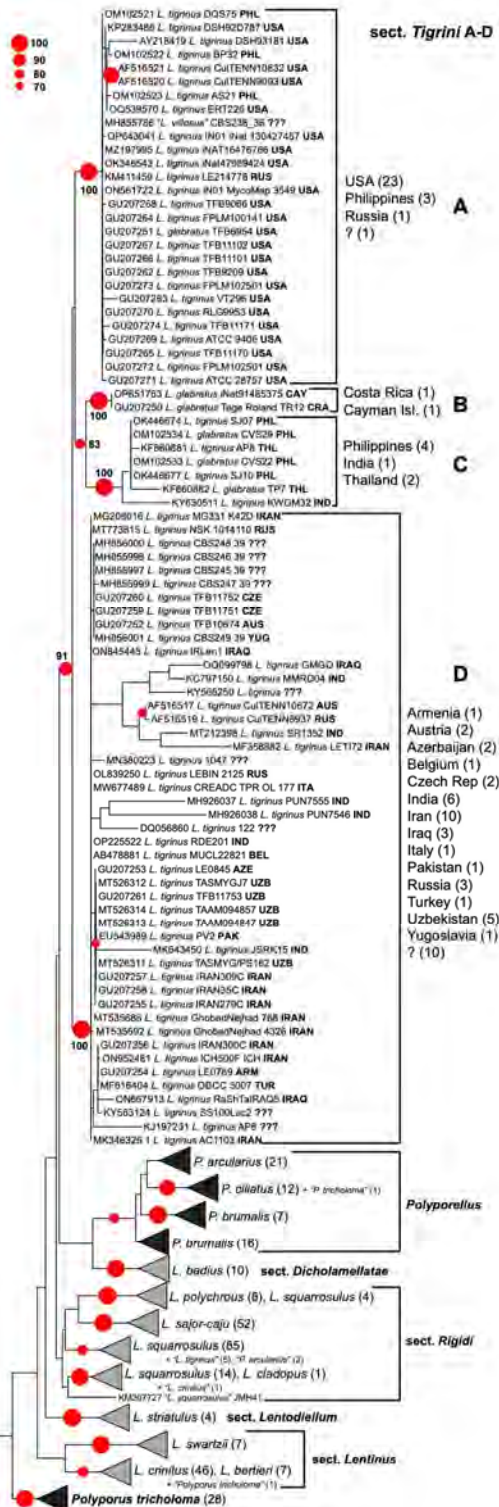
100

Group D is *Lentinus tigrinus* sensu stricto, from Europe, the Middle East, and North Africa.



L'AGARIC TIGRÉ.

Agaricus tigrinus Bull. (1782) *Herbier de la France* 2: tab. 70

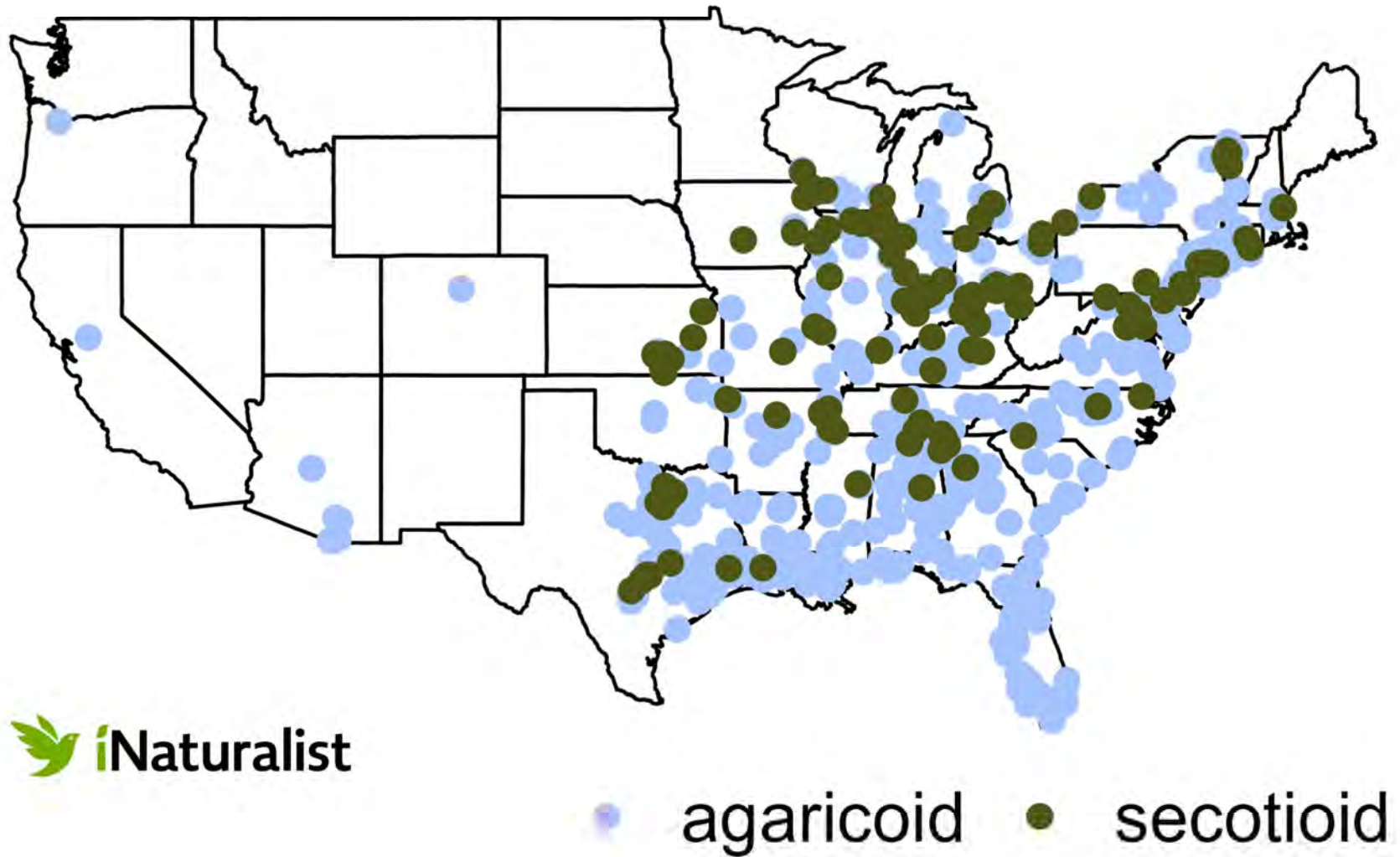


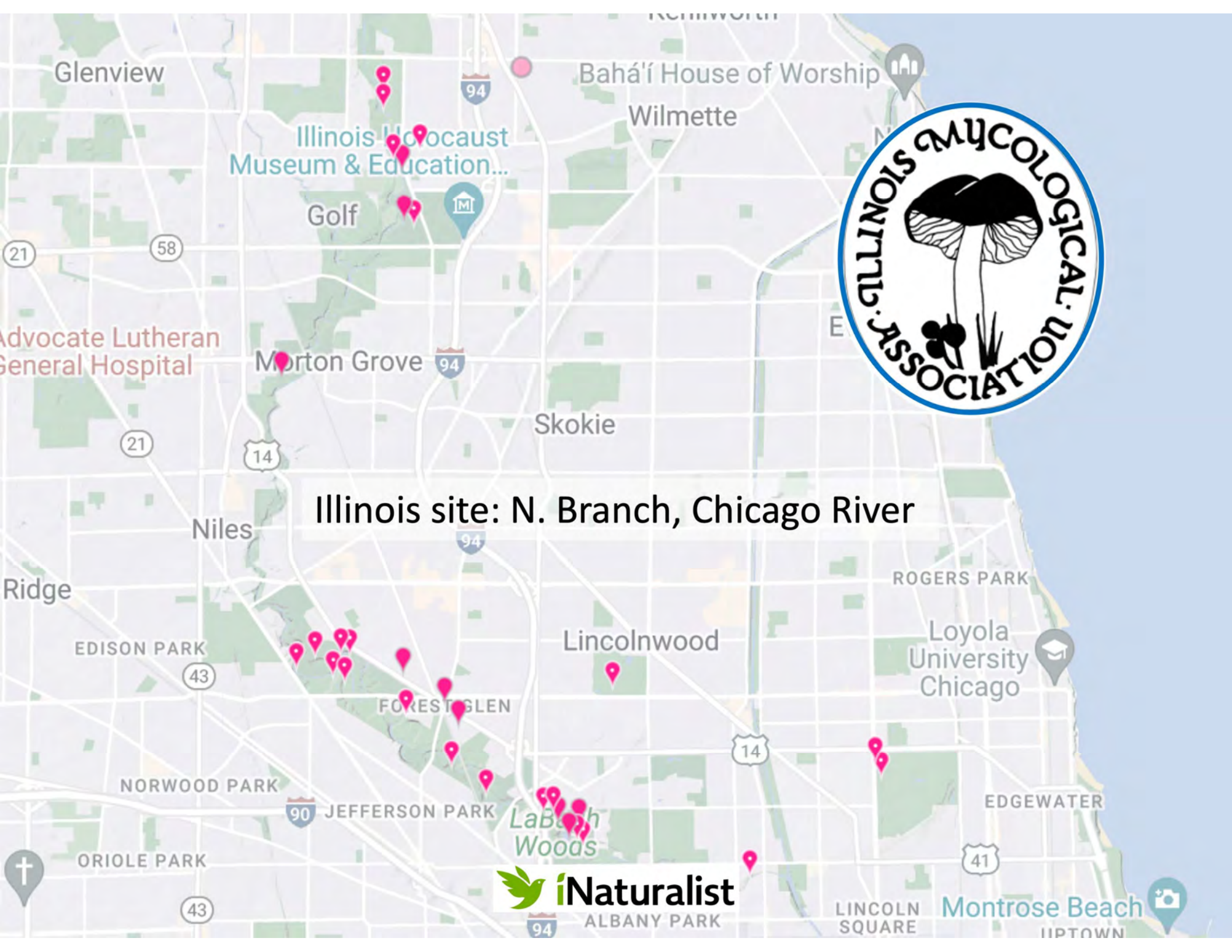
- OM102521 *L. tigrinus* DQS75 PHL
- KP283488 *L. tigrinus* DSH92D787 USA
- AY218419 *L. tigrinus* DSH93181 USA
- OM102522 *L. tigrinus* BP32 PHL
- AF516521 *L. tigrinus* CulTENN10832 USA
- AF516520 *L. tigrinus* CulTENN9093 USA
- OM102523 *L. tigrinus* AS21 PHL
- OQ539570 *L. tigrinus* ERT226 USA
- MH855786 "*L. villosus*" CBS238_36 ???
- OP643041 *L. tigrinus* IN01 iNat 130427457 USA
- MZ197995 *L. tigrinus* iNat16476786 USA
- OK346543 *L. tigrinus* iNat47989424 USA
- KM411459 *L. tigrinus* LE214778 RUS
- ON561722 *L. tigrinus* IN01 MycoMap 3549 USA
- GU207268 *L. tigrinus* TFB9066 USA
- GU207264 *L. tigrinus* FPLM100141 USA
- GU207251 *L. glabratus* TFB6954 USA
- GU207267 *L. tigrinus* TFB11102 USA
- GU207266 *L. tigrinus* TFB11101 USA
- GU207262 *L. tigrinus* TFB9209 USA
- GU207273 *L. tigrinus* FPLM102501 USA
- GU207263 *L. tigrinus* VT296 USA
- GU207270 *L. tigrinus* RLG9953 USA
- GU207274 *L. tigrinus* TFB11171 USA
- GU207269 *L. tigrinus* ATCC 9406 USA
- GU207265 *L. tigrinus* TFB11170 USA
- GU207272 *L. tigrinus* FPLM102501 USA
- GU207271 *L. tigrinus* ATCC 28757 USA

USA (23)
 Philippines (3)
 Russia (1)
 ? (1)

Group A is restricted to N. America
 (and Russia and Philippines?)

The secotioid form occurs only in North America.
23% of the 892 records on iNaturalist are secotioid.

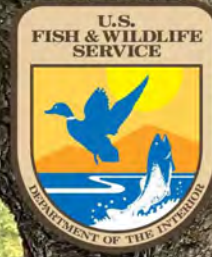




Illinois site: N. Branch, Chicago River



Massachusetts Site 1: Concord River, Great Meadows National Wildlife Refuge, Concord MA



Devon Rose Leaver and Thea Henry
Sept 11, 2022

Massachusetts Site 2: Ipswich River, Mass. Audubon
Ipswich River Nature Sanctuary, Topsfield MA



Christina Martin and Iris Knowles
June 29, 2021

Tiger Sawgill (*Lentinus tigrinus*)

needs ID

Follow



bdthomas

3,074 observations

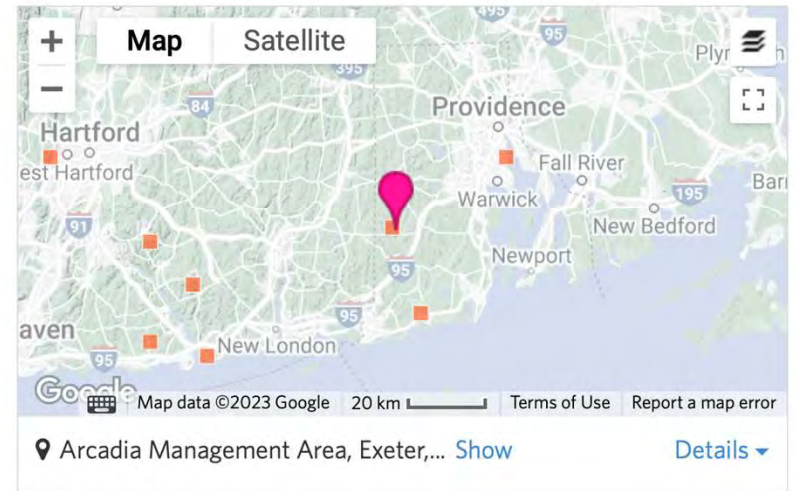


Observed:

Jun 29, 2023 · 4:00 PM EDT

Submitted:

Jun 29, 2023 · 9:17 PM EDT



Notes

On mostly bark less maple over flowing water.
Showing secotioid form!!!!

Activity



bdthomas suggested an ID

Leading 3mo



Tiger Sawgill
Lentinus tigrinus

Community Taxon

[What's this?](#)

The Community ID requires at least two identifications.

Projects (3)



Rhode Island Mycological Society



Biodiversity of Rhode Island

Thomas Roehl
Ipswich River
July 26, 2022





Concord River, July 7, 2022



Ipswich River, June 29, 2021

Water levels vary stochastically.

May 1, 2022 - October 2, 2023

Gage height, feet

4.03 ft - Oct 02, 2023 04:15:00 AM EDT





Ipswich River, October 9, 2022



Ipswich River, June 13, 2023



HYPOTHESES:

- **H1:** The secotioid form is under **positive** selection; the polymorphism reflects an ongoing selective sweep.
- **H2:** Both forms are maintained by **balancing** selection in a stochastically varying environment.



NEXT STEPS:

1. Phylogenomics of *Lentinus* sect. *Tigrini*.
2. Genome-Wide Association Studies (GWAS) to identify locus responsible for the secotioid form.
3. Population genetics to test selective hypotheses and assess population structure.

REFERENCES

- Hibbett, D. S., Tsuneda, A., & Murakami, S. (1994). The secotioid form of *Lentinus tigrinus*: genetics and development of a fungal morphological innovation. *Amer J Bot* 81, 466-478.
- Wu, B., Xu, Z., Knudson, A., Carlson ... & Hibbett, D. (2018). Genomics and development of *Lentinus tigrinus*: A white-rot wood-decaying mushroom with dimorphic fruiting bodies. *Genome Biol Evol* 10, 3250-3261.
- Sánchez-García, M., Ryberg, M., Khan, F. K., Varga, T., Nagy, L. G., & Hibbett, D. S. (2020). Fruiting body form, not nutritional mode, is the major driver of diversification in mushroom-forming fungi. *PNAS* 32528-32534.

TEAM

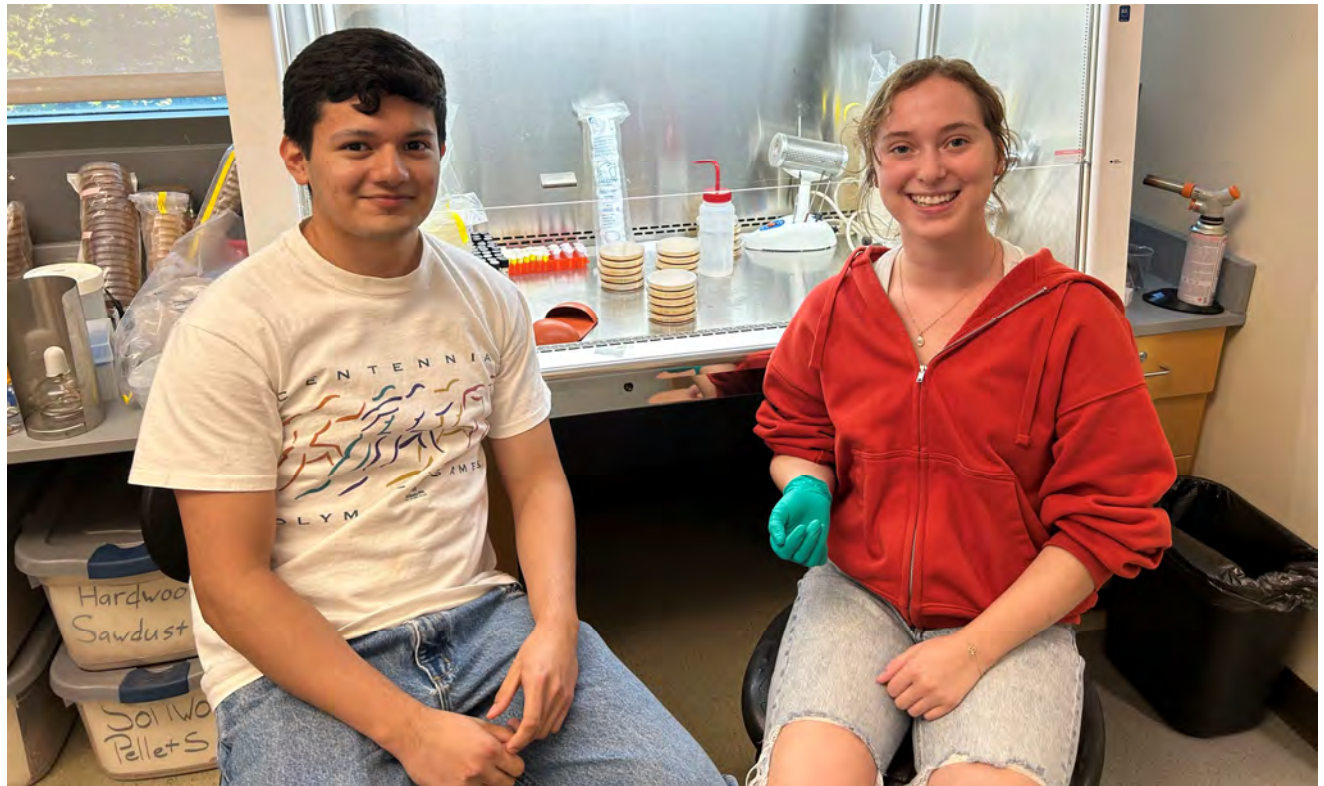
Current:

- Thomas Roehl
- Sofie Irons**
- Carlos Perez-Gazca*
- Zach Kratz*
- Javier Tabima



Former:

- Devon-Rose Leaver*
- Thea Henry*
- Christina Martin*
- Iris Knowles*
- Marisol Sánchez-García
- Martin Ryberg
- Laszlo Nagy
- Baojun Wu
- Zhangyi Xu
- Alicia Knudson
- Alexis Carlson*
- Sam Kovaka*
- Kiwamu Umezawa
- John Gibbons
- Akihiko Tsuneda
- Shigeyuki Murakami
- *undergrad./**Master's



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- Clark University, Andrea B. and Peter D. Klein



