



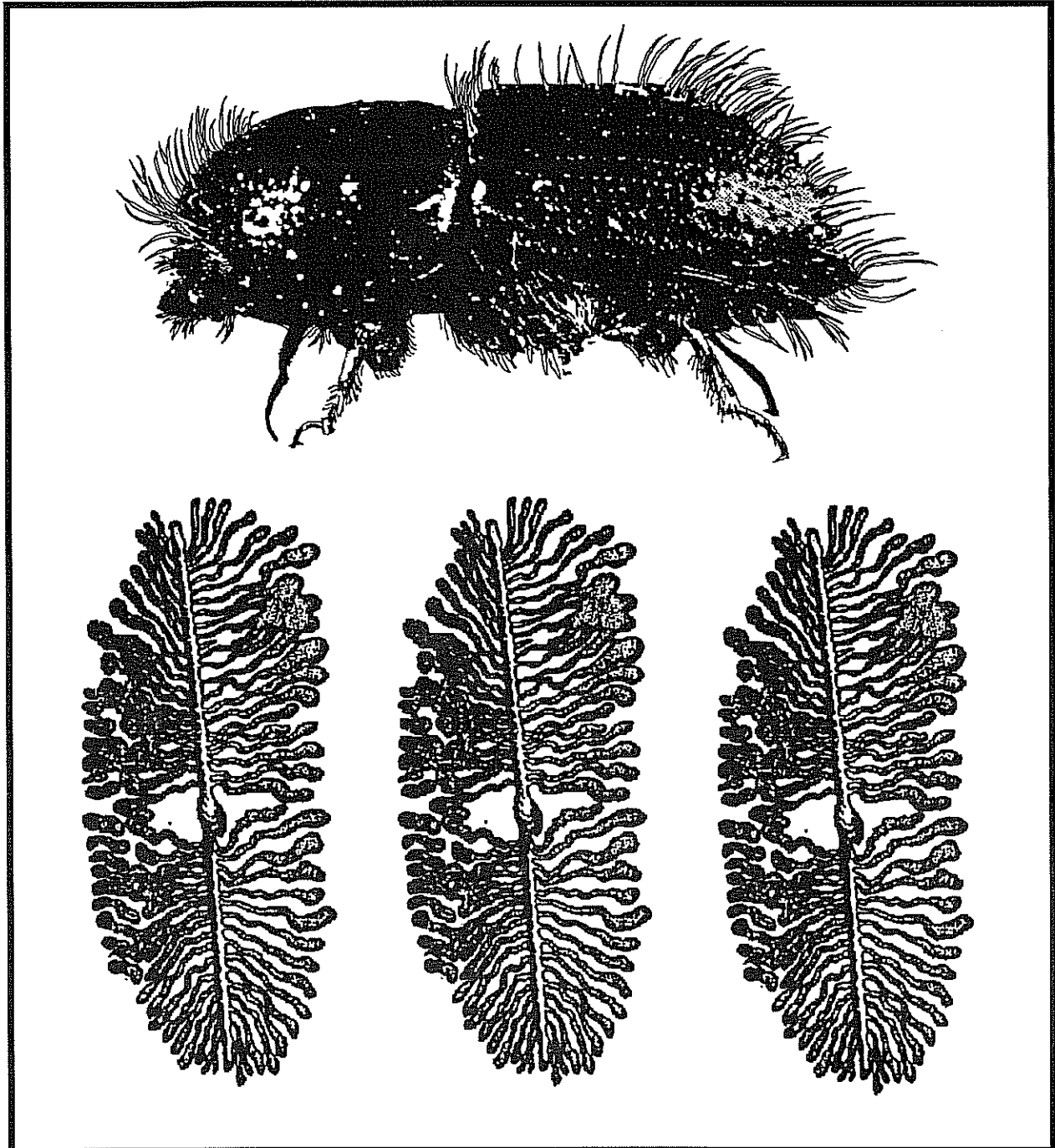
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Screening Aids for Exotic Bark Beetles in the Northeastern United States



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Screening Aids for Exotic Bark Beetles in the Northeastern United States

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Introduction

The Cooperative Agricultural Pest Survey (CAPS) in the Northeastern Region (NER) targeted six exotic bark beetles (Coleoptera: Scolytidae) for survey beginning in 1994, as detailed in the CAPS Fiscal Year 1994 guidelines (USDA 1993). Weekly samples from lure traps¹ placed throughout the region will contain numbers of native bark beetles. The attached materials are provided to aid CAPS cooperators in the Northeastern Region in screening exotic target species from survey samples of bark beetles.

These screening aids were simplified by restricting the species treated to native bark beetles that are from a limited geographic area (i.e., the Northeastern Region) and are similar to the exotic target. The keys, in particular, may not be useful for screening survey samples from outside the northeastern U.S.

In developing the materials, we assumed that personnel have some experience in applied beetle identification. We made every effort to illustrate the more critical and difficult characters used in the keys and comparisons. (Illustrations not referenced are by Joe Cavey.) For additional help, a condensed explanation of useful bark beetle morphology and terms may be found in Bright (1976:16-19).

This package contains screening aids for the exotic bark beetles listed below and a bibliography that applies to the entire package.

□ Primary Survey Target Species

Hylurgus ligniperda (F.), red-haired pine bark beetle.

Ips typographus (L.), spruce engraver beetle.

□ Secondary Survey Target Species.

Hylurgops palliatus (Gyllenhal), a bark beetle.

Ips sexdentatus (Boerner), six-toothed bark beetle.

Orthotomicus erosus (Wollaston), Mediterranean pine engraver beetle.

Pityogenes chalcographus (L.), spruce wood engraver.

¹ For additional information on lure traps contact authors.

Hylurgus ligniperda Fabr. Screening Aid

(Subfamily Hylesininae, Tribe Tomicini)

General Appearance in a Sample. Moderately large, 4.0-5.7 mm, black-brown, cylindrical, covered with rather long reddish hairs (Fig. 1). The distinctive, dense hairs are quite thick, and they appear notched at magnifications under 80X. (Actually, at very high magnification (Fig. 8), one can see these hairs are branched.) The elytral apex is convex with a slight indentation and without teeth or other armature. *Hylurgus ligniperda* is superficially similar to *Hylastes porculus* Erichson, a local, nearly hairless species.

Recognizing the Genus. Most similar to *Dendroctonus* and *Tomicus*, the genus *Hylurgus* is not known to occur in North America (Wood 1982). In the key to help screen for *Tomicus piniperda* (Passoa and Cavey 1993), *Hylurgus* will key to *Tomicus*, primarily because both have a 6-segmented funicle. In Wood (1982), specimens of *Hylurgus* will not go beyond couplet 11 in the generic key, again because of the 6-segmented funicle. The following key (modified from Wood 1982, 1986) will help differentiate *Hylurgus* from North American bark beetles, including *T. piniperda*.

Key to Help Screen *Hylurgus ligniperda* F. from Survey Samples of North American Scolytidae (Coleoptera).

1. Anterior margin of elytra a straight, transverse line, not raised or armed with a number of granulesnot *Hylurgus*.
Anterior margin of elytra raised and armed with a number of granules (Fig. 2), (subfamily Hylesininae)see #2.
2. Antennal funicle not 6-segmented or scutellum not visible not *Hylurgus*.
Antennal funicle 6-segmented (Fig. 3); scutellum visiblesee #3.
3. Procoxae widely separated (Fig. 4a) not *Hylurgus*.
Procoxae nearly contiguous (Fig. 4b) see #4.
4. Eye completely divided or deeply emarginatenot *Hylurgus*.
Eye entire (Fig. 5) see #5.
5. Elytral interstriae with single rows of erect setae (Fig. 6); procoxae moderately separated; frons with a raised median line for most of length (Fig. 9)*Tomicus piniperda* L.
Elytral interstriae with erect setae abundant, confused, not in rows (Fig. 7); procoxae contiguous; frons with a raised longitudinal tubercle near apex, basal half of frons not armed*Hylurgus ligniperda* suspect.

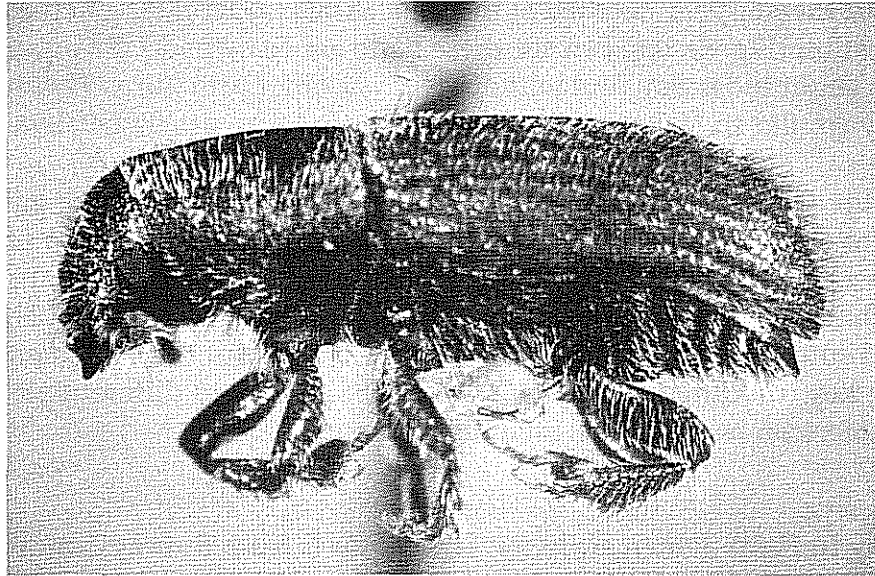


Figure 1. Habitus of *Hylurgus ligniperda* Fabricius, lateral view (photo, J.F. Cavey).

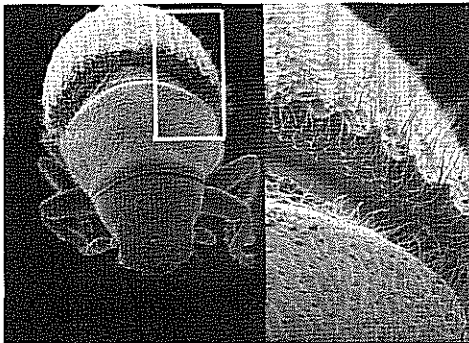


Figure 2. Raised base of elytra of *Tomicus piniperda* L., with granules (from Passoa and Cavey 1993).

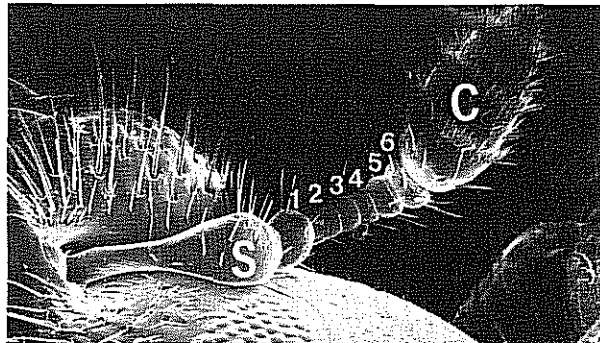


Figure 3. Antenna of *Tomicus piniperda* L. with segments of funicle numbered. S = scape, C = club (from Passoa and Cavey 1993).

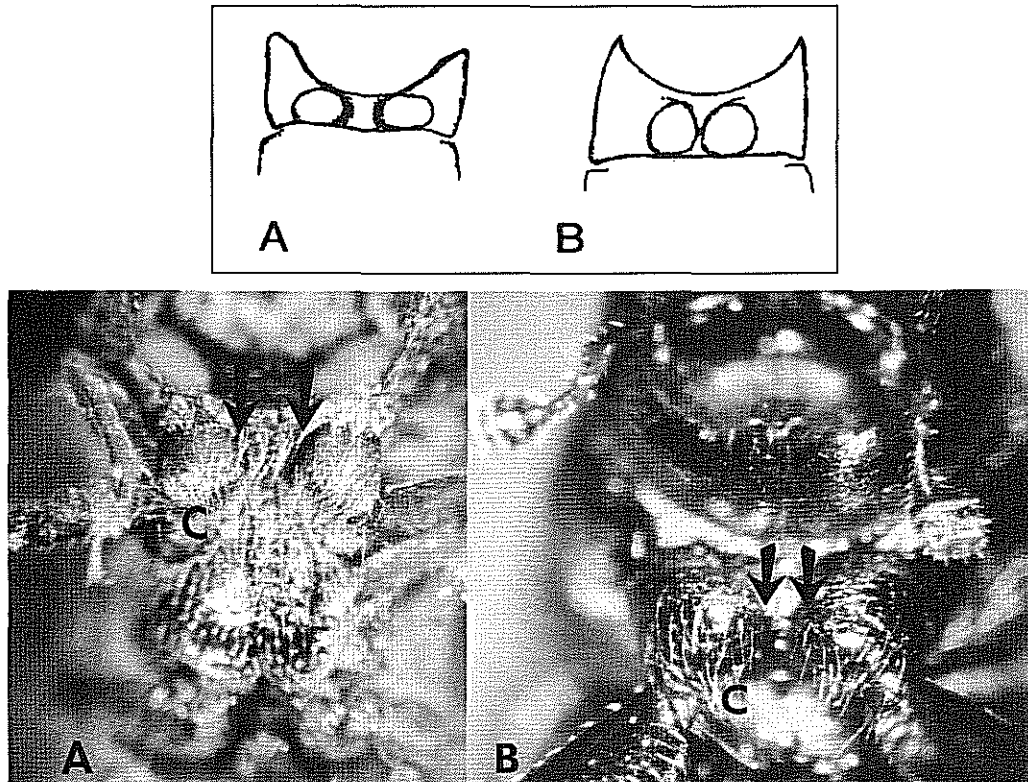


Figure 4. Bark beetle prosternum with procoxae a. widely separated b. nearly contiguous. C = procoxae, paired arrows denote coxal spacing.

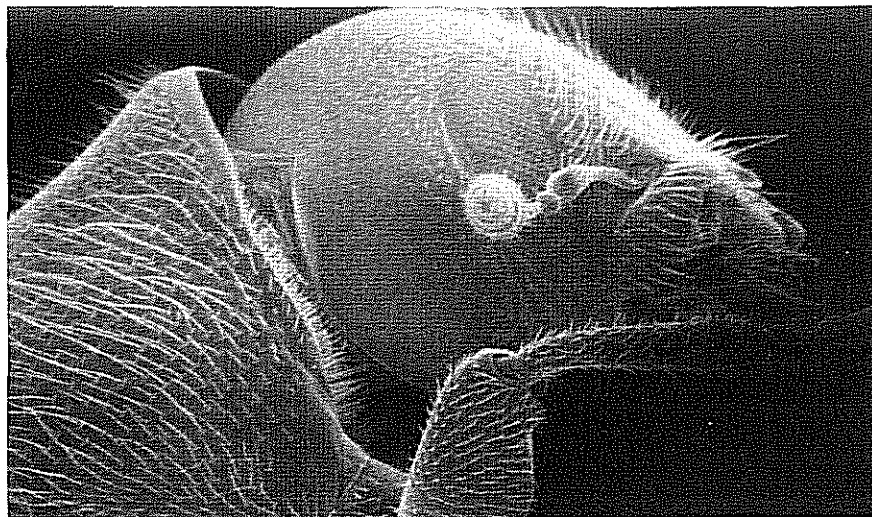


Figure 5. Head of *Tomticus piniperda*, showing eye entire (from Passoa and Cavey 1993).

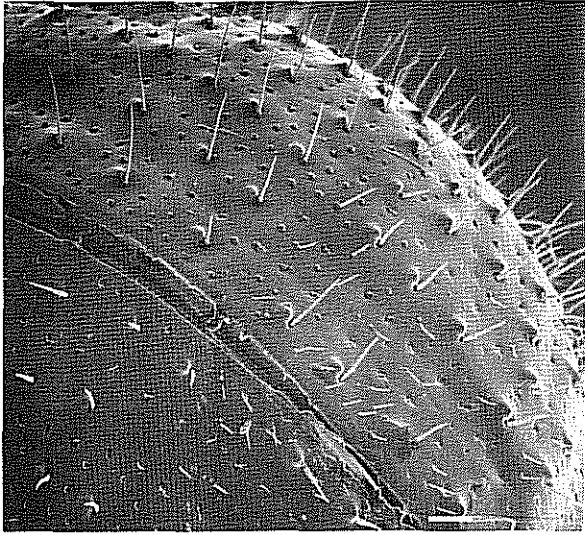


Figure 6. Elytra of *Tomicus piniperda* showing interstriae with single rows of erect setae (from Passoa and Cavey 1993).

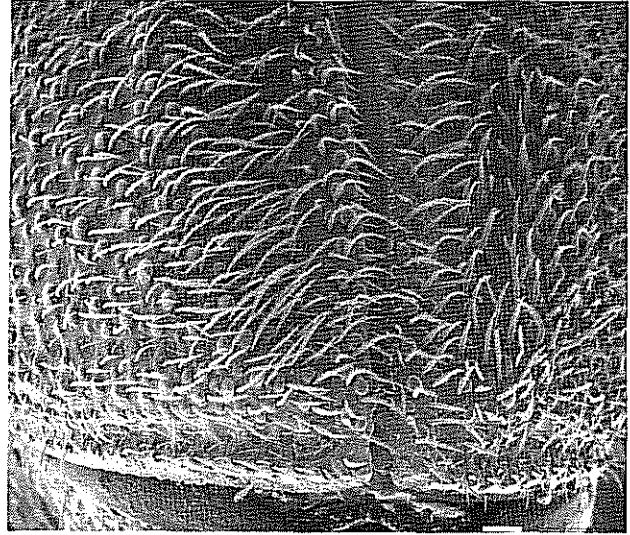


Figure 7. Elytra of *Hylurgus ligniperda* showing confused, erect interstitial setae (photo by John Mitchell and S. Passoa).

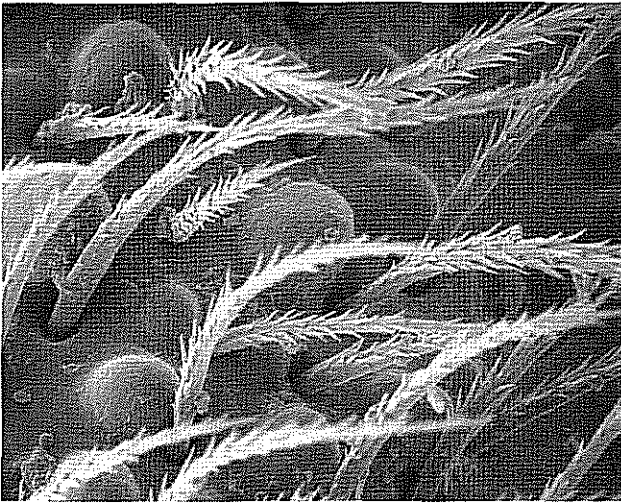


Figure 8. Elytral hairs of *Hylurgus ligniperda* under SEM, magnification 500X (photo by J. Mitchell and S. Passoa).

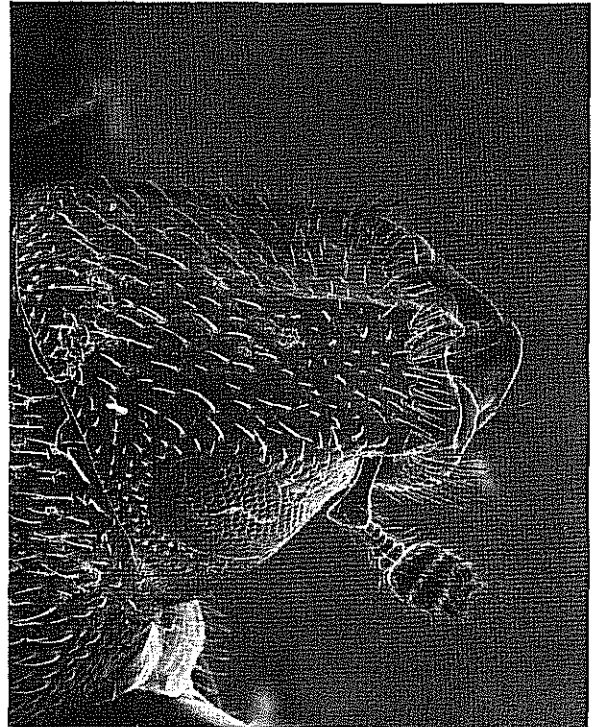


Figure 9. Head of *Tomicus piniperda* showing raised median line on frons (photo by S. Donahue and N. Vandenberg).

Ips typographus L., European Spruce Bark Beetle Screening Aid (Subfamily Scolytinae, Tribe Ipini)

General Appearance in a Sample. This moderate to large (4.2-5.5 mm), cylindrical, brown bark beetle has an excavated elytral declivity armed laterally with 4 spines on each side. The pronotum is covered with asperites on the anterior half. Viewed from above, erect yellow hairs protrude from the body perimeter and margins of the declivity.

Recognizing the Genus. In general, *Ips* differs from other North American scolytids in having the following combination of characters (from Wood 1982):

- Elytral declivity widely excavated armed laterally with 3 or more teeth, the teeth arising from the summit (ridge) of the lateral margins.
- Pronotum asperate on the anterior half.
- Antennal funicle 5-segmented.
- Antennal club strongly flattened, with two sutures on the anterior face bisinuate or procurved (curved forward).

Recognizing *I. typographus*. Whittle and Anderson (1985) gives adult characters and illustrates this species. Color and SEM photographs of *I. typographus* are available in the Forest Service Pest Alert (Cavey and Passoa 1993). Superficially, this species might be confused with other *Ips* having 4 teeth on the elytral declivity. It is most like the *I. plastographus* group (Whittle and Anderson 1985), but none in that group are known to occur in the NER (Wood 1982).

In the northeastern U.S., four *Ips* species have 4 declivital teeth: *avulsus*, *perroti*, *perturbatus* and *pini*. In traps baited with Ipslure, *I. pini* is especially common. The European spruce bark beetle may be separated from the above four species using the following key.

Key to Help Screen *Ips typographus* from *Ips* spp. with Four Declivital Teeth Known to Occur in the Northeastern U.S.

Figures 4-6, marked PA, refer to illustrations in the Pest Alert (Cavey and Passoa 1993)

1. Frons with a median, transverse pair of tubercles distinctly larger than others (Fig. 1); declivity shining between punctures¹ (*I. perturbatus*) not *typographus*

Frons with a single, prominent, median tubercle (Fig. 2); declivity sheen variable see #2.
2. Spine 3 on declivity conical, not capitate (Fig. 3), (*avulsus* 2.1-2.8 mm, *perroti* 2.7-3.5 mm, and female *pini*) not *typographus*

Spine 3 on declivity capitate (see PA Fig. 4 for example) see #3.
3. Declivity shining between punctures (see PA Fig. 6 for example)¹; usually smaller 3.3-4.3 mm (*pini* males) not *typographus*

Declivity dull (shagreened) between punctures (see PA Fig. 5 for example)¹; usually larger 4.2-5.5 mm *Ips typographus* suspect

¹ The declivity may have to be cleaned of debris, oil, etc. to interpret its sheen.

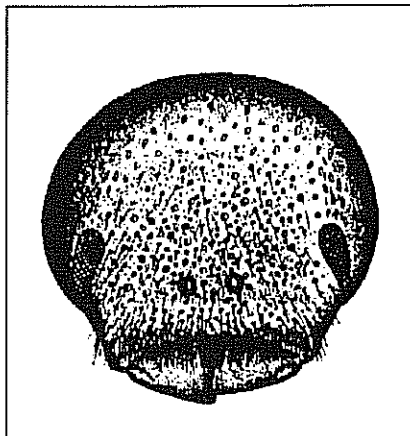


Figure 1. Head of *Ips perturbatus* with 2 enlarged tubercles on frons (After Wood 1982).

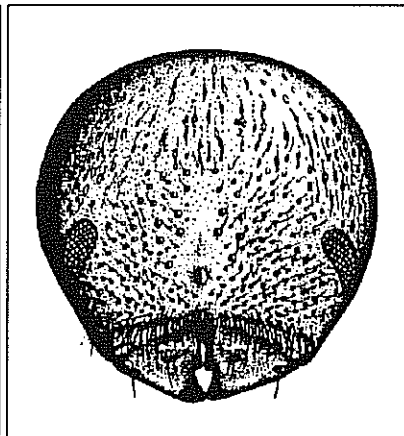


Figure 2. Head of *Ips* sp. with single enlarged tubercle on frons (After Wood 1982).



Figure 3. Apex of elytra of *Ips avulsus*, showing conical 3rd tooth (After Wood 1982).

Hylurgops palliatus (Gyllenhal) Screening Aid

(Subfamily Hylesininae, Tribe Hylastini)

General Appearance in a Sample. *Hylurgops palliatus* (Fig. 3) superficially resembles other scolytids in the subfamily Hylesininae. Some of the more obvious characters are:

- ❑ elytral apex rounded, not excavated, and without marginal teeth.
- ❑ elytral basal margin raised with a series of marginal flattened granules (crenulations) (Fig. 1).
- ❑ pronotum usually unarmed and with an anterior constriction (Fig. 6: Anderson 1989).
- ❑ head usually visible from above.

In addition, *H. palliatus* has red-brown elytra, pronotum and legs and a black underside.

Recognizing the Genus. Some members of the genus *Hylurgops* are difficult to distinguish from *Hylastes* (Wood 1982, Bright 1976). Fortunately, only one species of *Hylurgops* is known to occur in the eastern U.S., *H. rugipennis pinifex* (Fitch). This species and *H. palliatus* are clearly distinct from *Hylastes* in all or most of the characters presented in couplet 5 of the key, below.

Recognizing *H. palliatus*. Characters for separating *H. palliatus* from scolytids known from the northeastern U.S. are assembled in the following key. Because the recommended lure, alpha-pinene, will attract many bark beetles, screening personnel should obtain a specimen of the target pest to help preclude unnecessary, repetitive use of the key.

**Key to Help Screen *Hylurgops palliatus* (Gyllenhal)
from Survey Samples of Northeastern U.S. Scolytidae (Coleoptera).**

(Adapted from Wood 1982, 1986).

1. Anterior margin of elytra a straight, transverse line, not raised or armed with a number of granules; elytral apex may be excavated, with or without conspicuous spines or teeth not *Hylurgops*

Anterior margin of elytra raised and armed with a number of granules (Fig. 1), (subfamily Hylesininae); elytral apex convex, not excavated, without conspicuous spines or teeth see #2.
2. Eye completely divided (transversely, near middle) not *Hylurgops*

Eye entire (Fig. 3) see #3.
3. Pronotum armed with asperites on anterolateral areas (Fig. 2) ... not *Hylurgops*

Pronotum without asperites on anterolateral areas see #4.
4. Procoxae widely separated by an intercoxal piece that is at least half as wide as a coxa (Fig. 4) not *Hylurgops*

Procoxae contiguous or narrowly separated by an intercoxal piece that is less than half as wide as a coxa (Fig. 4b) see #5.
5. Pronotum without a noticeable anterior constriction (Fig. 5), with uniform large or small punctures (rarely with large punctures and a few smaller); 3rd tarsal segment small, emarginate but not bilobed; declivital hairlike setae, if present, not longer than ground vestiture (*Hylastes*) not *Hylurgops*

Pronotum with a noticeable anterior constriction (Fig. 6), and nearly equal numbers of small and large punctures on the disc; 3rd tarsal segment bilobed, broader; elytral declivity usually with sparse, uniseriate rows of fine, hairlike interstitial setae that are longer than the ground vestiture (*Hylurgops*) see #6.
6. Larger 3.7-5.2 mm; scalelike vestiture of elytra from middle of disc to apex; interstitial raised scallops or tubercles confused, not uniseriate (Fig. 7a.)
..... *Hylurgops rugipennis pinifex* (Fitch)

Smaller 2.5-3.2 mm; scalelike vestiture of elytra present from base to apex, more numerous on apical third; interstitial tubercles in a single row (Fig. 7b)
..... *Hylurgops palliatus* suspect.

Hylurgops palliatus (Gyllenhal) Screening Aid (continued).

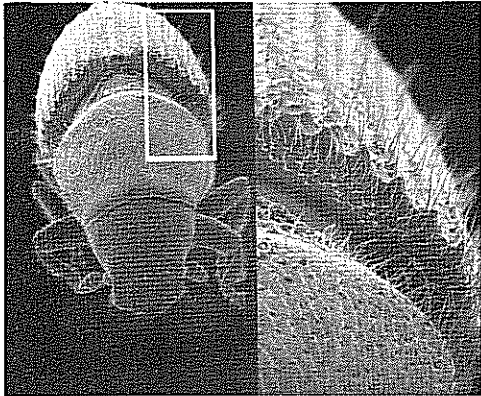


Figure 1. Raised anterior margin of elytron, *Tomicus piniperda* (L.) (From Passoa and Cavey 1993).

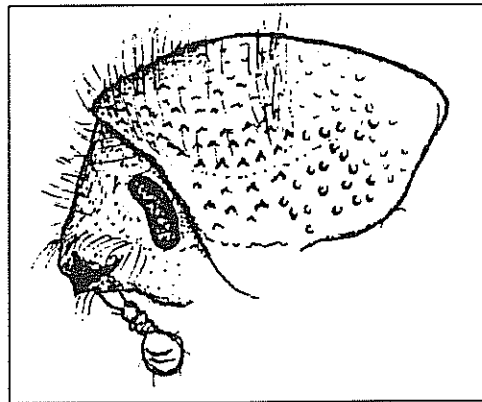


Figure 2. Pronotum of *Ips* sp., showing anterolateral asperities.

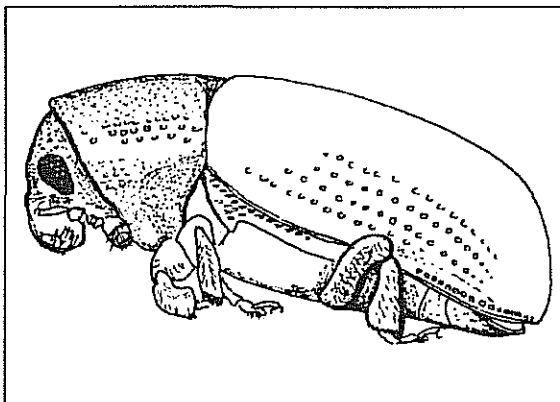


Figure 3. *Hylurgops palliatus* (Gyllenhal), lateral view.

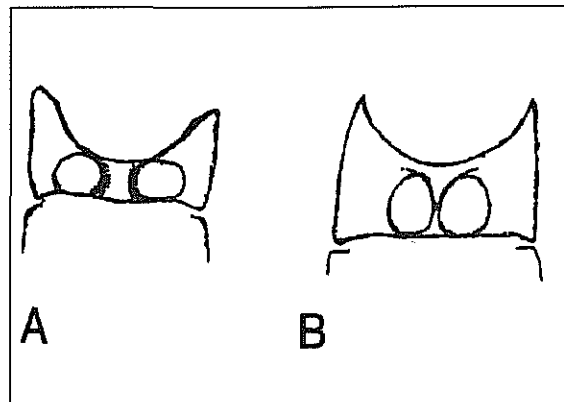


Figure 4. Venter of scolytid prothorax, a. procoxae widely separated, b. procoxae nearly contiguous.

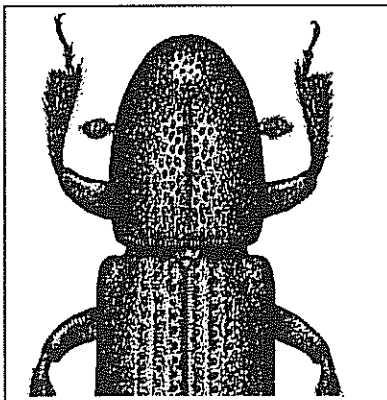


Figure 5. Typical pronotum of *Hylastes* (After Wood 1982).

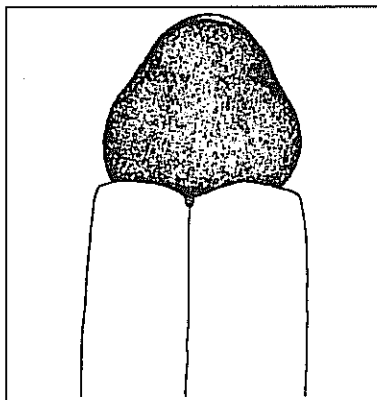


Figure 6. Typical pronotum of *Hylurgops* (After Wood 1982).

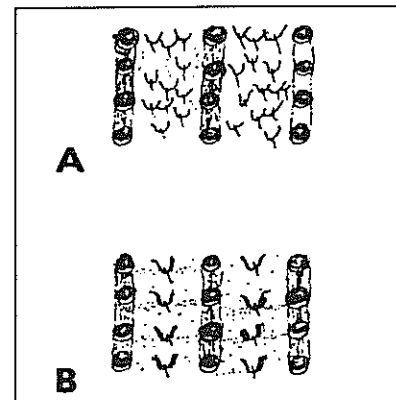


Figure 7. Elytron of a. *Hylurgops rugipennis pinifex* and b. *H. palliatus*, showing interstitial tubercles.

Ips sexdentatus (Boerner) Screening Aid

(Subfamily Scolytinae, Tribe Ipini)

General Appearance in a Survey Sample. At 5.5-8.2 mm in length, *I. sexdentatus* would be one of the largest scolytids found in a survey sample from the northeastern U.S. This brown species has an excavated elytral declivity armed laterally with spines. Viewed from above, erect yellow hairs protrude from the body perimeter.

Recognizing the Genus. In general, *Ips* differs from other North American scolytids in having the following combination of characters (from Wood 1982, 1986):

- Elytral declivity widely excavated and armed laterally with 3 or more teeth, the teeth arising from the summit (ridge) of the lateral margins.
- Pronotum asperate on the anterior half.
- Antennal funicle 5-segmented.
- Antennal club strongly flattened, with two sutures on the anterior face bisinuate or procurved (curved forward).

Members of the most similar genera, *Orthotomicus* and *Acanthotomicus*, are much smaller in size than *I. sexdentatus*.

Recognizing *I. sexdentatus*. This species is named for the six spines or teeth found on each lateral margin of the elytral declivity (Fig. 3). Of the U.S. *Ips* that have more than four spines on the declivity, only *grandicollis* (with 5 spines, the 3rd spine largest) and *calligraphus* (with 6 spines) occur in the NER (Wood 1982, Lanier 1987, Lanier *et al.* 1991). Both species could be present in numbers in survey samples.

The following will separate the target exotic species from *I. calligraphus*:

<i>I. sexdentatus</i>	<i>I. calligraphus</i>
larger 5.5-8.2 mm (Grune 1979).	smaller 3.8-5.9 mm (Wood 1982).
4th declivital spine largest (Fig. 3) (Grune 1979).	3rd declivital spine largest (Fig. 4) (Wood 1982).
frons with a short, transverse raised line above median tubercle (Fig. 1).	frons without a raised line above median tubercle (Fig. 2) (Wood 1982).

Ips sexdentatus (Boerner) Screening Aid (continued)

In addition to those cited above, other characters were noted from a limited study of 60 or more specimens of *I. sexdentatus* and about 175 *I. calligraphus* from the U.S. National Museum and Baltimore PPQ insect collections. Most useful is the frontal ridge shown in Figure 1 and described above. Also unlike *I. calligraphus*, *I. sexdentatus* has a series of setate granules in line near the suture on each elytron, but restricted to the basal half of the declivity; and the antebasal area of the pronotum is usually impunctate near the middle. On *I. calligraphus*, the setate granules near the suture are numerous and continuous to the declivital apex, so that the midline of the declivity appears entirely fuzzy. (However, be careful, because hairs can be abraded.) On *I. calligraphus*, the antebasal area of the pronotum is sparsely, finely punctate near the middle.

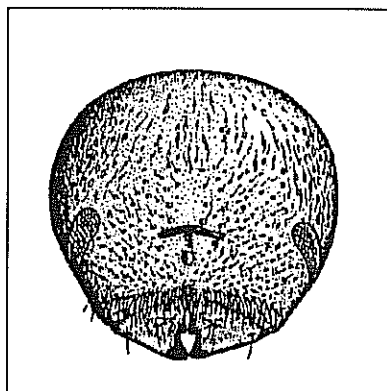


Figure 1. *Ips sexdentatus*, frontal view of head (modified from Wood 1982).

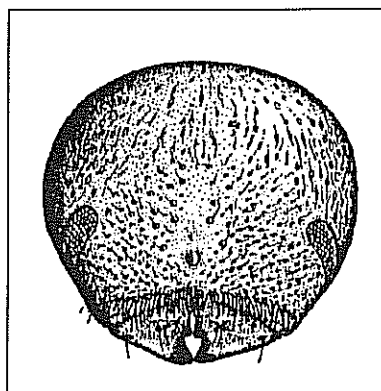


Figure 2. *Ips calligraphus*, frontal view of head (from Wood 1982).

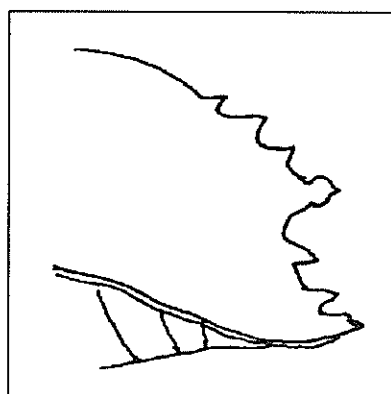


Figure 3. *Ips sexdentatus*, lateral view of elytral declivity.

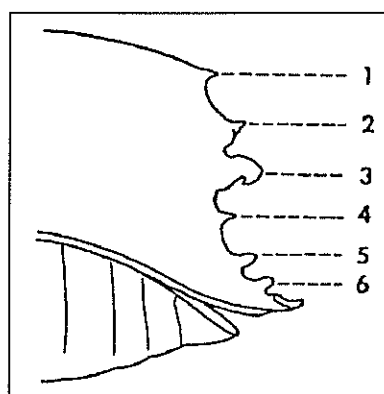


Figure 4. *Ips calligraphus*, lateral view of elytral declivity with teeth numbered (from Wood 1982).

Orthotomicus erosus (Wollaston) Screening Aid

(Subfamily Scolytinae, Tribe Ipini)

General Appearance in a Sample. Length 2.7-3.5 mm; red-brown; anterior portion of pronotum asperate; elytral declivity moderately concave with lateral spines or teeth.

Recognizing the Genus. This species might be keyed to either *Orthotomicus* or *Ips* in Bright (1976) or Wood (1982), depending on the workers interpretation of described characters. It is similar to the only North American *Orthotomicus*, *O. caelatus* (Eichhoff), a common species throughout the region. Wood (1982) placed *O. erosus* in the genus *Ips*, but we are using the old generic name to retain continuity with foreign literature and pest interception records. It is much like *Ips latidens* (LeConte), which occurs in the NER (S.L. Wood, pers. commun. 11/5/92). Having four declivital teeth, *O. erosus* might be confused with *Ips pini* (Say), the most common species in NER trap samples from the 1993 Pilot Bark Beetle Survey.

Recognizing *O. erosus*. This exotic pest may be separated from similar NER species in each genus as follows:

<i>Orthotomicus erosus</i>	<i>Ips pini</i>
2nd declivital tooth largest (on female and male), broad for most of its length (Fig. 1).	2nd declivital tooth small; 3rd largest and capitate on male (Fig. 3a); all 4 teeth conical on female (Fig. 3b).
<i>Orthotomicus erosus</i>	<i>Orthotomicus caelatus</i>
Antennal club with sutures procurved (Fig. 2a).	Antennal club with sutures recurved (Fig. 2b).
Declivity with 4 teeth (Fig. 1).	Declivity with 3 teeth (Fig. 4).
<i>Orthotomicus erosus</i>	<i>Ips latidens</i>
2nd declivital tooth largest (on males and females), broad for most of its length (Fig. 1).	3rd declivital tooth largest on male, conical, tapered from its base to apex, (Fig. 5).
A median pair and a few other granules on frons larger than remaining granules.	Granules of frons equally minute.

***Orthotomicus erosus* (Wollaston) Screening Aid (continued)**

Pityogenes and the closely related genus *Pityokteines* differ from *O. erosus* in having only 2 or 3 conical teeth on the declivity.

Figures 1, 3, 4, and 5, below, are modified from Wood (1982).

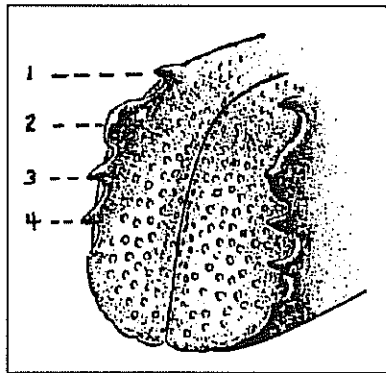


Figure 1. Elytral apex of *Orthotomicus erosus* (Woll.).

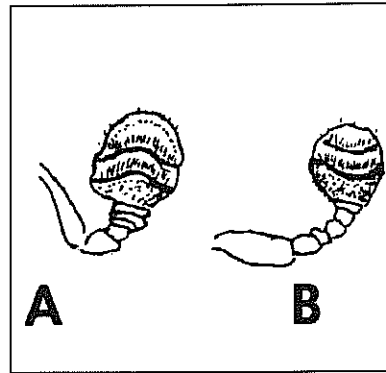


Figure 2. Antenna of a. *O. erosus* and, b. *O. caelatus* (Eich.).

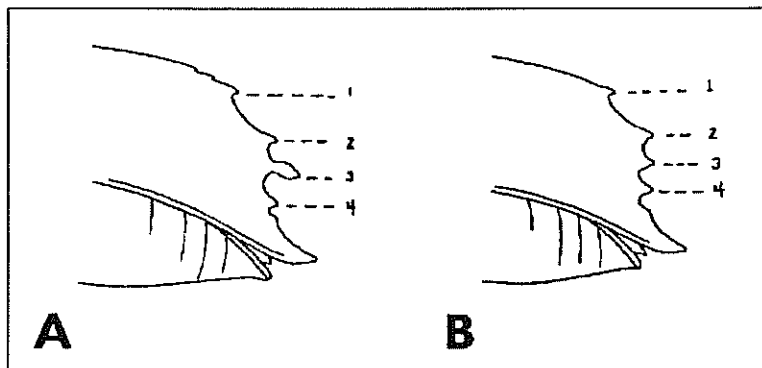


Figure 3. Elytral apex of *Ips pini* (Say), lateral view of a. male and, b. female.

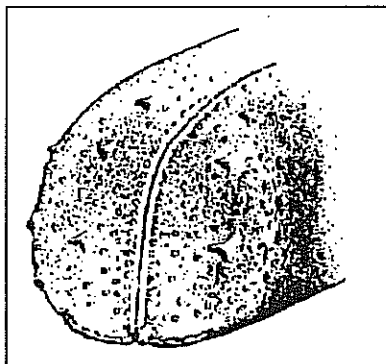


Figure 4. Elytral apex of *Orthotomicus caelatus*, female showing 3 declivital teeth.

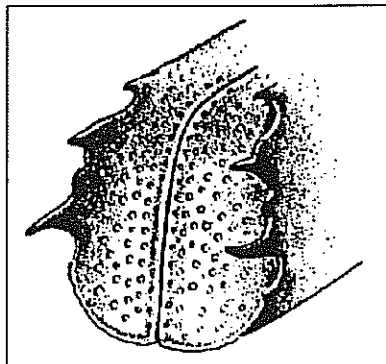


Figure 5. Elytral apex of *Ips latidens* (LeC.) male showing 3 declivital teeth.

Pityogenes chalcographus L. Screening Aid

(Subfamily Scolytinae, Tribe Ipini)

General Appearance in a Sample. A small species, 1.6-2.9 mm, with a moderately excavated elytral declivity bearing 3 conical teeth (males) or 3 smaller teeth (females). Color either black or often bicolored, black in front and red-brown on the latter half.

Recognizing the Genus. Similar genera of small bark beetles are *Pityokteines* and *Orthotomicus*, each represented in the NER by only one species. These taxa are distinguished from the genus *Pityogenes* below:

<i>Pityogenes</i>	<i>Pityokteines sparsus</i> (LeC.)	<i>Orthotomicus caelatus</i> (Eich.)
frons of female head often with a deep pit (Fig. 1).	frons of female head with a long tuft of hair (Fig. 2).	frons of female and male without tuft of hair or pit.
lower margin of elytral declivity rounded to apex, without a shelf or ridge (Fig. 3b).	lower margin of elytral declivity as in <i>Pityogenes</i> .	lower margin of elytral declivity with a shelf or elevated ridge before apex (Fig. 3a).

Recognizing *Pityogenes chalcographus*. Unlike *P. chalcographus* which has 3 teeth, males of most North American *Pityogenes* have 2 teeth on the elytral declivity, e.g. *P. bidentatus* (Herbst), a European species established in the NER. Only *P. hopkinsi* Swaine, a species common throughout the region, has 3 declivital teeth on both males and females (like *P. chalcographus*).

The following key will help screen *P. chalcographus* from NER *Pityogenes*. Males of *P. hopkinsi* are very difficult to distinguish from *P. chalcographus*. Unfortunately, even the aedeagi are similar and difficult to study, because of their small size. The dichotomy in couplet 5 should prove useful, but is relative, should be used with caution, and only with identified males of the 2 species in hand for comparison.

**Key to Help Screen *P. chalcographus* from *Pityogenes*
Known to Occur in the Northeastern Region.^{1,2}**

1. Elytral declivity with 2 teeth, teeth large with the upper pair hooked (male); or declivital teeth barely evident and head without a pit (female) (*P. bidentatus*)
.....not *P. chalcographus*.

Elytral declivity with 3 teeth (female or male), (Fig. 4)see #2.
2. Head with a frontal pit (Fig. 1); declivital teeth small relatively inconspicuous (females) see #3.

Head without a pit; declivital teeth conspicuous (Fig. 4) (males)see #5.
3. Frontal pit divided by a raised, longitudinal line (Fig. 5) distance from declivital tooth 1 to tooth 2 about 1/2 of that from 2 to 3 (Fig. 6) (*P. plagiatus* female)
.....not *chalcographus*.

Frontal pit entire, not divided (Fig. 1); distance between declivital teeth 1 and 2 subequal to that between 2 and 3 (Fig. 4)see #4.
4. Frontal pit round and small, occupying only about 1/3 of the width between the eyes (Fig. 1a) *P. hopkinsi* Swaine.

Frontal pit transversely oval and large, occupying at least 1/2 of the width between the eyes (Fig. 1b)*P. chalcographus* suspect.
5. Elytral declivity with central portion between rows of teeth narrowly excavated (Fig. 4b) *P. hopkinsi* Swaine.

Elytral declivity between rows of teeth widely excavated (Fig. 4a)
.....*P. chalcographus* suspect.

¹ Prepared by J.F. Cavey; character in couplet 5 provided by Dr. S.L. Wood (pers. commun. 1993).

² Northeast species considered in writing the key were *P. bidentatus*, *P. hopkinsi* and *P. plagiatus*.

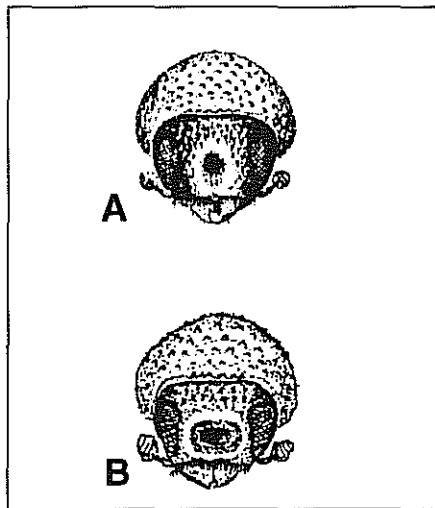


Figure 1. a. *Pityogenes hopkinsi* Swaine, and b. *P. chalcographus* L., female head. (a. from and b. modified from Swaine 1918).

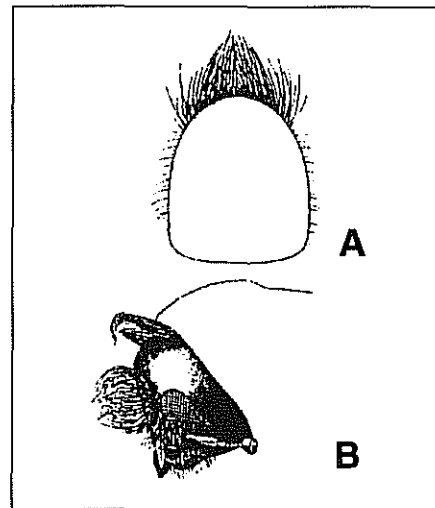


Figure 2. *Pityokteines sparsus* LeC., b. lateral view of female head, a. dorsal view of pronotum (from Swaine 1918).

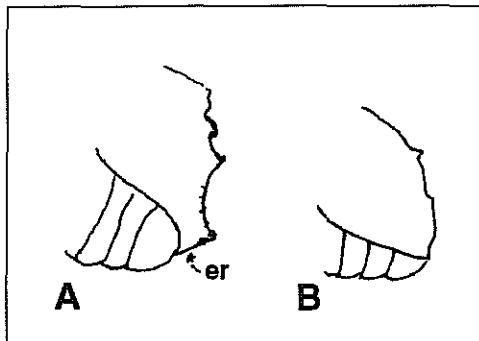


Figure 3. Abdominal apex of a. *Orthotomicus caelatus* (Eich.) and b. *Pityogenes chalcographus* L., lateral view. er = elevated ridge.

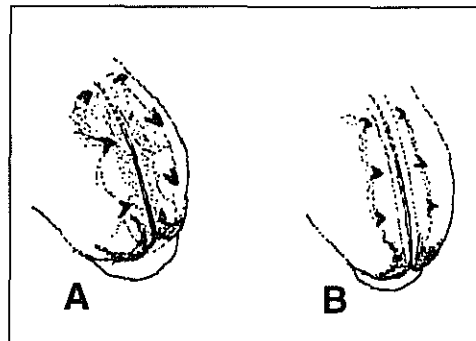


Figure 4. Elytral apex of male a. *Pityogenes chalcographus* L. and, b. *P. hopkinsi* Swaine, oblique view.

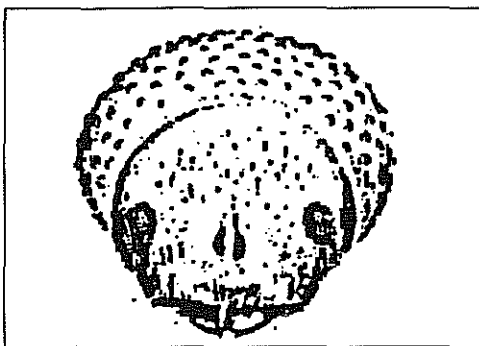


Figure 5. Head of *Pityogenes* spp. showing divided frontal pit (from Swaine 1918).



Figure 6. Abdominal apex of bark beetle showing tooth 2 closer to 1 than to 3 (from Swaine 1918).

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