Screening Aid

Six-toothed Bark Beetle
Ips sexdentatus (Börner)

Joseph Benzel

1) Identification Technology Program (ITP) / Colorado State University, USDA-APHIS-PPQ-Science & Technology (S&T), 2301 Research Boulevard, Suite 108, Fort Collins, Colorado 80526 U.S.A. (Email: itp@USDA.gov)

Version 6
30 June 2015

This CAPS (Cooperative Agricultural Pest Survey) screening aid produced for and distributed by:
USDA-APHIS-PPQ National Identification Services (NIS)
This and other identification resources are available at: http://caps.ceris.purdue.edu/taxonomic_services

The six-toothed spruce bark beetle, *Ips sexdentatus* (Börner) (Fig. 1), is a widely distributed pest in Europe. The primary hosts of the species is pine (*Pinus*) but it is known to be able to infest a number of other conifer species in the genera *Picea* (spruce), *Larix* (larch), *Abies* (fir), *Juniperus* (juniper), and *Pseudotsuga* (Douglas fir). The larvae feed in the cambium of tree branches and in the trunk, damaging the tree by girdling it and spreading blue stain fungus (Figs. 2-3).

Fig. 1: *Ips sexdentatus* in tree (photo by Gyorgy Csoka, Hungary Forest Research Institute, Bugwood.org).

Ips sexdentatus is a member of the Curculionidae (subfamily Scolytinae) which is comprised of weevils and bark beetles. Members of this family are highly variable but almost all species share a distinct club on the end of their antennae consisting of three segments. The subfamily Scolytinae, to which *Ips* belongs, consists of the bark beetles. In general, members of Scolytinae are small (<10mm long) pill shaped beetles of a reddish brown, black, or tan color. Some authors consider Scolytinae to be a distinct family (Scolytidae).

The tribe Ipini is a large and closely allied group of genera within Scolytinae. The tribe is most notable for having an excavated elytral declivity flanked by a number of spines on each side. The genus *Ips* contains 60 species, 23 of which are native to North America. The genus has a worldwide distribution, inhabiting every continent except South America and Antarctica. The genus is distinguished by weakly bisinuate or strongly angulate sutures on their antennal clubs and the presence of three to six pairs of spines surrounding their elytral declivity.

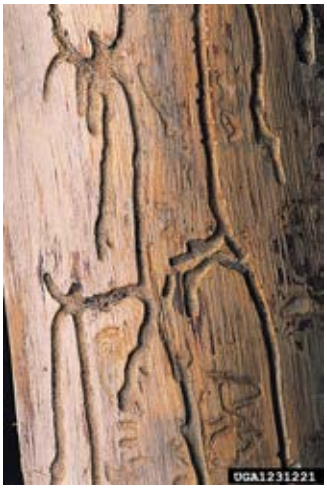


Fig. 2: *Ips sexdentatus* galleries (photo by Gyorgy Csoka, Hungary Forest Research Institute, Bugwood.org).

Ips sexdentatus has not yet been detected in the United States. Non-targets often captured during *I. sexdentatus* surveys include *I. calligraphus*, *I. plastographus*, and *I. montanus*. A quality, high powered microscope is required to examine the characters necessary to identify these beetles.

This aid is designed to assist in the sorting and screening of *I. sexdentatus* suspect adults collected in CAPS Lindgren funnel traps in the continental United States. It covers basic Sorting of traps, First Level, and Second Level screening, all based on morphological characters. Basic knowledge of Coleoptera morphology is necessary to screen for *I. sexdentatus* suspects.

Ips sexdentatus funnel traps should be sorted initially for the presence of beetles of the appropriate size color and shape.

1. Beetles are between 4 mm (0.2 inches) and 8 mm (0.75 inches) in length.

2. Beetles are pill-like in shape.

3. Beetles are black, reddish-brown, or tan colored (Figs. 4-5).

Beetles meeting these requirements should be forwarded to Level 1 Screening (Page 3).

Fig. 3: Trees attacked by *Ips sexdentatus*. During a bark beetle attack trees will show little sign of damage other than a series of small bore holes. Often it is not apparent that bark beetles have infested a tree until after they have emerged from it (photo by Jacques Regard, Département de la Santé des Forêts, Bugwood.org).

Figs. 4 and 5: Variation in coloration of different *Ips sexdentatus* individuals. color can depend on a variety of factors ranging from time since emergence to genetics. Most species of bark beetles show similar variations.

Level 1 Screening

Six-toothed Bark Beetle

Ips sexdentatus (Börner)

Suspect adults should be pointed and properly labeled. Level 1 Screening is based on characteristics of the antennae, general dorsal surface, and elytral declivity. Specimens with these traits should be forwarded to Level 2 Screening.

Fig. 6: Antennae of *Ips* spp. Note the long scape and large three part club.

Antennae

Scolytids have relatively stout, geniculate, clubbed antennae. The clubs are made up of three antennomers and can be solid, annulated, or occasionally lamellate. The scape will always be well developed (Fig. 6). In *Ips* the antennal club is flat with two procurved sutures.

General Dorsal Surface

Beetles in the tribe Ipini (Figs. 9-10) have the basal margins of their elytra unarmed and forming a straight line across the body (Fig. 7). The scutellum of tribe members is usually large and flat and the head is usually concealed at least partially by an enlarged pronotum (Fig. 9). In the genus *Ips* the anterior pronotum is roughly aspartate.

Fig. 7: Base of elytra and scutellum of *Ips* spp. Members of the Scolytinae should have a broad scutellum and the base of the elytra should be unarmed.

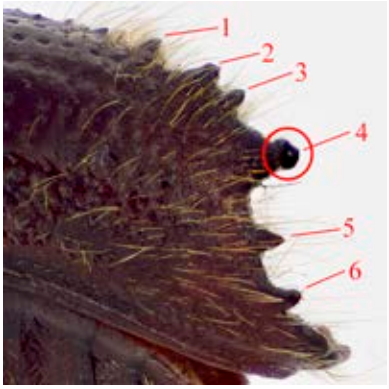
Elytral Declivity

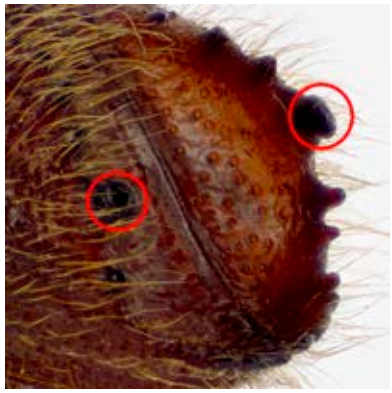
The tribe Ipini is known for the multiple pairs of spines found around the beetle's elytral declivity (Fig 8). The number of spines ranges from 1-7 on each elytron, depending on species. Some spines may be capitate.

Fig. 8: *Ips* spp. elytral declivity. Note the ring of spines and yellow hairs surrounding the declivity which is typical of the Ipini.

Figs. 9 and 10 (left): Dorsal and lateral views of the common North American species *Ips pini.* Note how the pronotum covers the head, the large wide scutellum, and the excavated and armed elytral declivity.

Fig. 11 (left) : Dorsal view of *I. sexdentatus*.





Figs. 12 and 13 (above and above right): lateral and posterolateral view of *Ips sexdentatus* elytral declivity. In *I. sexdentatus* suspects the declivity should be ringed by 12 spines (six on each side) with the fourth spine down from the top being the largest (circled).

Level 2 screening is designed to screen out potential *Ips sexdentatus* (Fig. 11) from other members of *Ips* (Figs. 16-21). Screening is based mostly on characteristics of the general dorsal surface, frons, and elytral declivity. In addition, size alone can be a good indicator of *I. sexdentatus* as only a few native *Ips* come within the size range of this beetle.

General Dorsal Surface

Ips sexdentatus (Fig. 11) is moderately large in length (5.5-8.2 mm). It is the largest species within its genus.

Elytral Declivity

The elytral declivity of *Ips sexdentatus* has six spines on each elytron that form a ring around the lateral margins of its elytral declivity. Most native *Ips* have five or fewer spines (Figs. 25-29). The fourth spine from the declivity top is the largest and is capitate (Figs. 12-13). This feature differentiates *I. sexdentatus* from *I. calligraphus*, the only native bark beetle with six spines, on which the third spine is the largest (Figs. 23-24).

Frons

The frons of female *Ips sexdentatus* bears a short transverse line above the median tubercle (Fig. 14). This feature does not appear in *I. calligraphus* females, or in males of either species (Fig. 15).

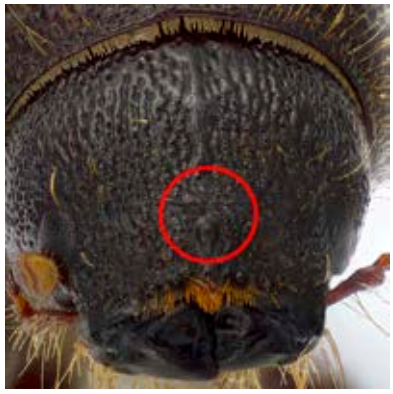


Fig. 14: Frons of female *Ips sexdentatus.* Note the small transverse ridge above the median tubercle (circled).

Fig. 15: Female *Ips calligraphus* frons. Unlike *Ips sexdentatus*, *I. calligraphus females* lack a transverse ridge above their median tubercle. Males of both species do not have a ridge.

Fig. 16: *Ips calligraphus*

Fig. 17: *Ips emarginatus*

Fig. 18: *Ips grandicollis*

Fig. 19: *Ips integer*

Fig. 20: *Ips montanus*

Fig. 21: *Ips plastographus*

Fig. 22: *Ips sexdentatus* declivity, posterolateral view (target).

Fig. 23: *Ips calligraphus* declivity, posterolateral view.

Fig. 24: *Ips calligraphus* declivity, lateral view.

Fig. 25: *Ips emarginatus* declivity.

Fig. 26: *Ips grandicollis* declivity.

Fig. 27: *Ips integer* declivity.

Fig. 28: *Ips montanus* declivity.

Fig. 29: *Ips plastographus* declivity.

Suspect *I. sexdentatus* specimens (scolytids with a depressed elytral declivity ringed by six spines on each side with the fourth spine from the top being the largest) should be sent forward for identification. Specimens must be labeled and carefully packed to avoid damage during shipping.

Key to Sort and Screen *Ips sexdentatus* Suspects in the United States

1. Beetles approximately 5-8 mm long; pill shaped and with black; brown, or tan coloration..... 2
1'. Beetles larger or smaller than 5-8 mm long; not pill shaped; or color not a shade of black, brown, or tan..... Not *I. sexdentatus*

2. Antennae geniculate with a large club made up of three segments on the end (Fig. 6); basal margins of elytra unarmed and forming a straight transverse line across the body (Fig. 7); scutellum large and flat; head usually covered by pronotum; elytral declivity surrounded by multiple pairs of spines or spines (Fig. 8) 3
2'. Antennae not geniculate or without a large club made up of three segments on the end; basal margins of elytra armed with ridge or forming strongly procurved; scutellum small or absent; head may or may not be covered by pronotum; elytral declivity unarmed..... Not *I. sexdentatus*

3. Each elytron armed with six spines the fourth of which is the largest and is capitate (Figs. 11-12); frons may or may not have a short transverse ridge above the median tubercle (Fig. 14). .....***I. sexdentatus suspect***
3'. Each elytron armed with five or fewer spines (Figs. 25-29), or if armed with six spines the fourth of which is not the largest (Figs. 23-24); frons without a short transverse ridge above the median tubercle (Fig. 15)..... Not *I. sexdentatus*

Citation

Benzel, J. S. 2015. Screening aid: Six-toothed Bark Beetle, *Ips sexdentatus* (Börner). Identification Technology Program (ITP), USDA-APHIS-PPQ-S&T, Fort Collins, CO. 7 pp.

References for more information on *I. sexdentatus* and non-targets

Cavey, J., Passoa, S. & Kucera, D. 1994. *Screening aids for exotic bark beetles in the Northeastern United States.* NA-TP-11-94, Northeastern Area. USDA Forest Service. 19 pp.

Ciesla, W. M. 2001. *Exotic Forest Pest Information System for North America: Ips sexdentatus.* North American Forestry Commission. caps.ceris.purdue.edu/webfm_send/1963.

Cognato, A. I. 2015. *Biology, Systematics, and Evolution of Ips*, pp. 351-370. *In* Vega, F. E., & Hofstetter. R. W. *Bark Beetles: Biology and Ecology of Native and Invasive species.* Academic Press, Elsevier. 620pp.

Wood, S. L. 1982. The Bark and Ambrosia Beetles of North and Central America (Coleoptera: Scolytidae) a taxonomic monograph. *Great Basin Naturalist Memoirs No 6*. 1359 pp.

Acknowledgments

Funding for this project was provided to J. S. Benzel through section 10201 of the FY2014 Farm Bill. I would like thank Terrence Walters (USDA-APHIS-PPQ-S&T ITP) and USDA-APHIS-PPQ National Identification Services for support of this work and access to imaging equipment. Boris Kondratieff, Donald Bright, and Todd Gilligan (Colorado State University) provided advice on species identification, image editing, and screening aid formatting.