Screening Aid

Six-toothed Spruce Bark Beetle

Pityogenes chalcographus (Linnaeus)

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, *Pityogenes chalcographus* (Linnaeus) (Fig. 1) is a widely distributed pest in Europe. The host for this species is spruce (*Picea*), but it is known to be able to infest a number of other conifers including *Pinus* (pine), *Larix* (larch), *Abies* (fir), *Juniperus* (juniper), and *Pseudotsuga* (Douglas fir). 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: trapped *Pityogenes chalcographus* in the field (photo by Milan Zubrik, Forest Research Institute - Slovakia, Bugwood.org).

Pityogenes chalcographus 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 antennal club consisting of three segments. The subfamily Scolytinae, to which *Pityogenes* belongs, consists of the bark beetles. In general, members of Scolytinae are small (<10mm long) pill shaped beetles of a reddish brown or black 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. Members of the tribe have an excavated elytral declivity flanked by a number of spines on each side. *Pityogenes* contains 24 species, seven of which are native to North America. The remaining species are native to Europe and Asia. Adults can be distinguished by a short obtuse intercoxal piece and large spines on the elytral declivity in the male. In addition, females of native species have a large fossal excavation on the frons which is absent in native males.

Fig 2: Boring galleries of *Pityogenes chalcographus* (photo by Gyorgy Csoka, Hungary Forest Research Institute, Bugwood.org).

Pityogenes chalcographus was detected in Maryland in 2007 but since then has not been found despite regular surveys. Non-targets beetles often captured during *P. chalcographus* surveys include *P. fossifrons*, *P. hopkinsi*, *Pityokteines* spp. and *Orthotomicus* spp. 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 *P. chalcographus* 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 *P. chalcographus* suspects.

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

1. Beetles are less than 5 mm (0.25 in) long.

2. Beetles are pill-like in shape.

3. Beetles are black, reddish-brown, or tan colored.

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

Fig. 3: Trees attacked by *P. chalcographus*. 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 Landesforstpräsidium Sachsen Archive, Bugwood.org).

Fig. 4: *Pityogenes chalcographus* male.

Fig.5: *Pityogenes chalcographus* female.

Fig. 4 and 5: Sexual dimorphism in *Pityogenes* with *P. chalcographus* male (top) and female (bottom). In this genus, the declivity spines on the male are much larger than those of the female. This makes identifying females more difficult. However, females have a pit in the center of the frons which shows strong variation between the different species.

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

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).

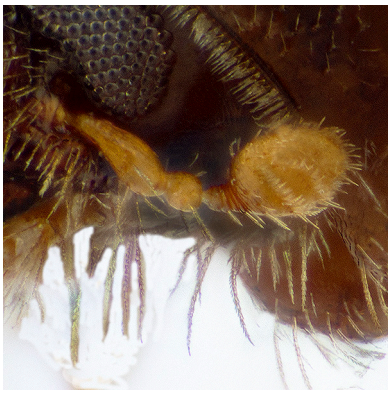

Fig. 6: Antenna of *P. chalcographus*. Note the long scape and large three part club.

General Dorsal Surface

Beetles in the Ipini (Figs. 9-10) have the anterior 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. 7: Base of elytra and scutellum of *Ips* spp. Members of the Ipini should have a broad scutellum and the base of the elytra should be unarmed.

Elytral Declivity

Species of Ipini are characterized by the multiple pairs of spines on the margin of the 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

Figs. 11 and 12 Lateral view of male (left) and female (right) *Pityogenes chalcographus* declivities. Note how the spines are much larger in the male but all three sets of spines are present in the female.

Level 2 screening is designed to separate *Pityogenes chalcographus* (Fig. 25) suspects from other members of Ipini (Figs. 26-27). Screening is based mostly on the frons and elytral declivity. It should be noted that *P. chalcographus* (Fig. 13) bears a close resemblance to *P. hopkinsi* (Fig. 14) and *P. fossifrons*.

General Dorsal Surface

Pityogenes chalcographus is small in length (1.6-2.9mm). It is usually either black or bi-colored: black on the front and red-brown on the elytra.

Elytral Declivity

The structure of the elytral declivity in *Pityogenes* is highly sexually dimorphic (Figs. 4-5), with large conspicuous spines in the male and small spines in the female (Figs 11-12). In both male and female *P. chalcographus,* the declivity is armed by three pairs of spines (Figs. 15-16), which separates *P. chalcographus* from most of the Nearctic *Pityogenes* (Figs. 21-22). The lower margin of the declivity is rounded without a shelf or ridge as often seen in *Orthotomicus* (Fig. 24). The declivity of *Pityokteines* is more setous than that of *Pityogenes* and the elytra are more striate (Fig. 23). In the male the elytral declivity between the rows of teeth is widely excavated. The elytral declivity is more strongly impressed and the spines are slightly larger in *P. chalcographus*, than in the closely related *P. fossifrons* (Figs. 19-20) and *P. hopkinsi* (Figs. 17-18).

Frons

The head of most female *Pityogenes* has a distinct pit in the center of the frons. In *P. chalcographus* this pit is not divided, has a transversely oval shape, and occupies half the width between the eyes (Fig. 28). The frons of *P. chalcographus* is significantly larger and wider than that of *P. fossifrons* (Fig. 29). The heads of other *Pityogenes* species have narrower or divided frons (Figs. 30-31) *Orthotomicus* females completely lack a central pit on the frons while the females of *Pityokteines* have a large tuft of hair on the frons sometimes accompanying a shallow pit.

Fig. 13: Dorsal view of male *Pityogenes chalcographus.*

Fig. 14: Dorsal view of male *Pityogenes hopkinsi.*

Fig. 15: *Pityogenes chalcographus* male.

Figs. 17: *Pityogenes hopkinsi* male

Fig. 19: *Pityogenes fossifrons* male

Fig.16: *Pityogenes chalcographus* female.

Figs. 18: *Pityogenes hopkinsi* female

Fig. 20: *Pityogenes fossifrons* female

Fig. 21: *Pityogenes plagiatus* male.

Fig. 23: *Pityokteines* spp. female

Fig. 24: *Orthotomicus* spp. female

Fig. 22: *Pityogenes plagiatus* female.

Figs. 15-22: Assorted declivities of *Pityogenes* species and related genera (posterolateral views). The declivity of *Pityogenes* species is sexually dimorphic with large spines in the male and small spines in the female. In *P. chalcographus* there are three spines on each elytron and the declivity base lacks a shelf.

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.

Fig. 25: *Pityogenes chalcographus*

Fig. 26: *Pityokteines* spp.

Fig. 27: *Orthotomicus* spp.

Fig. 28: *Pityogenes chalcographus*

Fig. 29: *Pityogenes fossifrons*

Figs. 25-27 (above and above left): Dorsal views of *Pityogenes chalcographus* female and *Pityokteines* and *Orthotomicus* species. *Pityogenes* can be distinguished from these other two genera by the absence of a shelf at the bottom of the elytral declivity as in *Orthotomicus* and the absence of the tuft of hair on frons in female *Pityokteines. Pityokteines* also has more striate elytra.

Fig. 30: *Pityogenes hopkinsi*

Fig. 31: *Pityogenes carnulatus*

Figs. 28-31 (left): Frons of different female *Pityogenes* spp. The pit in the center of the frons is the best way to diagnose female *Pityogenes.* Female *P. chalcographus* have a transverse oval pit taking up half the width between the eyes.

Key to Sort and Screen *P. chalcographus* Suspects in the United States

1. Beetles less than 3 mm long; pill shaped and; with black, brown, or tan coloration 2
1'. Beetles larger than 3 mm long; not pill shaped; or color not a shade of black, brown, or tan ..... Not *P. chalcographus*

2. Antennae geniculate with a large club made up of three segments on the end (Fig. 6); anterior 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 (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 *P. chalcographus*

3. Beetle approximately 1.6-2.9 mm long; each elytron armed with three large or small spines (Figs. 11-12); no shelf at bottom of declivity; elytra with only sparse setae and lacking large striations 4
3'. Beetle smaller or larger than 1.6-2.9 mm in length; each elytron armed with more or less than 3 spines (Figs. 21-22); or if armed with three spines, shelf present at bottom of declivity (Fig. 24) or with large numbers of setae and heavy striation (Fig. 25) ..... Not *P. chalcographus*

4. Spines on elytral declivity large (Fig. 11); no pit in center of frons ..... 5, male
4'. Spines on elytral declivity small (Fig. 12); distinct pit in center of frons..... 6, female

5. Declivity strongly impressed and widely excavated (Fig. 15) ..... *P. chalcographus suspect*
5'. Declivity narrowly impressed or moderately excavated (Fig. 17) ..... Not *P. chalcographus*

6. Pit in center of frons not divided, transversely oval and takes up half of width between compound eyes (Fig. 28)..... *P. chalcographus suspect*
6'. Pit in center of frons either divided or, not transversely oval in length and not taking up half the width between eyes (Figs. 29-31)..... Not *P. chalcographus*

Citation

Benzel, J. S. 2015. Screening aid: Six-toothed spruce bark beetle, *Pityogenes chalcographus* (Linnaeus). Identification Technology Program (ITP), USDA-APHIS-PPQ-S&T, Fort Collins, CO. 7 pp.

References for more information on *P. chalcographus* and non-targets

CERIS. 2011. *Exotic Wood Borer/Bark Beetle Survey Reference*: *Pityogenes chalcographus.* https://caps.ceris.purdue.edu/node/506.

Cavey, J., Passosa, 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.

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

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*. 669-705.

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.