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Source: Florida Entomologist, 95(3) : 767-770

Published By: Florida Entomological Society

URL: <https://doi.org/10.1653/024.095.0329>

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## FIRST INCIDENCE OF *SINOXYLON INDICUM* AND *SINOXYLON SUDANICUM* (COLEOPTERA: BOSTRICHIDAE) IN MISSISSIPPI

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Auger beetles (Coleoptera: Bostrichidae), also known as false powderpost beetles, are serious pests of trees, forest products, agricultural crops, and stored vegetable products in most regions of the world (Fisher 1950; Lawrence 2010). There are approximately 570 species in 89 genera worldwide (Lawrence 2010), including approximately 73 native species found in North America (Ivie 2002). Most woodboring bostrichids obtain nutrition from starch, enabling many species to utilize almost any dry wood material from an enormous host range (Ivie 2002). The frequency of non-native bostrichid interceptions at ports of entry and storage facilities around the world has increased during the last decade (Teixeira et al. 2002; Ratti 2004; Filho et al. 2006; Aukema et al. 2011; EPPO 2011; Price et al. 2011). Bostrichids, along with many other wood-boring insects, are often accidentally introduced inside solid wood packing material in containerized cargo (Haack 2006).

The bostrichid genus *Sinoxylon* Duftschmid contains 52 species, all of which are native to Asia, Africa, and Southern Europe (Borowski & Wegrzynowicz 2007) and are typically not considered primary pests. *Sinoxylon* species utilize a wide variety of hosts, including numerous trees, shrubs, herbaceous plants, and bamboos (Filho et al. 2006). *Sinoxylon* damage is typically caused by the boring of adults and larvae in the stems, branches, or twigs of dead, damaged, or stressed hosts (Nair 2007). One species has even been known to damage lead cables (Filho et al. 2006). Species of *Sinoxylon* are frequently intercepted in the U.S.A., representing 32% of bostrichid interceptions between 1985 and 2000 (Haack 2006; Price et al. 2011). There have been 289 *Sinoxylon* interceptions in the U.S.A. between 2007 and 2012 (Brian Saunders, USDA-APHIS-PPQ, Cape Canaveral, Florida, personal communication).

In the continental U.S.A., there are 2 established non-native species of *Sinoxylon*. *Sinoxylon anale* Lesne and *S. conigerum* Gerstäcker are both established in southern Florida (Peck & Thomas 1998). Another species, *S. ceratoniae* (L.), may be established in California (Ivie 2002). *Sinoxylon anale* Lesne is the most economically important and most commonly intercepted species of *Sinoxylon*, typically arriving in solid wood packing materials (Fisher 1950; Argaman 1987; Teixeira et al. 2002; Sittachaya et al. 2009; Beaver et al. 2011). *Sinoxylon anale* is native to the

Indomalaya and Palearctic ecozones, where it attacks more than 70 species of plants. In the United States, Price et al. (2011) reported 2 interceptions of *S. anale* in Georgia in 2004 and 2010, both arriving from India in solid wood packing materials. Borowski and Wegrzynowicz (2007) list 3 other species, *S. japonicum* Lesne, *S. sexdentatum* (Olivier) (as *S. muricatum* (L.)), and *S. ruficornis* Fahaeus, as introduced into the United States, but these records are apparently based on the interceptions reported by Fisher (1950) that do not represent established populations.

On 29 Aug 2011 in West Point, Mississippi, United States (N 33°36'25" W 88°39'01"), a substantial infestation of larval and adult *Sinoxylon indicum* Lesne (Fig. 1A) and *S. sudanicum* Lesne (Fig. 1B) was discovered in wooden crates and pallets that originated from Pakistan. It is not known if the wood used to construct the crates originated in Pakistan, or whether the wood was treated according to IPPC international standards

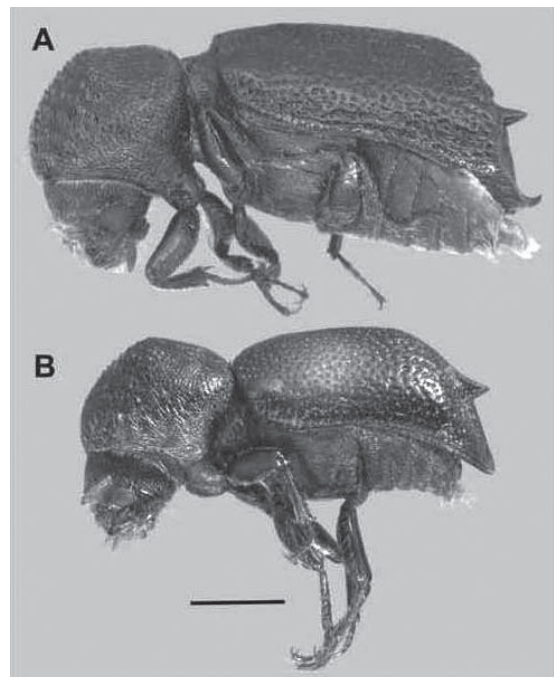


Fig. 1. Lateral views of *Sinoxylon* species intercepted in West Point, Mississippi during 2011. A) *S. indicum*; B) *S. sudanicum*. Scale bar = 1mm.

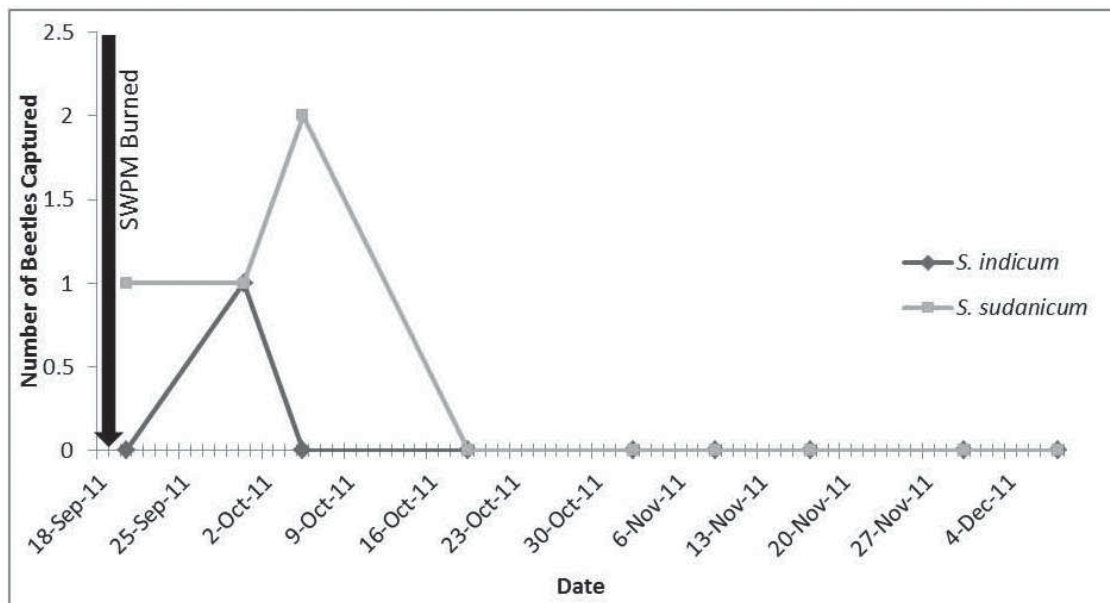


Fig. 2. *Sinoxylon indicum* and *S. sudanicum* captures in Lindgren funnel traps baited with ethanol lures in West Point, Mississippi. Arrow indicates date that solid wood packing materials (SWPM) were burned.

for wood packaging. Voucher specimens were collected and deposited in the Mississippi Entomological Museum at Mississippi State University. The infested wooden crates were being stored outside the warehouse and were not burned until 19 Sep 2011, 3 wk after the damage was discovered, giving the beetles ample opportunity to disperse. To monitor for *Sinoxylon* presence in the nearby environment, 2 Lindgren 12-funnel traps (Lindgren 1983) baited with an ultra high release (UHR) ethanol gel lure (PheroTech, Delta, British Columbia) with an elution rate of 275 mg/day (Silk et al. 2006) were placed 23 and 49 m from the site of the wooden crates and checked periodically from 6 Sep 2011 to 8 Dec 2011. Adults of *S. indicum* and *S. sudanicum* were captured in traps after all crates had been incinerated (Fig. 2), indicating that both species dispersed into the environment or were still present inside the adjacent warehouse. Traps will be utilized again in Spring 2012 to monitor for overwintering survivorship of either species.

*Sinoxylon indicum* has been intercepted 4 times in the United States at ports in California (San Francisco), Georgia (Savannah) and Washington (Blaine and Seattle), with all shipments originating from India (Joel Floyd, USDA-APHIS-PPQ, Riverdale, Maryland, personal communication). It has also been intercepted within wood packing material in Belgium (EPPO 2008). The native recorded range of *S. indicum* is Burma and India (Borowski & Wegrzynowicz 2007), where it is reported as a pest of *Prosopis cineraria* (L.) Druce, the state tree of Rajasthan, India. Two

predators of *S. indicum*, *Melambia* sp. (Trogossitidae) and *Psuedobothrideres* sp. (Bothrideridae), were reported to feed on *S. indicum* and *S. pugnax* Lesne inside of *P. cineraria* (Parihar & Singh 1998).

*Sinoxylon sudanicum*, has also been intercepted at various ports of entry in the United States (Robert Beiriger, Everglades Research & Education Center, Belle Glade, Florida, personal communication). Its native range includes Sudan, Senegal, Egypt, Yemen, Pakistan and India, but it has also been intercepted in Germany (Gentry 1965; Borowski & Wegrzynowicz 2007) and Venice, Italy (Ratti 2004). This species is a stem borer of soft woody hosts including mangoes (*Mangifera indica* L.) (Srivastava 1997, Biosecurity Australia 2008), agathi (*Sesbania grandiflora* (L.) Pers.), and young fig trees (*Ficus* sp. L.) in Sudan, where it most often attacks weakened nursery stock (King 1911). Additionally, *S. sudanicum* is reported from Cambodia cotton (*Gossypium hirsutum* L.) in western Pakistan and southern India, within wilted stalks of cotton killed by a stem weevil (Fletcher 1914; Ayyar & Margabandhu 1944; Sabesh 2007).

*Sinoxylon sudanicum* is best known in its native range as a destructive borer of wooden furniture (Fletcher 1914; Ananthkrishnan 2004). Reddy & Urs (1991) investigated natural extracts of several plants as potential antifeedants and repellants, attempting to reduce the impact of *S. sudanicum* on furniture. They concluded that *Pterocarpus marsupium* Roxb. (Indian Kino Tree) and *Terminalia paniculata* Roth (Kindal) con-

tained antifeedants and *Vateria indica* L. (Damar Tree) contained repellants. *Spathius critolaus* Nixon (Hymenoptera: Braconidae) is a parasitoid of *S. sudanicum* in cotton (Ayyar 1941), and the globular mite, *Pediculoides ventricosus* Newport (Acarina: Pediculoidae), was found preying on immature stages of *S. sudanicum* and *S. critolaus* (Ayyar & Margabandhu 1944).

The historic records for both species of *Sinoxylon* indicate that solid wood packing material is the most common source of interceptions of infested material, aligning with our encounter in Mississippi. It is troubling that the shipment was not intercepted at the port, and that it was successfully delivered to its destination. The destructive, woodboring habits of many species within the genus *Sinoxylon* as well as other bostrichids indicate a potential for economic damage in the USA. It is vital to implement more stringent monitoring of imported solid wood packing materials to help prevent the establishment of these and other destructive pests (Price et al. 2011). Currently, USDA-APHIS does not recognize bostrichids as actionable pests (a pest that triggers quarantine actions), and we recommend here that this policy be re-considered.

We would like to thank Michael Thomas (Florida State Collection of Arthropods, Gainesville, Florida) and Robert Beiriger (Everglades Research & Education Center, Belle Glade, Florida) for confirming species identifications, and Joe MacGown (Mississippi Entomological Museum) for assistance in taking photographs.

#### SUMMARY

In Aug 2011, 2 exotic auger beetle species, *Sinoxylon indicum* and *Sinoxylon sudanicum*, were found in northeastern Mississippi infesting wooden crates that had originated in Pakistan. Species of *Sinoxylon* attack timber products and a wide range of woody and herbaceous plants, including important agricultural crops.

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