

An Illustrated Key to the *Ips*, *Orthotomicus*, and *Pseudips* of North America

Introduction and use of this key

Skip to Key

Along with members of the genus *Dendroctonus*, bark beetles in the genus *Ips* are among the most important members of the subfamily Scolytinae in both the ecological and economic senses. Several of the species are well known for widespread damage in conifer forests and plantations. Two related taxa, some members of which have been traditionally placed within *Ips*, are also treated herein: *Orthotomicus* Ferrari and *Pseudips* Cognato. Accurate identification of members of these taxa is important to tracking the distribution and impacts thereof, especially where human actions may be exerting influence, as in the case of introduced invasive species.

Despite the justifiable recognition of the flaws and limitations inherent in a dichotomous key, some taxa do not lend themselves to matrix-based identification aids, such as LUCIDTM. This is particularly so of taxa such as *Ips* and the other two genera, whose identification is largely dependent upon the assessment of subtle character states, confounded by sexual dimorphism and variability in character expression. As a consequence, this key is arranged in the standard dichotomous manner.

The key is largely based upon that used by the late Stephen L. Wood in his landmark 1982 treatment of North and Central American bark beetles. Several characters I have found unreliable or felt were too difficult to assess have been omitted. Unlike Wood, I've had the privilege of access to superb digital imagery, along with access to

An Illustrated Key to the *Ips*, *Orthotomicus*, and *Pseudips* of North America

Introduction and use of this key (continued)

the talents of a true artist of that medium, Steven A. Valley. Consequently, the users of this key will be able to rely on images of all the character states utilized herein. This is a vast improvement over reliance primarily upon textual descriptions, although identification of these bark beetles is still anything but a "snap".

There are twenty-three species of *Ips* described from North America north of Mexico. I've also included two exotic species of concern. Four species of *Orthotomicus* and two species of *Pseudips* are addressed.

Identification of these insects can be challenging. Several of the characters used for identification require subtle interpretation. Identification can be complicated by sexual dimorphism, especially with regard to structures of the frons and the elytral declivity, and great intraspecific variation in size. Many of the diagnostic features involve the number and form of spines on the elytral declivity. Unfortunately, the spines are subject to breakage, developmental malformation, and great individual intraspecific variability. Sometimes the spines on one side of the declivity differ in appearance and number from those on the other side. To some degree, this variability is also evident in the structures of the frons, particularly the presence or absence of tubecles. Caution must be used in species diagnosis based on a single specimen - if possible,

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Introduction and use of this key (continued)

long series of specimens are desirable. Clean specimens are critical, especially on the frons and elytral apex. Debris, mites, and oils can obscure key features. Even with perfect specimens and long series, several species groups are difficult to reliably determine and it may be necessary to submit material to a specialist. If available, host data may be critical to enabling an accurate identification.

A particular cautionary note: several of the images show pale brown or reddish brown specimens versus dark specimens, color is not a reliable characteristic. Recently eclosed adults are often pale, but darken with age.

This sign, ②, and blue text, indicate the species in question is an exotic species of regulatory concern.

Acknowledgements

Although a great many people have helped with this project, I want to single out a few for special recognition, without whose help success would have been impossible:

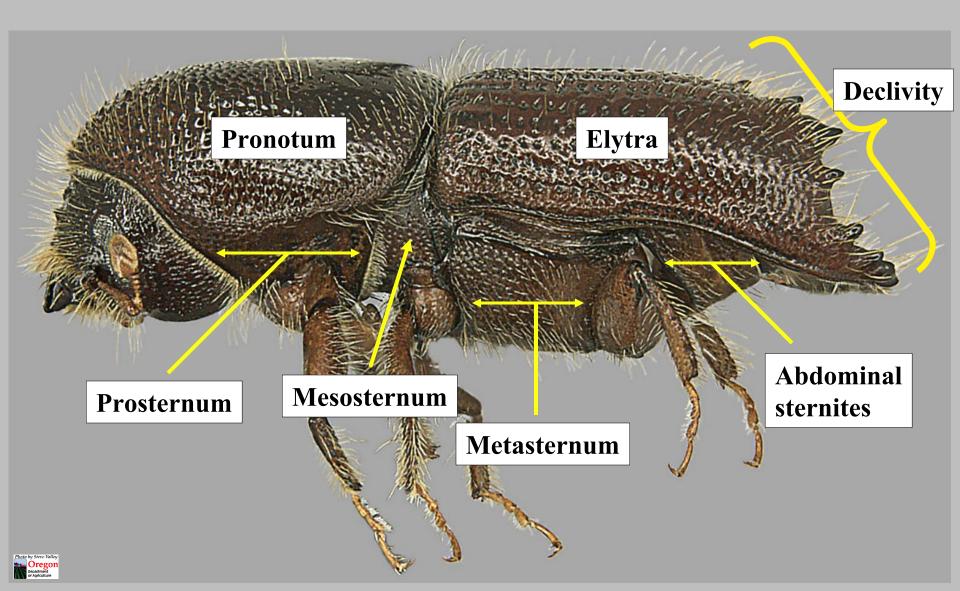
Joshua Vlach, my long-suffering colleague at Oregon Department of Agriculture, who helped borrow, prepare, and curate specimens, and, more importantly, vetted my ideas on how best to present this information.

David Maddison, Curator, and Chris Marshall, Collections Manager, Oregon State University Arthropod Collection, for generous loans of material, often on short notice.

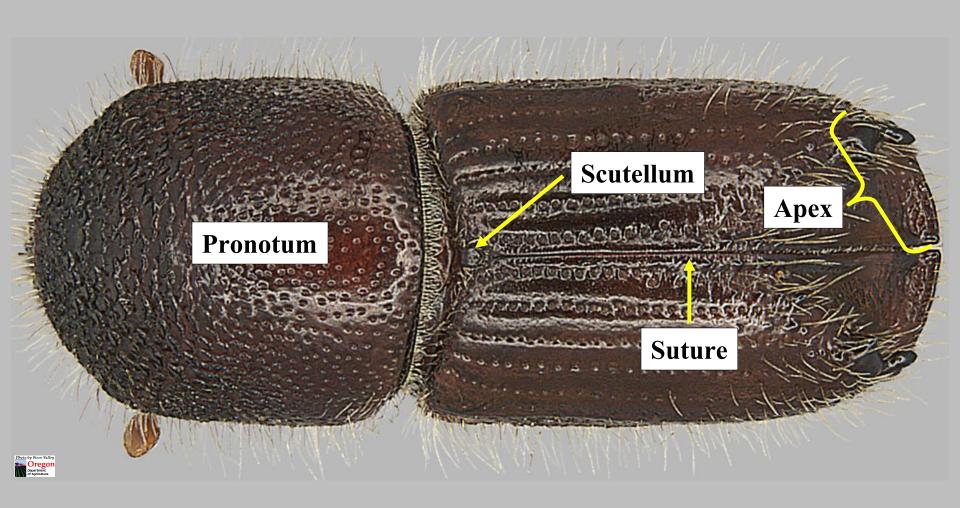
Bob Rabaglia, U.S. Forest Service, Forest Health Protection, Maryland, for bringing several species to my attention and generously loaning some as well.

Anthony Cognato, Curator, Michigan State University Insect Collection, for advice on how best to differentiate some species of *Ips*.

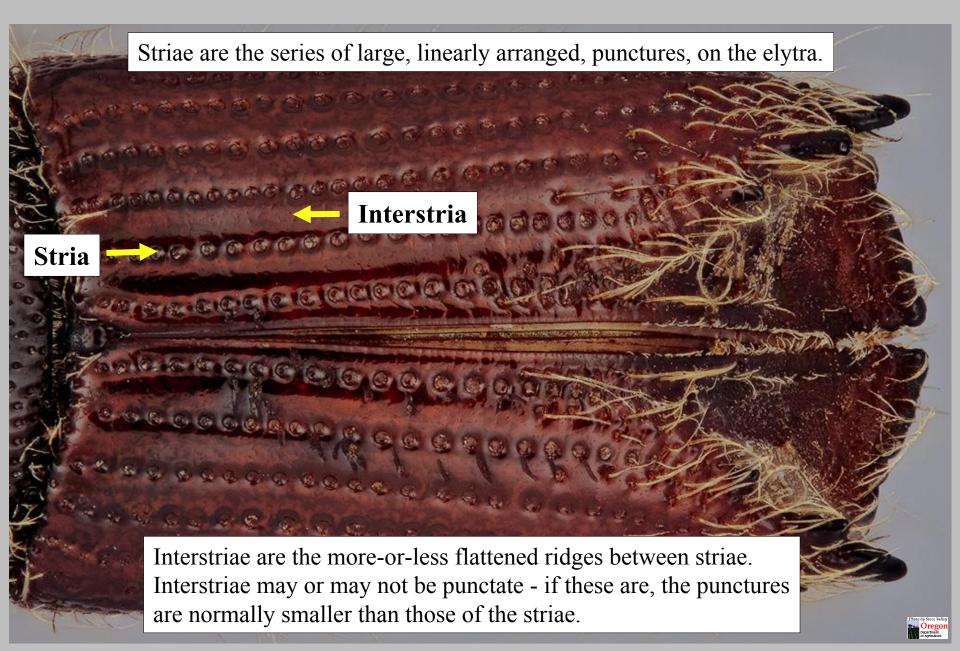
Basic body parts Lateral view



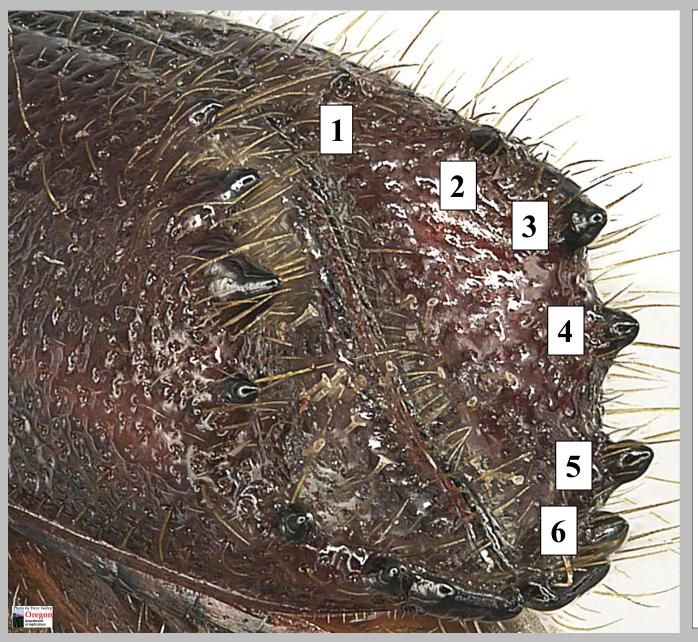
Basic body parts Dorsal view



Striae and interstriae

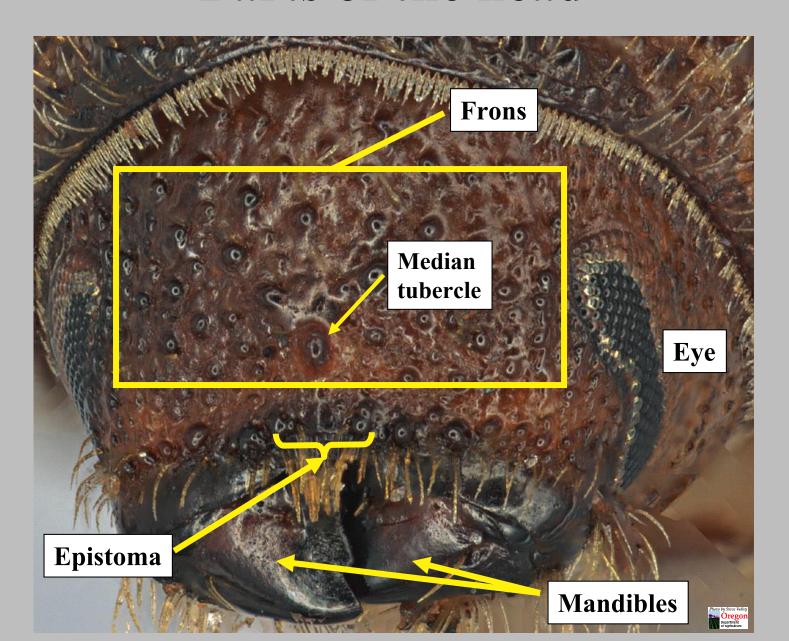


Counting spines

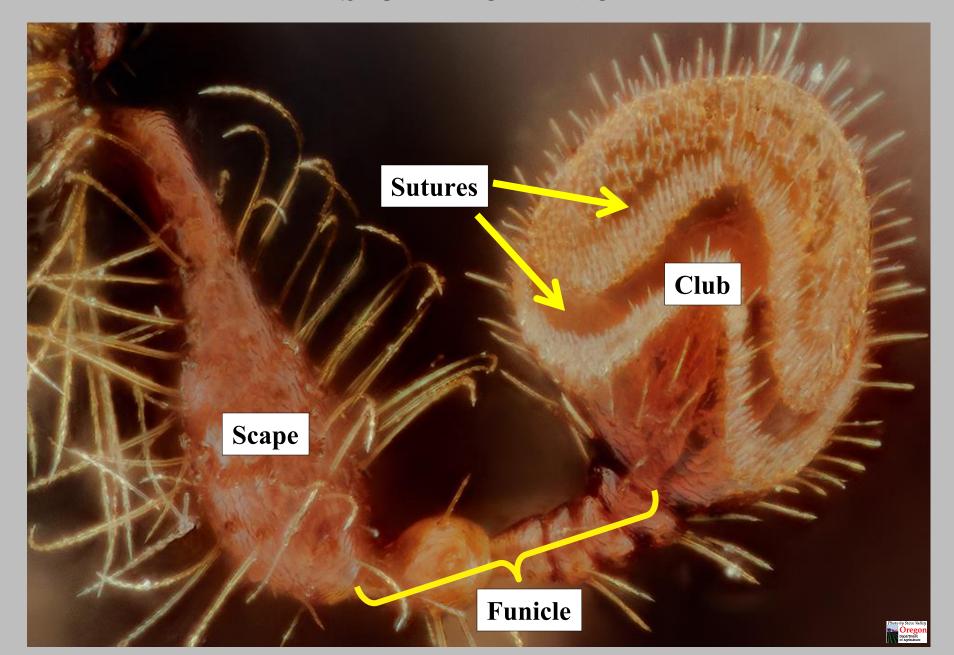


Counting the pairs of major spines on the elytral declivity of *Ips* and related bark beetles is essential for their identification. Spine pairs are numbered starting from the suture. There may be from 3 to 6 pairs. Normally, pair 3 is the largest. There may be pairs of minor spines near pair 1, but these are not counted. A sixspined *Ips* is shown here.

Parts of the head

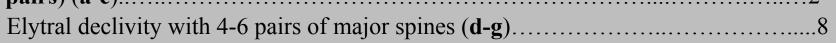


Parts of the antenna

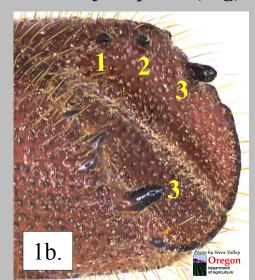


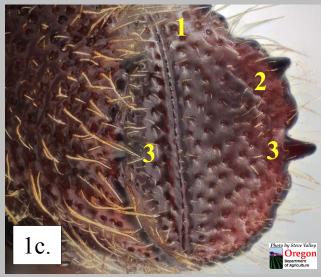
1

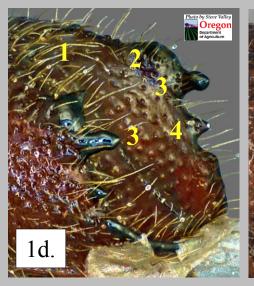
Elytral declivity with 3 pairs of major spines (*numbers on images denote spine pairs) (a-c)....

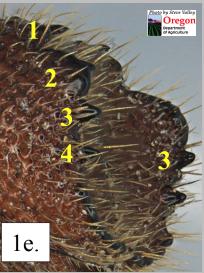


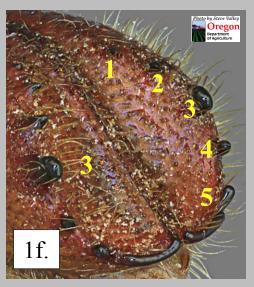


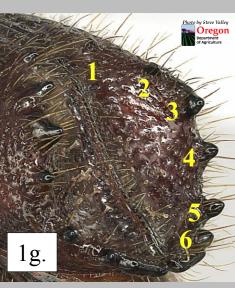








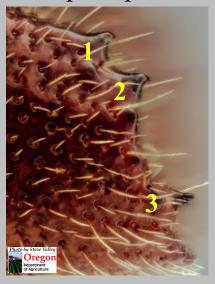


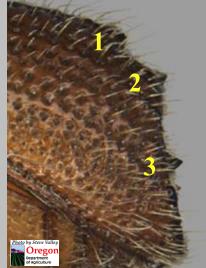


2(1)

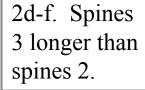
Elytral declivity with 3rd pair spines short, no longer than 2nd pair (**a-c**).....3 Elytral declivity with 3rd pair spines longer than 2nd pair (**d-f**)............4

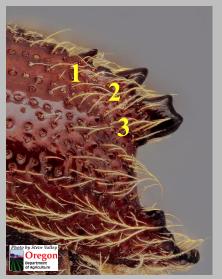




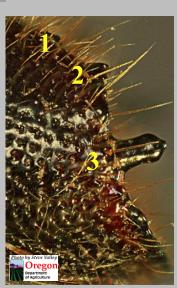


2a-c. Spines3 no longerthan spines 2.









3 (2): Part I

Antennal club sutures procurved (**b**); elytral declivity broadly excavate, lower declivital carinate margin about at level of spines 3, spines 1 and 2 distant (about as distant as 2 & 3) (**e-f**); portrait (**i**)......

.....<u>female</u> Orthotomicus erosus (Wollaston) 🗵

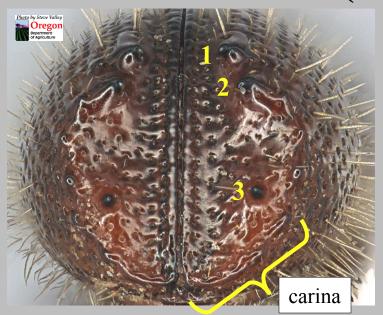
3a. *Orthotomicus caelatus*: antennal club sutures recurved.



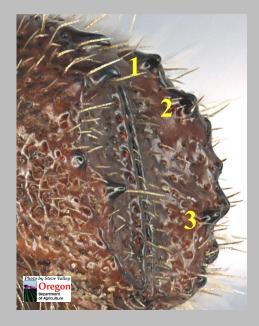
3b. <u>Female</u> *Orthotomicus erosus*: antennal club sutures procurved.

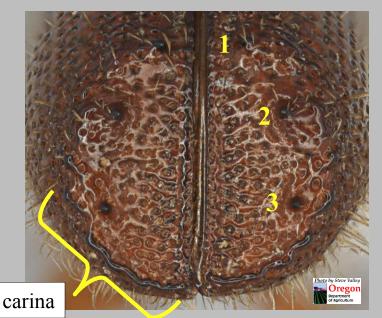


3 (2): Part II

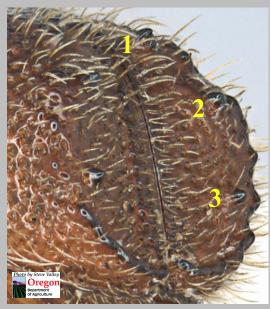


3c, d. *Orthotomicus caelatus*: declivity narrowly excavate; carina not reaching bottom pair of spines, spines 1 & 2 closer together.





3e, f. *Orthtomicus*erosus female:
declivity broadly
excavate; carina
extending beyond
bottom pair of spines,
spines 1 & 2 distant
from each other.



3 (2): Part III

Orthotomicus caelatus (Eichoff)





3 (2): Part IV Orthotomicus erosus (Wollaston) <u>Female</u>



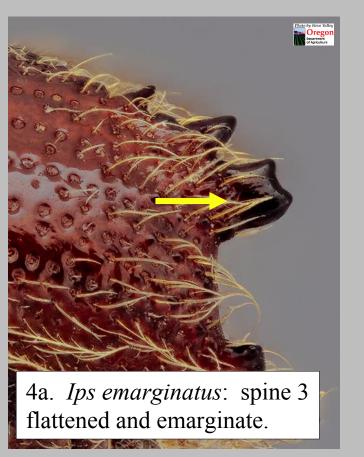
4 (3): Part I

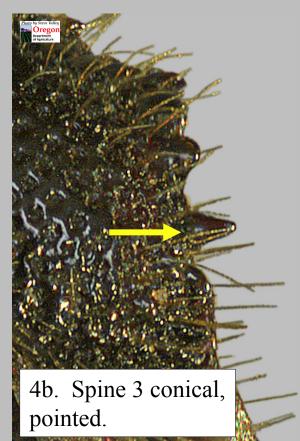
Elytral declivital spine 3 flattened, emarginate at apex (a); portraits (d, e)....

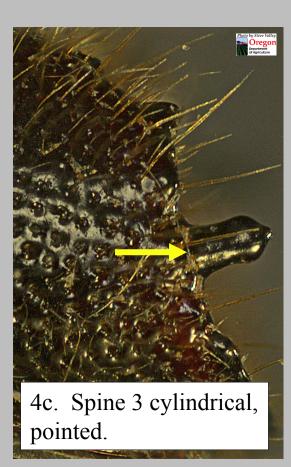
Ips emarginatus (LeConte)*

*Females of this species rarely have a fourth spine - these would key to couplet 17.

Elytral declivital spine 3 conical or cylindrical, pointed at apex (b, c)......5







4 (3): Part II

Ips emarginatus (LeConte)

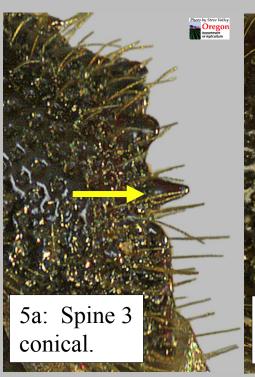
- three spined

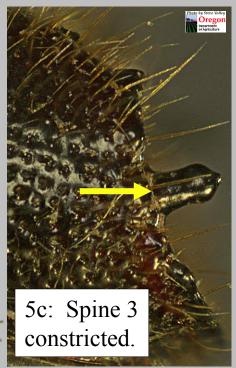


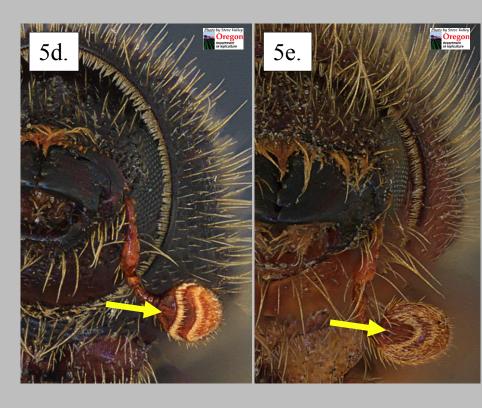
5 (4)

Elytral declivital spine 3 conical, not constricted before apex (**a**, **b**); antennal club sutures weakly procurved, almost straight (**d**)......6

Elytral declivital spine 3 capitate, with a distinct constriction before apex (c); antennal club sutures very strongly procurved (e)......7

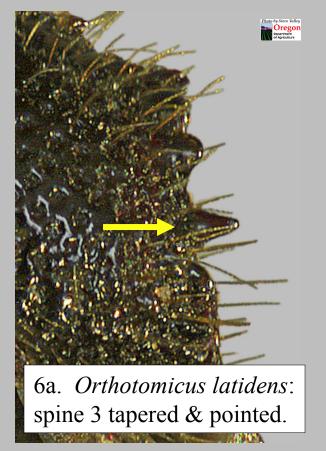






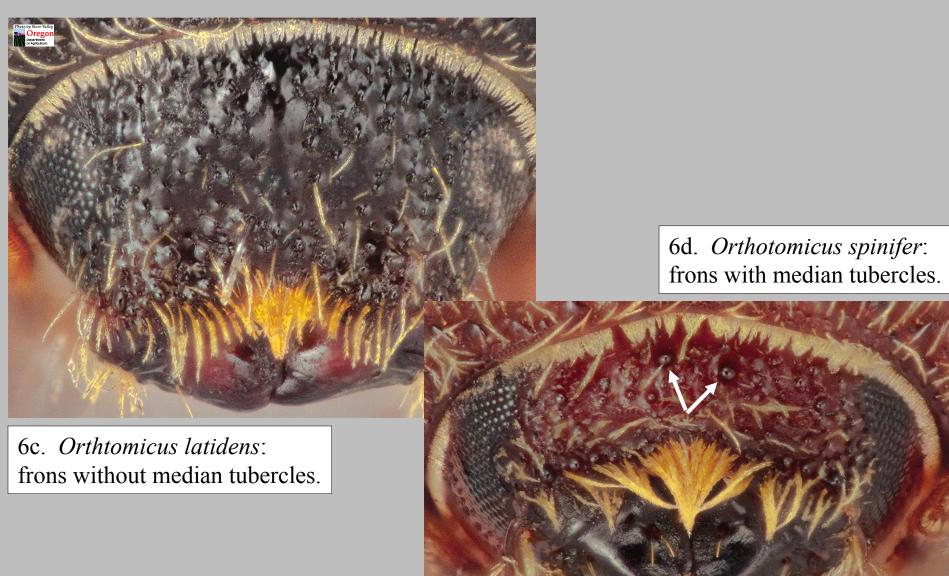
6 (5): Part I

Elytral declivital spine 3 tapered from base and pointed (a); from without median tubercles (c); portraits (e, f).........Orthotomicus latidens (LeConte)





6 (5): Part II



6 (5): Part II

Orthotomicus latidens (LeConte)



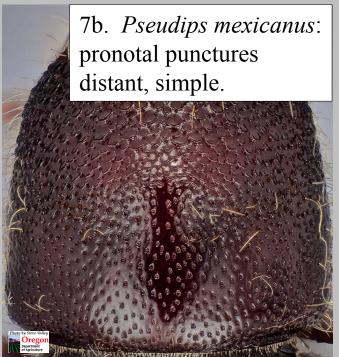
6 (5): Part III Orthotomicus spinifer (Eichoff)



7 (5): Part I

*It can be extremely difficult to distinguish between these species. *Pseudips concinnus* is known only from coastal localities west of the Cascades from Alaska to northernmost California while *P. mexicanus* has a much greater known range. Outside of west coastal locales, *P. mexicanus* is most likely.





7 (5): Part III

Pseudips concinnus (Mannerheim)



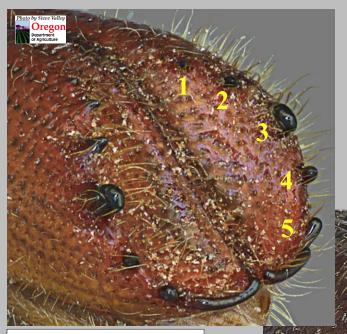
7 (5): Part IV Pseudips mexicanus (Hopkins)



7f. Male.

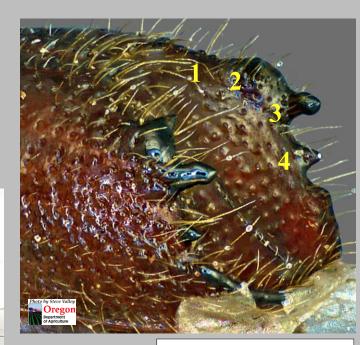
8 (1)

Photo by Steve Valley
Oregon
Department
of Agriculture



8a. 5 pairs spines.

8b. 6 pairs spines.



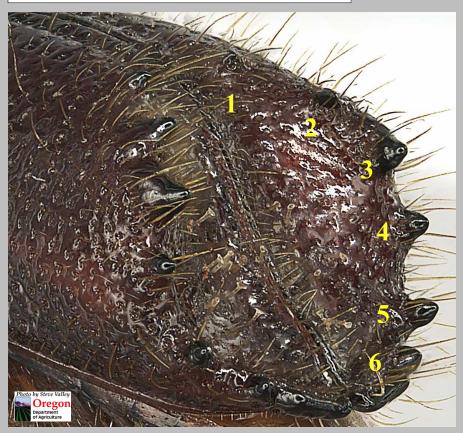
8c. 4 pairs spines.

9 (8)

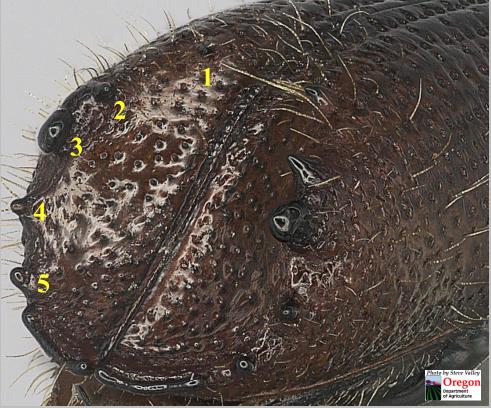
Lateral margins of elytral declivity with 6 pairs of spines (a)....10 Lateral margins of elytral declivity with 5 pairs of spines (b)....11



9a. 6 pairs of spines on declivity.



9b. 5 pairs of spines on declivity.



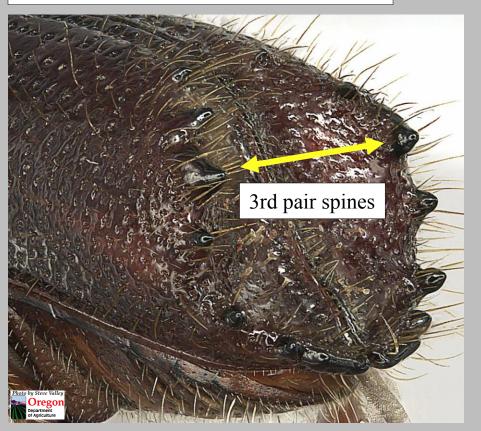
10 (9): Part I

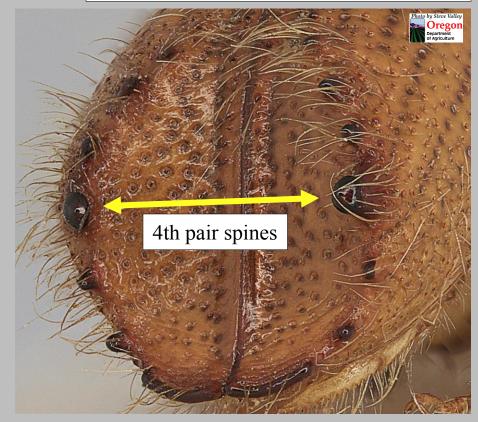
3rd pair of declivital spines largest (a); from without a raised line above the median tubercle (c); larger, 5.5-8.2 mm in length; portrait (e)..... Ips calligraphus (Germar) *Ips apache Lanier, from s. AZ & MX, can only be reliably distinguished via DNA.

4th pair of declivital spines largest (**b**); frons with a short, transverse raised line above median tubercle (**d**); smaller, 3.5-5.9 mm in length; portrait (**f**)......

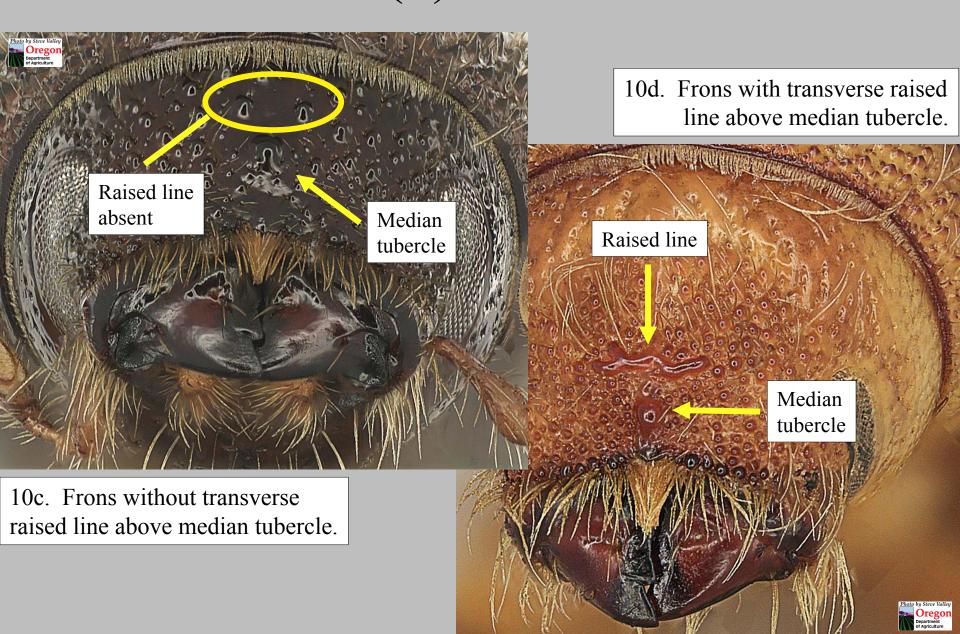
10a. 3rd pair declivital spines largest.







10 (9): Part II



10 (9): Part III

Ips calligraphus (Germar)

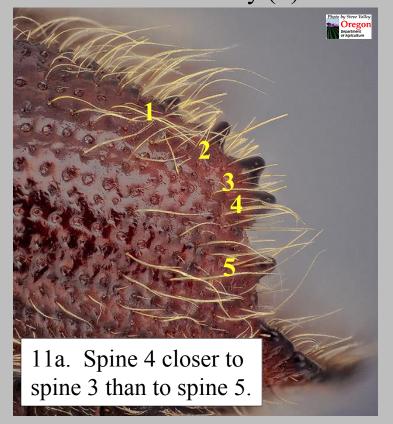


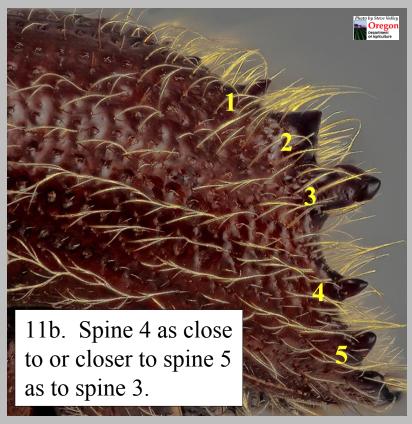
10 (9): Part IV Ips sexdentatus (Boerner) ⊗



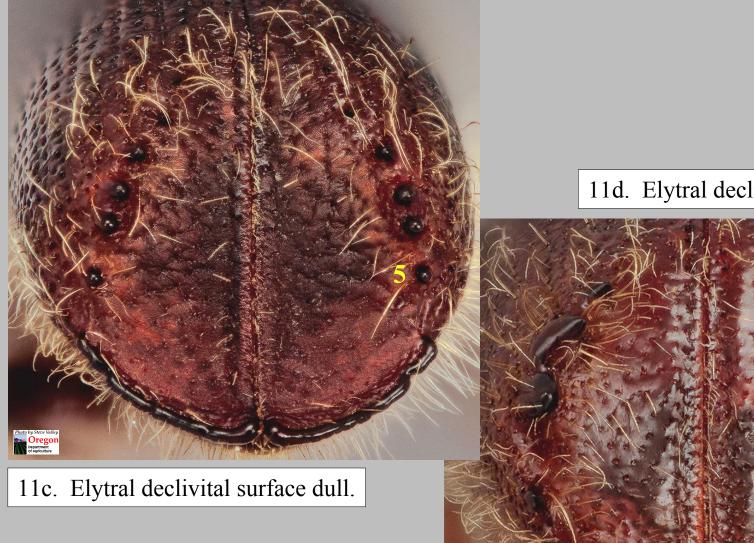
11 (9): Part I

*Normal *I. knausi* have a large, flattened, emarginate spine 3 and will key to couplet 17. Some females have this spine greatly reduced so that the apices of the emargination appear as separate spines. These will key here.





11 (9): Part II



11d. Elytral declivital surface shiny.

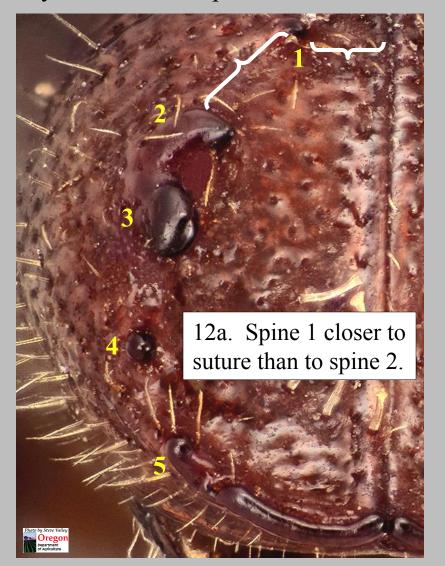
11 (9): Part III

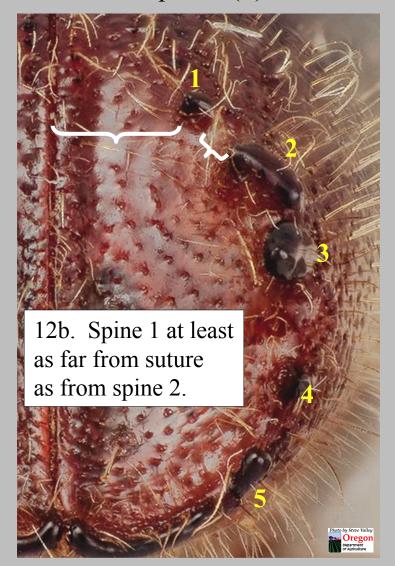
Ips knausi Swaine*
"5-spined"



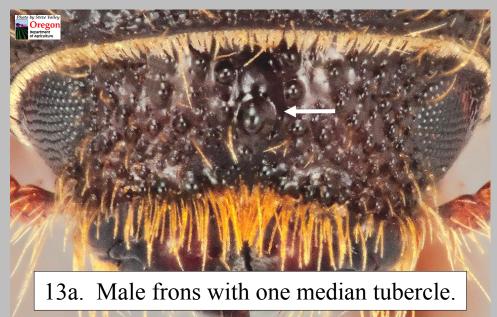
12 (11)

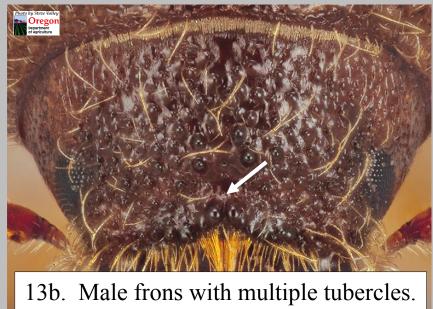
Elytral declivital spine 1 distinctly closer to suture than to spine 2 (a)......13 Elytral declivital spine 1 at least far from suture as from spine 2 (b)......14





13 (12): Part I





13 (12): Part I

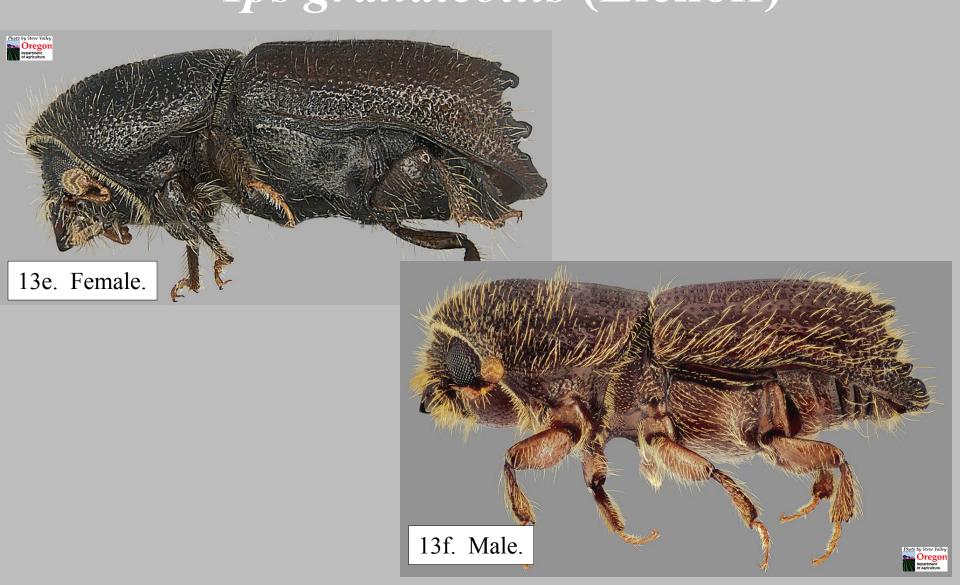


13c. Female declivital spines 2 & 3 connected at base.

13d. Female declivital spines 2 & 3 separate at base.



13 (12): Part III Ips grandicollis (Eichoff)



13 (12): Part IV Ips lecontei Swaine

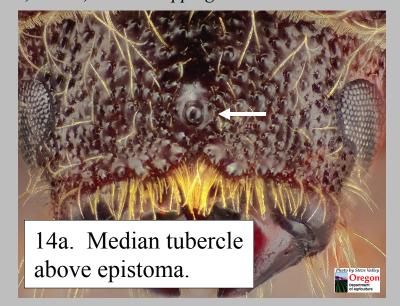


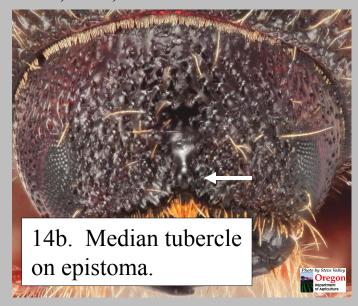


14 (12): Part I

Fovea on frons deeply impressed, upper margin of large median tubercle in male almost touching epistoma and lower than upper margin of eyes (**b**); no more than 4.3 mm in total length; portraits (**e-h**)...*Ips confusus* (LeConte), *Ips hoppingi* Lanier, **and** *Ips paraconfusus* Lanier*

*The characters differentiating *I. paraconfusus* from *I. confusus* and *I. hoppingi* are very subtle and *I. confusus* and *I. hoppingi* cannot be differentiated via external characters. *Ips paraconfusus* is known from pines in CA, w. NV, OR, & WA. *Ips confusus* is found in *Pinus edulis* and *P. monophylla* in AZ, CA, CO, NM, NV, UT, WY, & MX, while *I. hoppingi* is found in *P. cembroides* in s. AZ, e. TX, & MX.





14 (12): Part II

Ips montanus (Eichoff)





14 (12): Part III Ips paraconfusus Lanier*

14f. Male.



14 (12): Part IV

Ips confusus (LeConte)* Ips hoppingi Lanier*





15 (8)

Surface of elytral declivity dull, roughened between punctures (**a-b**).....16 Surface of elytral declivity shiny, smooth between punctures (**c**).......18



15a, b. Declivital surface dull, rough.





15c. Declivital surface shiny, smooth.



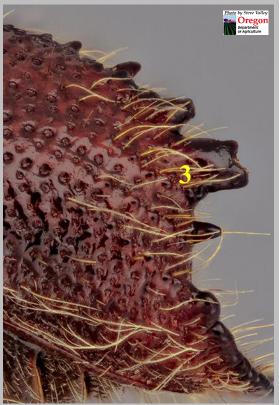
16 (15): Part I

16 a. Declivital spine 3 smaller, capitate, apically pointed.



16b-c. Declivital spine 3 large, flattened, apically emarginate.





16 (15): Part II

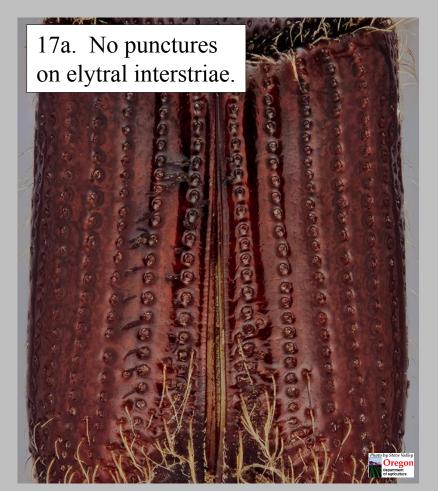
Ips typographus (Linnaeus) 🗵

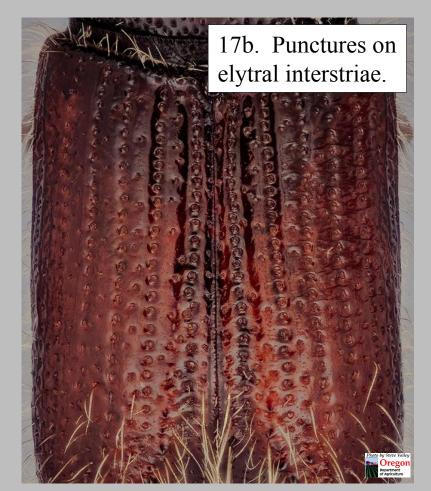


17 (16): Part I

No punctures on elytral interstriae (a); portrait (c)... Ips emarginatus (LeConte)*
*This species is more likely to key out at couplet 4 because spine 4 is most often absent, except in rare females.

Punctures present on elytral interstriae (b); portraits (d, e).....Ips knausi Swaine





17 (16): Part II

Ips emarginatus (LeConte)

- four spined

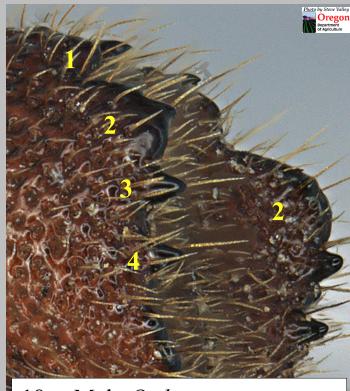


17 (16): Part III

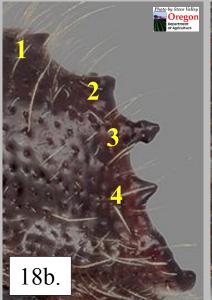
Ips knausi Swaine



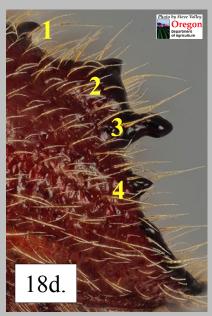
18 (15): Part I



18a. <u>Male Orthotomicus erosus</u>: spine pair 2 largest and lobate.

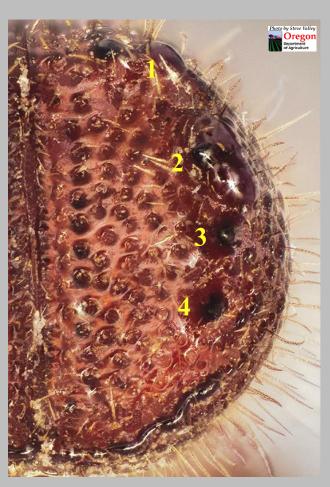




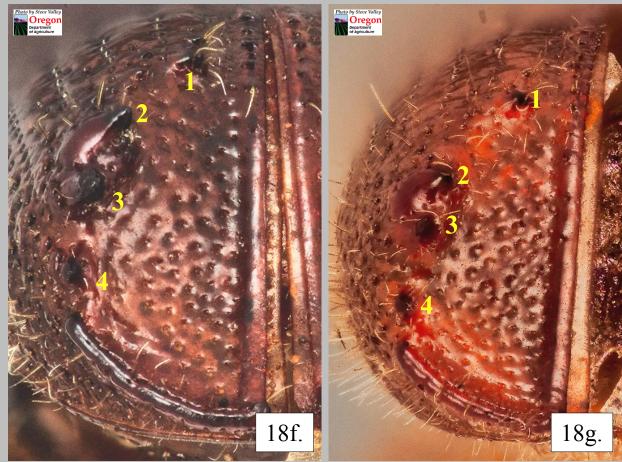


18. b-d. Spine pair 2 smaller, not lobate.c. Spine pair 2 lobate, large, but short.

18 (15): Part II



18e. <u>Male Orthotomicus</u> *erosus*: spine pair 4 displaced toward suture, not on edge of declivity.



18f-g. All spine pairs on edge of declivity.

18 (15): Part III Orthotomicus erosus (Wollaston) Male



19 (18)

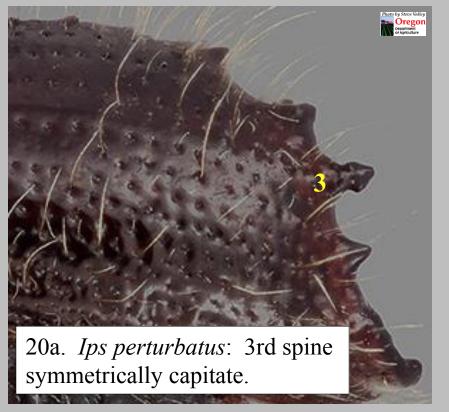


19a. Discal interstriae impunctate.



19b. Discal interstriae punctate, setose throughout.

20 (19): Part I



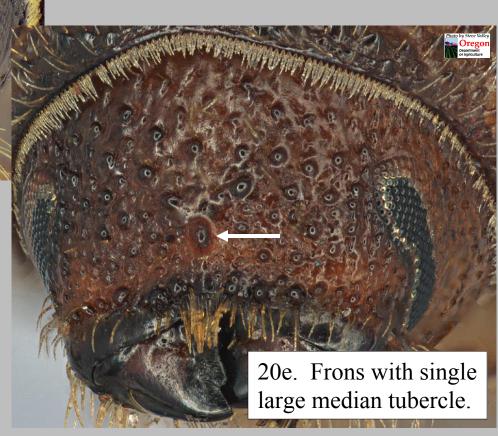




20 (19): Part II



20d. *Ips perturbatus*: frons with transverse pair of median tubercles.



20 (19): Part III

Ips perturbatus (Eichoff)

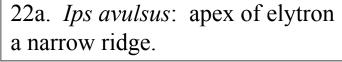


21 (20)

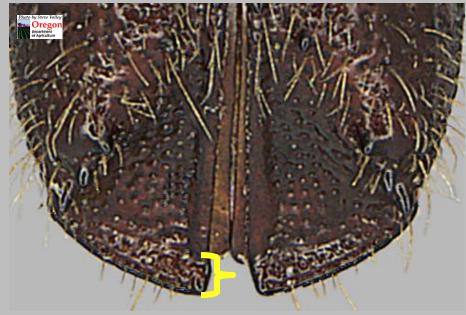




22 (21): Part I

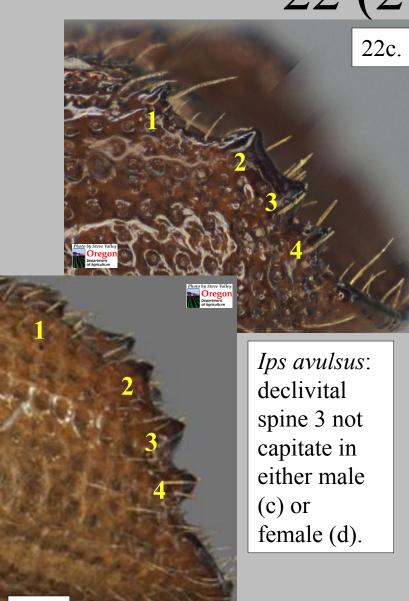






22b. Apex of elytron a strongly projecting shelf.

22 (21): Part II



22d.



Declivital spine 3 capitate in male (e), not capitate in female (f).

22e.

22 (21): Part III Ips avulsus (Eichoff)

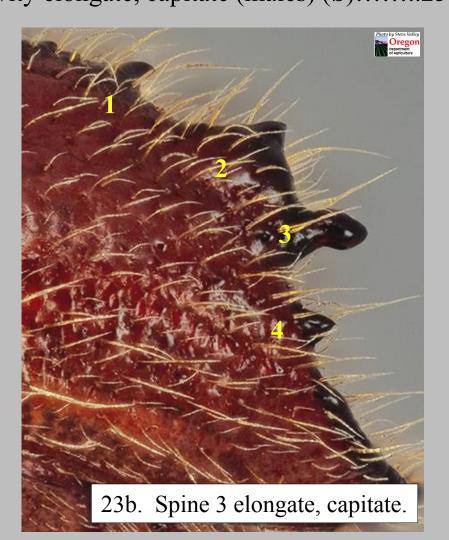


22h: Male.

23 (22)

In lateral view, spine 3 on elytral declivity conical (females) (a)......24
In lateral view, spine 3 on elytral declivity elongate, capitate (males) (b)......25

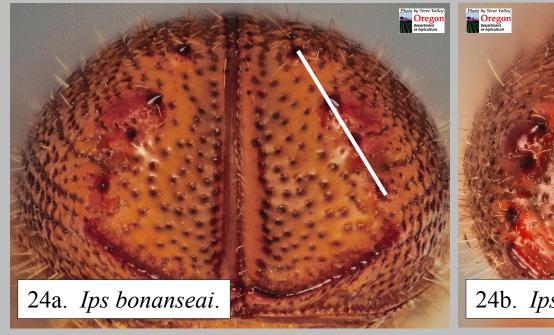


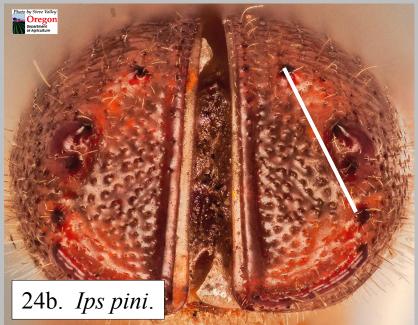


24 (23): Part I

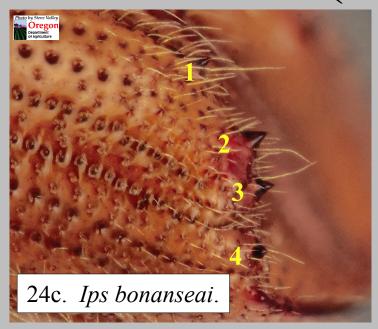
In posterior view, elytral declivital spines 2 & 3 on a line drawn between spines 1 & 4 (a); in lateral view, spines 2 & 3 shorter, smaller (c); in dorsal view, spines 2 & 3 pointed toward suture (e); portrait (g); distribution AZ & MX......

Ips bonanseai (Hopkins)

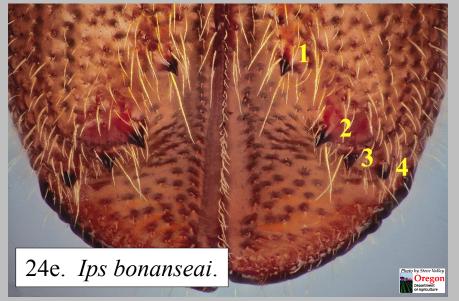


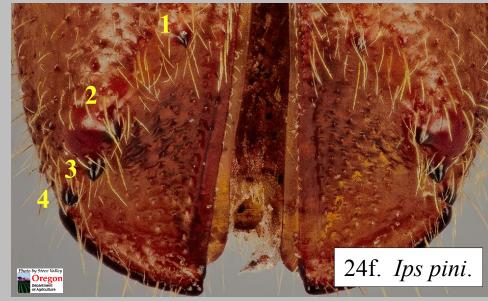


24 (23): Part II









24 (23): Part III

Ips bonanseai (Hopkins) - female

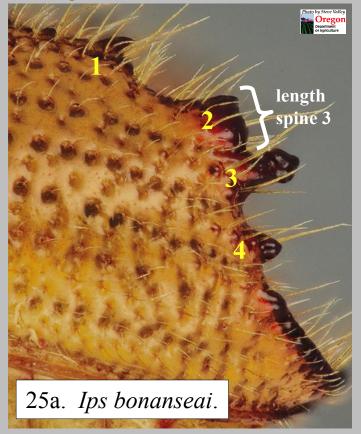


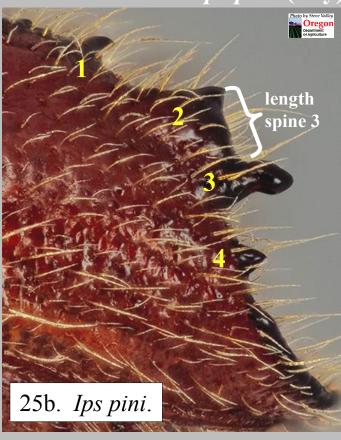
24 (23): Part IV

Ips pini (Say) - female



25 (23): Part I





25 (23): Part II

Ips bonanseai (Hopkins) - male

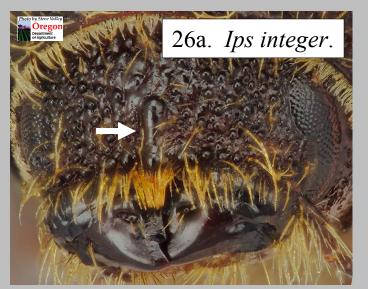


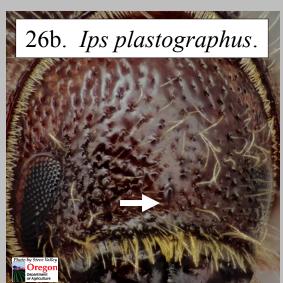
25 (23): Part III

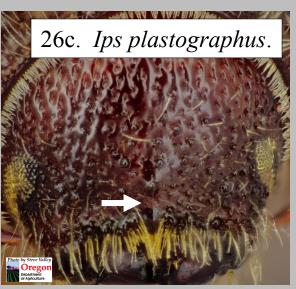
Ips pini (Say) - male



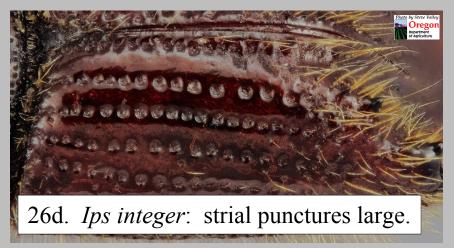
26 (21): Part I

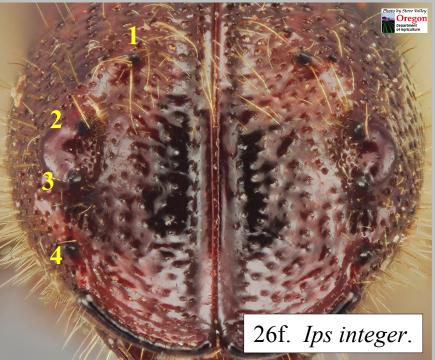


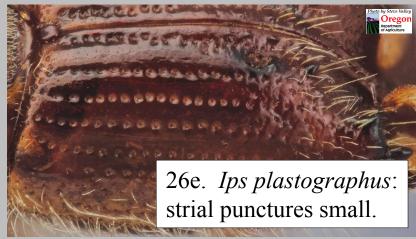


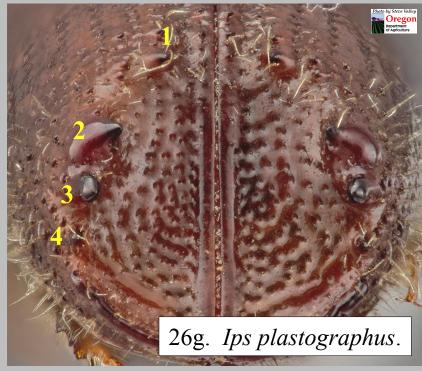


26 (21): Part II









26 (21): Part III

Ips integer (Eichoff)

26i. Male.



26 (21): Part IV

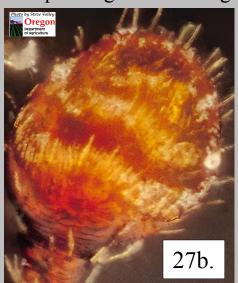
Ips plastographus (LeConte)



27 (19): Part I

Antennal club with sutures from weakly bisinuate to strongly and acutely angulate (b-d); first five elytral interstriae with setose punctures throughout length of elytra (f); female from variable, but often protruding and pilose (h-k); representative portraits (n, o)...The "4-spined fuzzies" or "pig-snouted spruce *Ips*": *I. borealis* Swaine, *I. hunteri* Swaine, *I. pilifrons* Swaine, *I. tridens* (Mannerheim), and *I. woodi* Thatcher*The species boundaries of these described species are uncertain and the characters separating them are vague at best.

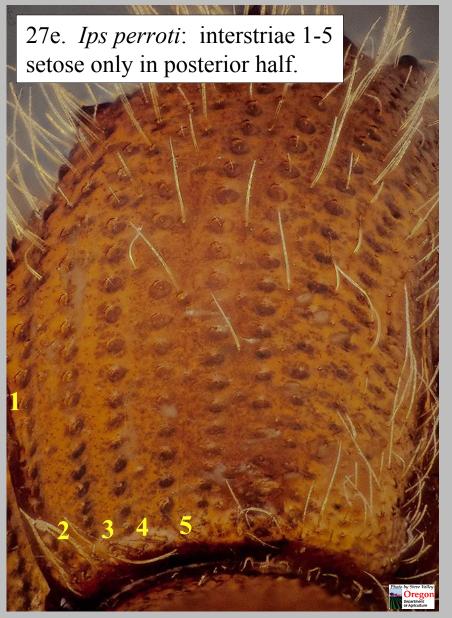








27 (19): Part II





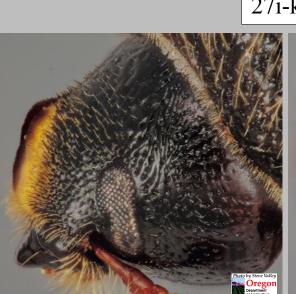
27 (19): Part III



27h. Female frons



protuberant, not pilose.







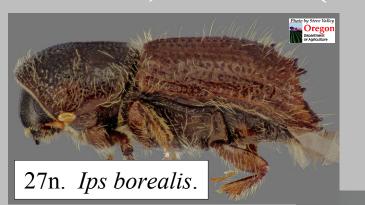
27 (19): Part IV

Ips perroti Swaine



27 (19): Part V

Ips borealis Swaine, I. hunteri Swaine, I. pilifrons Swaine, I. tridens (Mannerheim), and I. woodi Thatcher







27q. Ips tridens.



