Herpetology Notes, volume 14: 1101-1103 (2021) (published online on 17 August 2021)

Clinical signs of pathogenic fungal infection in *Coluber constrictor foxii* (Colubridae, Squamata) in Illinois, USA

Bennett M. Hardy[1,2,*], Aaron H. Griffing[3], and Brendan J. Pinto[4,5]

Fungal pathogens are increasingly prominent issues for wildlife health and management and are implicated as major drivers of population declines in amphibians (Skerratt et al., 2007) and bats (Blehert et al., 2009). Recently, snake fungal disease (SFD), predominantly caused by the pathogen *Ophidiomyces ophiodiicola*, has been documented in the wild in at least 23 states and over 30 species in the United States (Lorch et al., 2016; Haynes et al., 2020). Herein we report observations of clinical signs of an apparent SFD infection in *Coluber constrictor foxii* (Baird & Girard, 1853), which could be the third species to be infected in the state of Illinois and the southern-most documentation of the pathogen in the state.

At 15:11 h on 1 April 2017, we observed one adult *C. c. foxii* basking on a stone wall in Trail of Tears State Forest, Union County, Illinois (37.484, -89.3593; WGS84, 122 m elevation). It became apparent as we approached that the snake was not healthy. At least six lesions were visible on its dorsum, many crusty and discoloured lesions covered its cranial scales, and both eyes were completely clouded (Fig. 1); all clinical signs of SFD (Sleeman 2013; Lorch et al., 2015). The individual did not appear to notice our presence at first and did not attempt to flee as expected. It repeatedly extended the anterior portion of its body slowly against the side of the stone wall, attempting to scrape its cranial scales across the wall and in crevices. This behaviour could indicate an attempt to initiate a moult, which occurs more often in snakes with SFD (Lorch et al., 2015). The individual also gaped its mouth periodically over several minutes. While the majority of skin lesions occurred on the head, and the ocular opaqueness likely inhibited vision and olfactory cues for effective foraging, the snake did not appear emaciated as commonly reported in snakes with SFD (Dolinski et al., 2014; Lorch et al., 2015). At approximately 2000 h, the individual was at the same location we observed it in the afternoon, but coiled in a small burrow against the wall. The following afternoon on 2 April 2017 at approximately 13:30 h, the snake was again found basking on the same wall.

Published reports of confirmed species with SFD infections in Illinois prior to our observation include *Sistrurus catenatus* (Rafinesque, 1818) in 2008 found approximately 120 km to the north of our observation (Allender et al., 2011) and *Thamnophis radix* (Baird & Girard, 1853) in 2012 found approximately 300 km to the north of our observation (Dolinski et al., 2014). Confirmed cases of SFD in the genus *Coluber* Linnaeus, 1758 have previously been reported in Florida (Sleeman 2013), New York (Lorch et al., 2016), Virginia (Guthrie et al., 2016), Connecticut (Licitra et al., 2019), and Georgia (Haynes et al., 2020).

Without permission from state wildlife officials or institutional approval, we were unable to sample the lesions for confirmation of *O. ophiodiicola* or other fungi associated with SFD (Barber et al., 2016) by histopathology (Lorch et al., 2015) or molecular genetic techniques (Allender et al., 2015; Bohuski et al., 2015). However, the *C. c. foxii* displayed obvious clinical signs (as described above) consistent with reports of moderate SFD infection (Allender et al., 2011; Sleeman, 2013; Dolinski et al., 2014; Lorch et al., 2015), and recent research suggests that the observation of clinical signs, especially in spring or summer, are reliable indicators of *O. ophiodiicola* infection (McKenzie et al., 2019).

[1] Department of Biological Sciences, University of Wisconsin-Milwaukee, Milwaukee, Wisconsin 53211, USA.
[2] Present address: Department of Fish, Wildlife, and Conservation Biology, Colorado State University, Fort Collins, Colorado 80523, USA.
[3] Department of Biological Sciences, Marquette University, Milwaukee, Wisconsin 53233, USA.
[4] Milwaukee Public Museum, Milwaukee, Wisconsin 53233, USA.
[5] Present address: Department of Integrative Biology, University of Texas at Austin, Austin, Texas 78712, USA.
[*] Corresponding author. E-mail: bhardy@colostate.edu

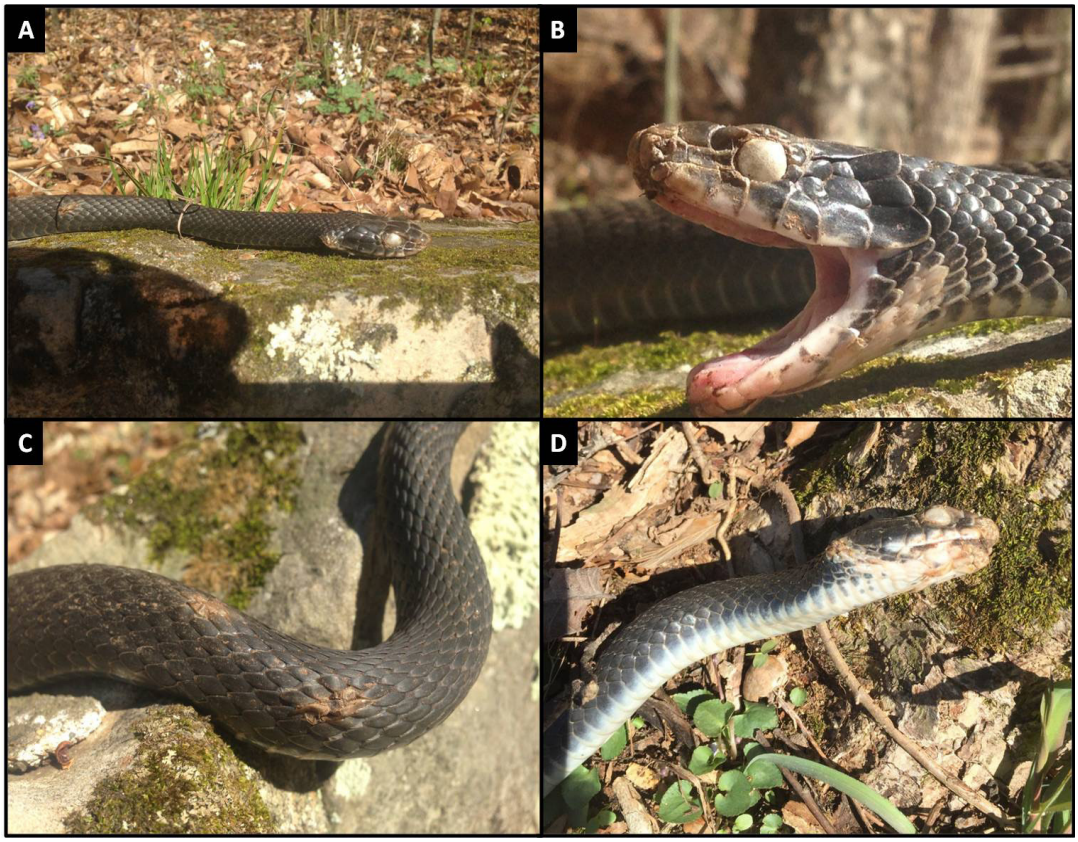

Figure 1. *Coluber constrictor foxii* displaying clinical signs of snake fungal disease infection in Union County, Illinois, USA. (A) Snake *in situ* as we approached. (B) Close-up of ocular opaqueness and mouth gaping behaviour. (C) Two dorsal lesions. (D) Lateral view of multiple cranial lesions. Photos by Bennett M. Hardy.

We also note that the proximity of our observation to the major snake hibernaculum on LaRue "Snake" Road (~ 10 km) is particularly concerning. Our observation of clinical signs consistent with SFD could add to the geographic and host ranges of SFD and highlights the need for further research in this sensitive geographic area.

References

Allender, M.C., Bunick, D.B., Dzhaman, E., Burrus, L., Maddox, C. (2015): Development and use of real-time polymerase chain reaction assay for detection of *Ophidiomyces ophiodiicola* in snakes. Journal of Veterinary Diagnostic Investigation **27**: 217–220.

Allender, M.C., Dreslik, M., Wylie, S., Phillips, C., Wylie, D., Maddox, C., Delaney, M.A., Kinsel, M.J. (2011): An unusual mortality event associated with *Chryspsporium* in eastern massasauga rattlesnakes (*Sistrurus catenatus catenatus*). Emerging Infectious Diseases **17**: 2383–2384.

Barber, D.M., Poole, V.A., Sanchez, C.R., Roady, P., Allender, M.C. (2016): Snake fungal infection associated with Fusarium found in *Nerodia erythrogaster transversa* (Blotched Water Snake) in Texas, USA. Herpetological Review **37**: 39–41.

Blehert D.S., Hicks, A.C., Behr, M., Meteyer, C.U., Berlowski-Zier, B.M., Buckles, E.L., et al. (2009): Bat white-nose syndrome: an emerging fungal pathogen? Science **323**: 227.

Bohuski, E., Lorch, J.M., Griffin, K.M., Blehert, D.S. (2015): Taqman real-time polymerase chain reaction of *Ophidiomyces ophiodiicola*, the fungus associated with snake fungal disease. BMC Veterinary Resources **11**: 95.

Dolinski, A.C., Allender, M.C., Hsiao, V., Maddox, C.W. (2014): Systematic *Ophidiomyces ophiodiicola* infection in a free-ranging plains garter snake (*Thamnophis radix*). Journal of Herpetological Medicine and Surgery **24**: 7–10.

Guthrie, A.L., Knowles, S., Ballmann, A.E., Lorch, J.M. (2016): Detection of snake fungal disease due to *Ophidiomyces ophiodiicola* in Virginia, USA. Journal of Wildlife Diseases **52**: 143–149.

Haynes, E., Chandler, H.C., Stegenga, B.S., Adamovicz, L., Ospina, E., Zerpa-Catanho, D., et al. (2020): Ophidiomycosis

surveillance of snake sin Georgia, USA reveals new host species and taxonomic associations with disease. Scientific Reports **10**: 10870.

Licitra D., Quinn, D.P., Reeder, J.E., Gavitt, T., Dickson, J., Hess, B., et al. (2019): Snake fungal disease in Colubridae snakes in Connecticut, USA in 2015 and 2017. Journal of Wildlife Diseases **55**: 658–662.

Lorch, J.M., Lankton, J., Werner, K., Falendysz, E.A., McCurley, K., Blehert, D.S. (2015): Experimental infection of snakes with *Ophidiomyces ophiodiicola* causes pathological changes that typify snake fungal disease. mBio **6**(6): e01534–15.

Lorch, J.M., Knowles, S., Lankton, J.S., Michell, K., Edwards, J.L., Kapfer, J.M., et al. (2016): Snake fungal disease: an emerging threat to wild snakes. Philosophical Transactions of the Royal Society B: Biological Sciences **371**: 20150457.

McKenzie, J.M, Price, S.J., Fleckenstein, J.L., Drayer, A.N., Connette, G.M., Bohuski, E., Lorch, J.M. (2019): Field diagnostics and seasonality of *Ophidiomyces ophiodiicola* in wild snake populations. EcoHealth **16**: 141–150.

Skerratt, L.F., Berger, L., Speare, R., Cashins, S., McDonald, K.R., Phillott, A.D., Hines, H.B., Kenyon, N. (2007): Spread of chytridiomycosis had caused the rapid global decline and extinction of frogs. EcoHealth **4**: 125–134.

Sleeman, J. (2013): Snake fungal disease in the United States. USGS National Wildlife Health Center, Wildlife Health Bulletin 2013-02. Available at: https://www.usgs.gov/centers/nwhc/science/wildlife-health-bulletins. Accessed on 21 October 2020.

Accepted by Andrew Durso