



Recent Introductions and Movements of Fleshy Fungi in the Hawaiian Islands

Don E. Hemmes¹, Dennis E. Desjardin², and Brian A. Perry³

¹Biology Department, University of Hawai'i at Hilo, 200 W. Kawili St., Hilo, HI 96720; ²Department of Biology, San Francisco State University, 1600 Holloway Avenue, San Francisco, CA 94132;

³Department of Biological Sciences, California State University East Bay, 25800 Carlos Bee Blvd., Hayward, CA 94542. Corresponding author: hemmes@hawaii.edu.

Abstract: The appearance and distribution of several macrofungi on the major Hawaiian Islands since the publication of the field guide *Mushrooms of Hawai'i* are described. *Favolaschia calocera*, *Macrocybe spectabilis*, *Saproamanita (Amanita) manicata*, and *Filoboletus manipularis* have been collected more frequently and appear to be spreading across the island chain. *Phallus cinnabarinus*, *P. multicolor*, *P. atrovolvatus*, along with *Aseroë arachnoidea*, have been localized on Hawai'i Island up to this point although *Aseroë arachnoidea* was recently reported from Oahu for the first time.

Key words: invasive, *Favolaschia*, *Macrocybe*, *Saproamanita*, *Filoboletus*, *Phallus*, *Aseroë*



Figure 1. *Favolaschia calocera* has invaded both native and alien forests in Hawai'i.

Since the publication of the field guide *Mushrooms of Hawai'i* (Hemmes and Desjardin, 2002) several large, conspicuous mushrooms have been reported for the first time and appear to be spreading across the various islands. They may have been missed or rare in our initial years of canvassing the islands from 1980 until 2002, before the field guide was produced, but now these species are so frequently encountered that it appears they were not overlooked, but are recent arrivals.

Favolaschia calocera R. Heim (Fig. 1) is a classic example of an invasive species in the islands. The bright orange poroid fruiting bodies of this fungus were not seen during the twenty or more years of collecting on each of the major islands, but in the last few years it is often encountered in troops on fallen logs and branches in both alien and native forests on all the major Hawaiian Islands. The spread of this fungus from Madagascar to Europe, Africa, Australia, New Zealand, China and various Pacific islands is well documented (Vizzini et al., 2009).

Macrocybe spectabilis (Peerally & Sutra) Pegler & Lodge (Fig. 2) is difficult to miss in the field. Clusters of 30-50 or more fruiting bodies with pilei up to 60 cm in diameter and stipes 40 cm long appear on lawns in parks and in pastures. This species was first recorded from



Figure 2. *Macrocybe spectabilis* has been seen fruiting in the National Tropical Botanical Garden on Kaua'i (photo courtesy of the National Tropical Botanical Garden).

Mauritius and Japan (Pegler et al., 1998) as being associated with sugar cane, but in Hawai'i it frequents lawns and agricultural areas. At first, in the early 2000s, most reports were from Kaua'i near Kalaheo, in and around the National Tropical Botanical Garden at Lāwa'i. Since sugar cane was a large agricultural venture in the islands, including Kaua'i, it is not difficult to imagine spores of this

species being introduced to Kaua'i from Japan with machinery or field workers. Additional reports in recent years show this species is now widespread on Oahu and has been seen at Ho'omaluhia Botanical Gardens on the windward side of Oahu, at Kunia Farms in central Oahu, and in banana plantations at Waimanalo in east Oahu. Recently, we received reports of this species in a



Figure 3. *Saproamanita (Amanita) manicata* often occurs at Bay Front in Hilo on the Big Island.



Figure 4. These beautiful clusters of *Filoboletus manipularis* were photographed near the Buddhist Monastery on Kaua'i (photo courtesy of the Kaua'i Buddhist Monastery).

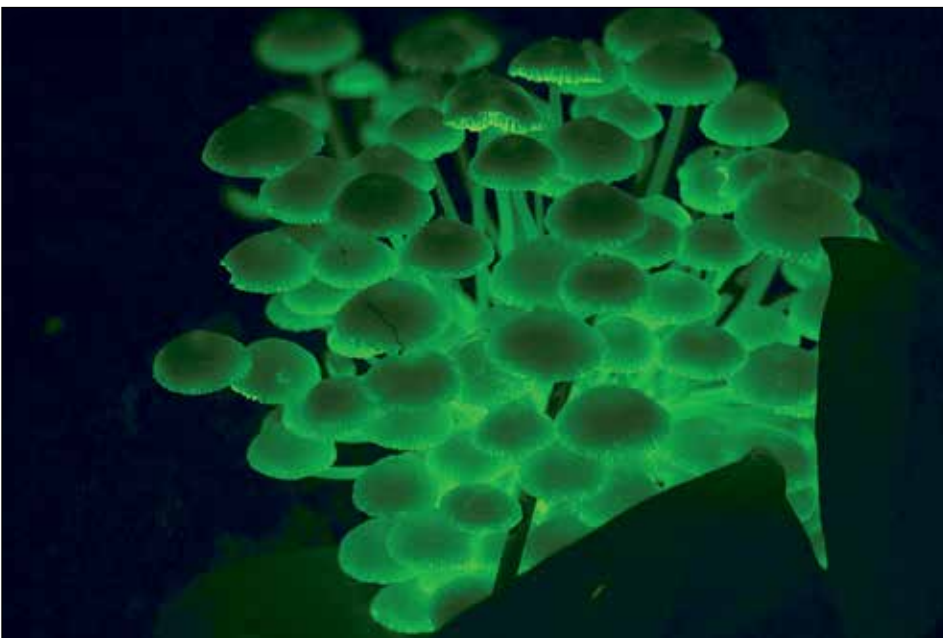


Figure 5. *Filoboletus manipularis* should be easy to spot with its intense bioluminescence (photo courtesy of the Kaua'i Buddhist Monastery).

garden at Makawao, in pastures in Kula and nursery areas in Kihei, all on Maui. In 2016 the first record of this species from Hawai'i Island, the Big Island, was made at Kukuihaele on the northern part of the island.

As to the edibility of *M. spectabilis*, there have been personal communications from some Kaua'i residents that this species is a highly recommended tasty edible. However, recently specimens offered at a local farmer's market on Kaua'i sent a number of people to the emergency ward with acute gastrointestinal problems, so it is best to avoid this species even though it is so tempting. *Macrocybe giganteum*, a similar species present in Japan but with slightly smaller pilei, is considered a good edible by Japanese gourmets.

Saproamanita (Amanita) manicata (Berk. & Broome) Redhead, Vizzini, Drehmel & Contu (Fig. 3) was first collected on lawns in Ho'omaluhia Botanical Gardens on Oahu in 1990 (Hemmes and Desjardin, 2008). Since then fruiting bodies have been recorded on most of the major islands on lawns, in composted wood chips, and at the berm of beaches in sand. This saprotrophic species (see Redhead et al., 2016 for genus designation) is not only easily identified by the large fruiting bodies with regular spaced squamules on the pileus and shaggy flakes on the stipe leading to a distinct annulus, but also by its strong unpleasant odor (see description, additional photos, and discussion of this species on Amanitaceae.org by R. E. Tulloss and L. Possiel). At Bay Front in Hilo, records show that fruiting bodies have appeared in composted wood chips from October 18-20 for a number of consecutive years suggesting that this fungus must contain some type of internal clock.

Recently, *Filoboletus manipularis* (Berk.) Singer was sighted for the first time in Hawai'i near Kapa'a and Kilauea on the western and northern sides of Kaua'i on rotting *Eucalyptus* logs and in alien forests (Fig. 4). This species is found in Australasia, Malaysia, and various Pacific Islands and may have made its way to Hawai'i with the alien plants found in these *Eucalyptus* and alien forest habitats. The bioluminescence is so bright (Fig. 5) that more records of this species should be forthcoming if it spreads.

Three species of *Phallus* (formerly



Figure 6. *Phallus cinnabarinus* invaded a nursery pot at a Hilo garden shop, evidence of how easily these stinkhorns can be spread in mulch and potting material.



Figure 7. *Phallus multicolor* is now the dominant species in composted woodchips at the 'Imiloa Astronomy Center on the campus of the University of Hawai'i at Hilo.

Dictyophora), *P. cinnabarinus* (W. S. Lee) Kreisel (Fig. 6), *P. multicolor* (Berk. & Broome) Cooke (Fig. 7) and *P. atrovolvatus* Kreisel & Calonge (Fig. 8), and one species of *Aseroë*, *A. arachnoidea* E. Fisch. (Fig. 9), have become common in Hilo and the surrounding areas of Hawai'i Island in compost/woodchip piles and on lawns in recent years (Hemmes and Desjardin, 2009). Green waste from areas where these members of the Phallales are found is hauled to the county dump in Hilo where it is composted and then distributed to gardeners and landscapers as mulch, and thus the spores are spread. These smelly, but beautiful, netted stinkhorns appear in great troops in mulch and on lawns during wet periods throughout the eastern side of the Big Island, while *A. arachnoidea* forms fairy rings on lawns. These stinkhorns appear to have been introduced to the Hilo area, perhaps at the University of Hawai'i at Hilo agriculture farm. There have been no sightings of these netted stinkhorns on any of the other islands at this point, but in late 2017 the first record of *Aseroë arachnoidea* was made on the windward side of Oahu. *Aseroë rubra* is widely distributed on all the islands, usually in *Eucalyptus* forest, and may have been introduced in these plantations decades ago.

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Figure 8. *Phallus atrovolvatus*, with its pure white indusium and dark volva, appears to be a recent addition to the other two netted stinkhorns found previously on Hawai'i Island.



Figure 9. Numerous reports show that *Aseroë arachnoidea* is spreading to lawns in the newer subdivisions near Hilo on the Big Island.