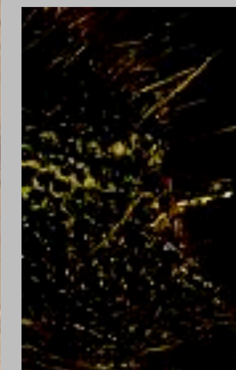
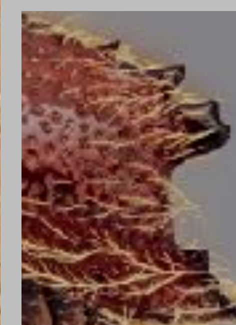
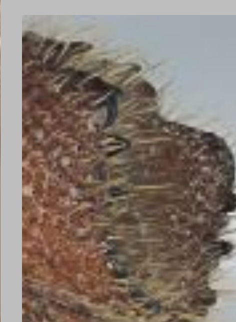



Illustrated Key to the Species of *Ips*, *Orthotomicus*, and *Pseudips* of North America (or spines, spines, and more spines)

Version 03-03-19

James R. LaBonte
Steven A. Valley
Oregon Dept. Agriculture
Salem, OR

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

Start Key

Introduction and use of this 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 LUCID™ . 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,

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, ☹️, 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:

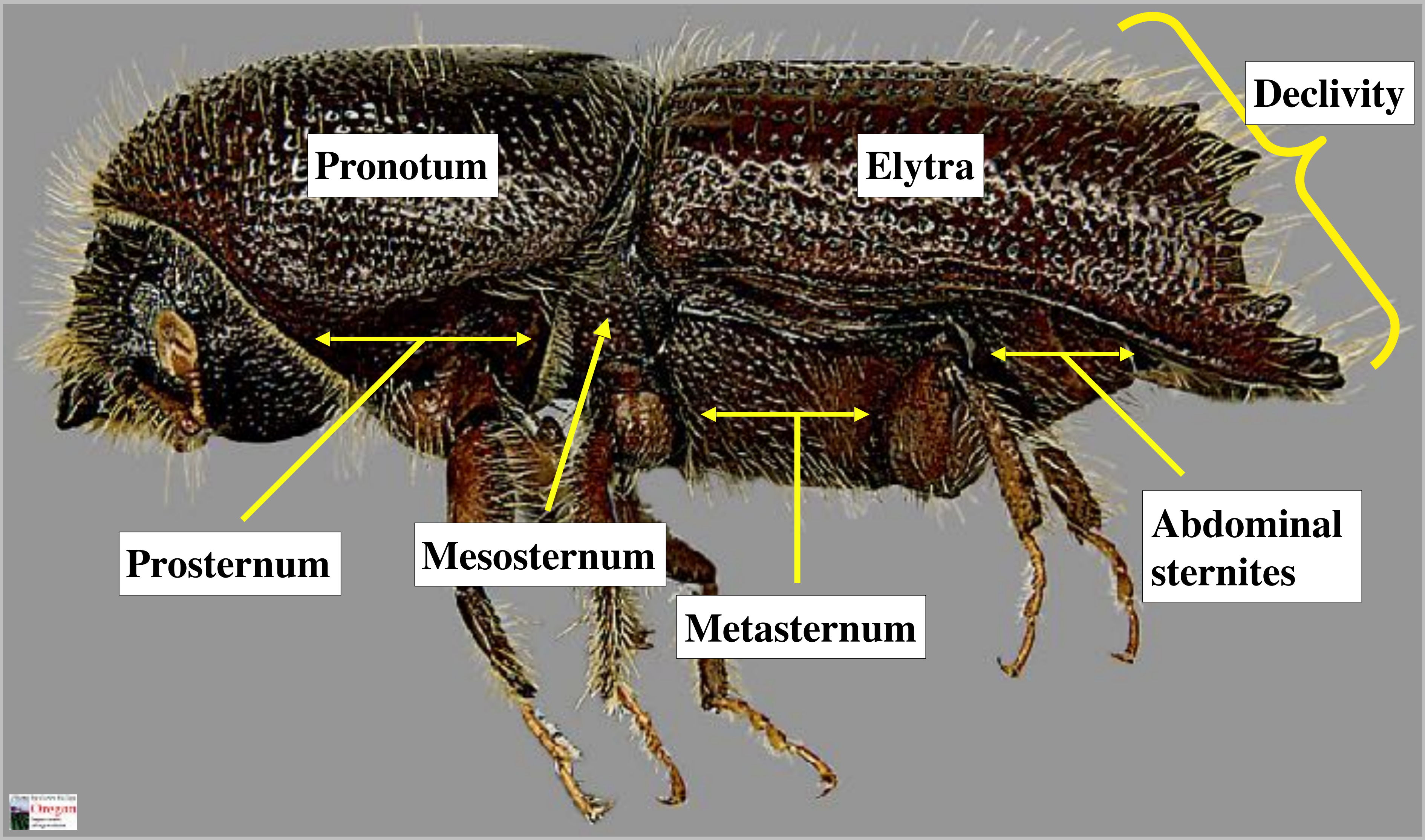
Joshua Vlach, my long-suffering colleague at Oregon Department of Agriculture, who helped borrow, prepare, and curate specimens, and, more importantly, vetted my ideas on how best to present this information.

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

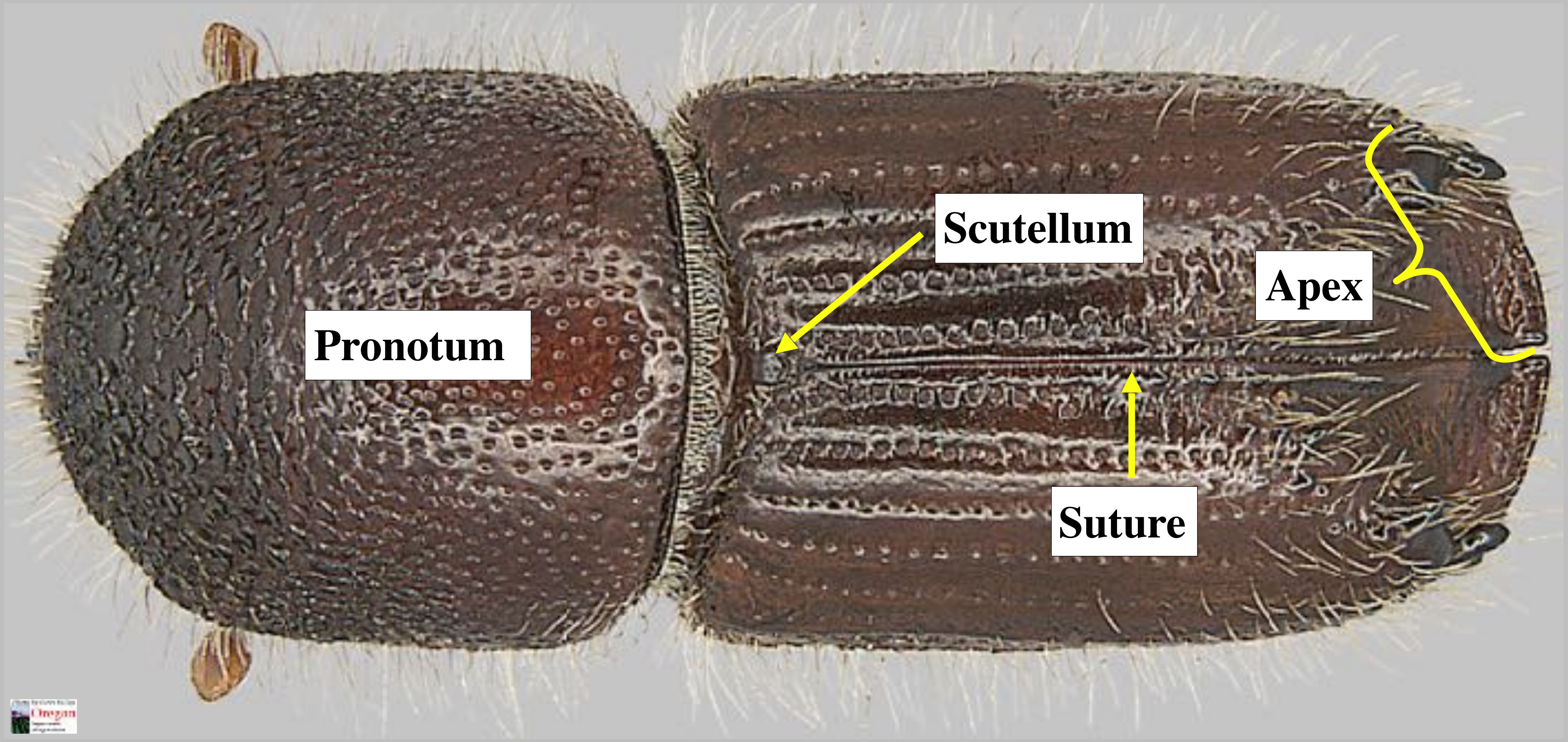
Bob Rabaglia, U.S. Forest Service, Forest Health Protection, Maryland, for bringing several species to my attention and generously loaning some as well.

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

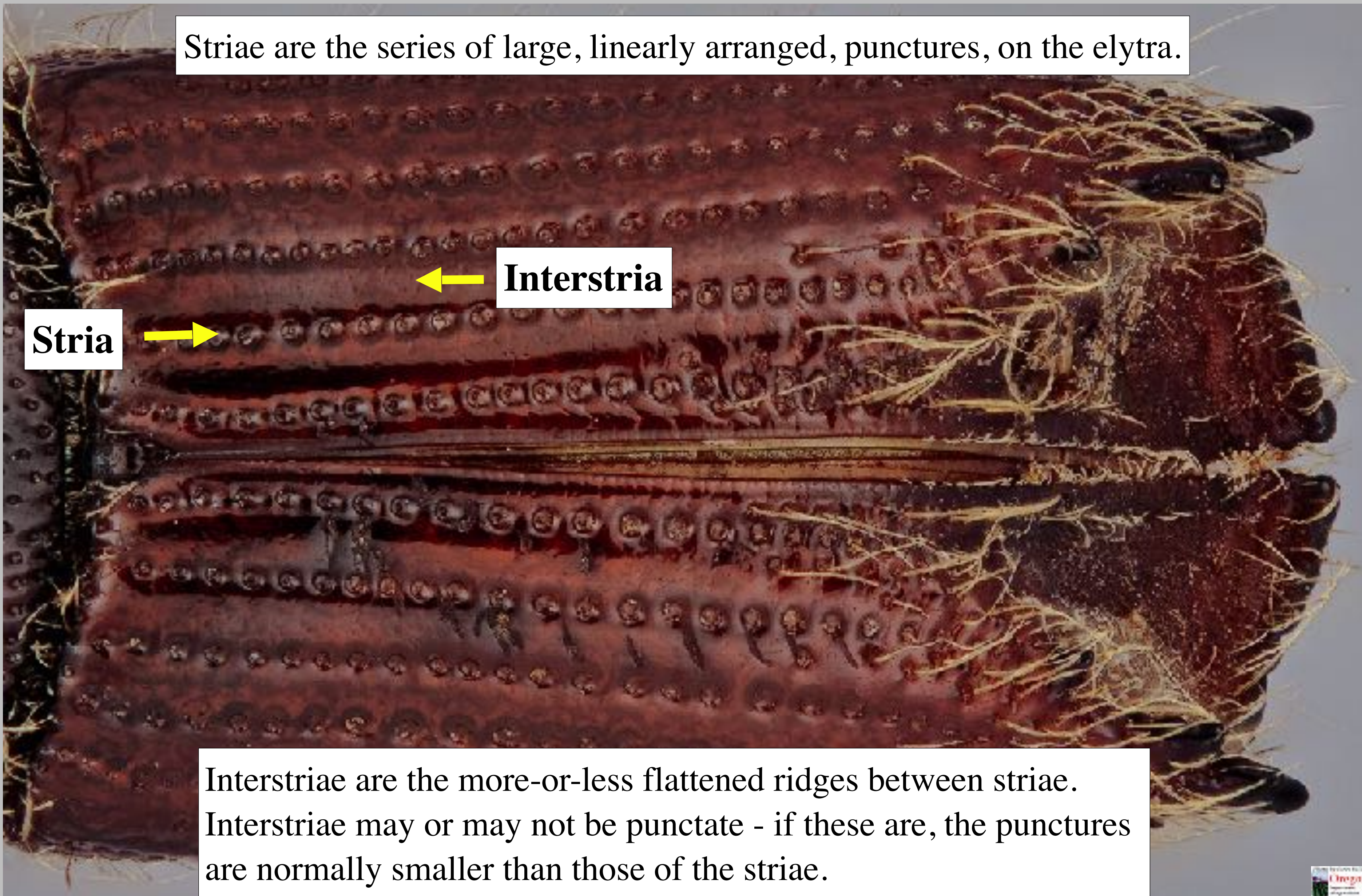
Basic body parts
Lateral view



Basic body parts
Dorsal view



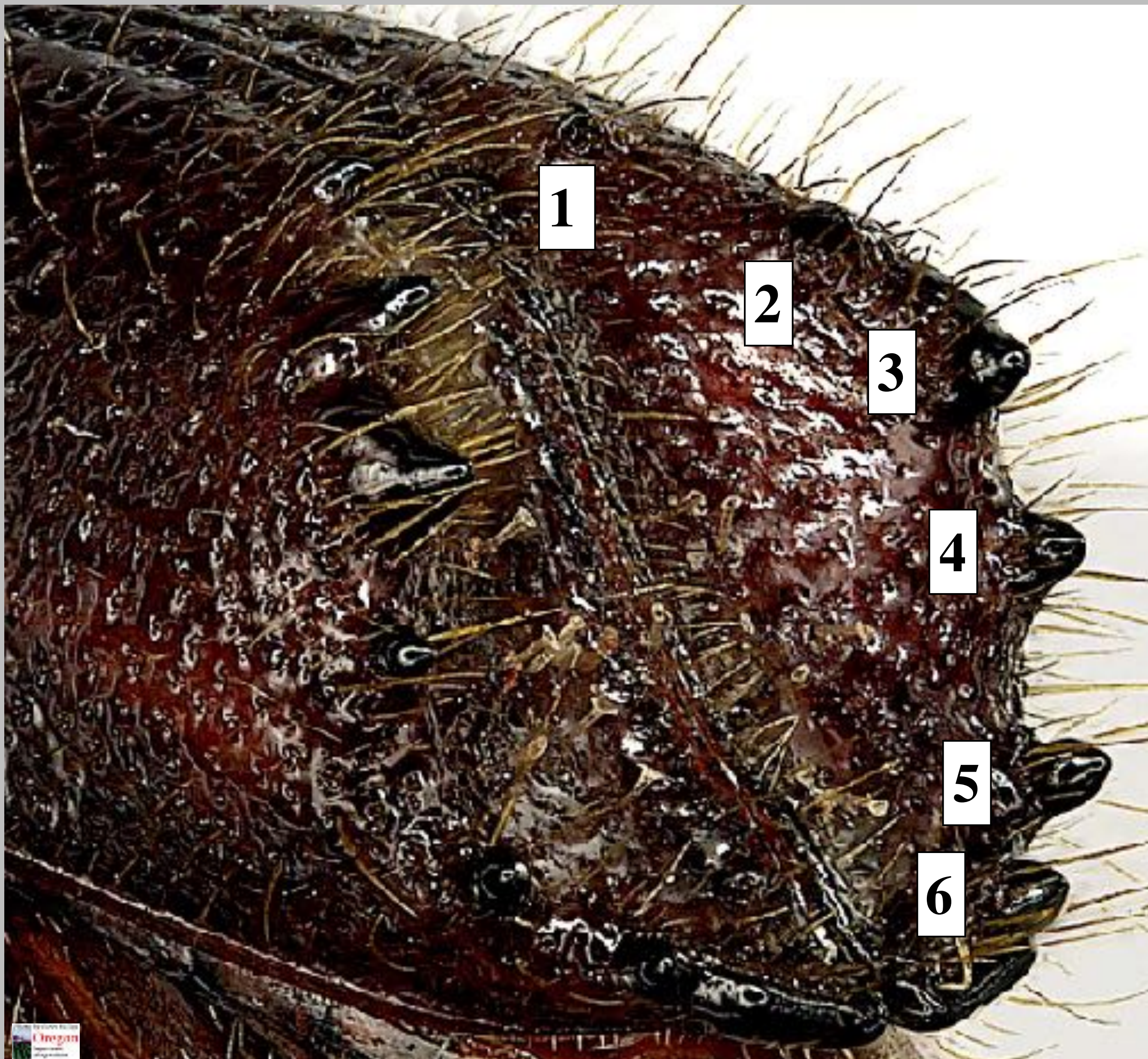
Striae and interstriae



Striae are the series of large, linearly arranged, punctures, on the elytra.

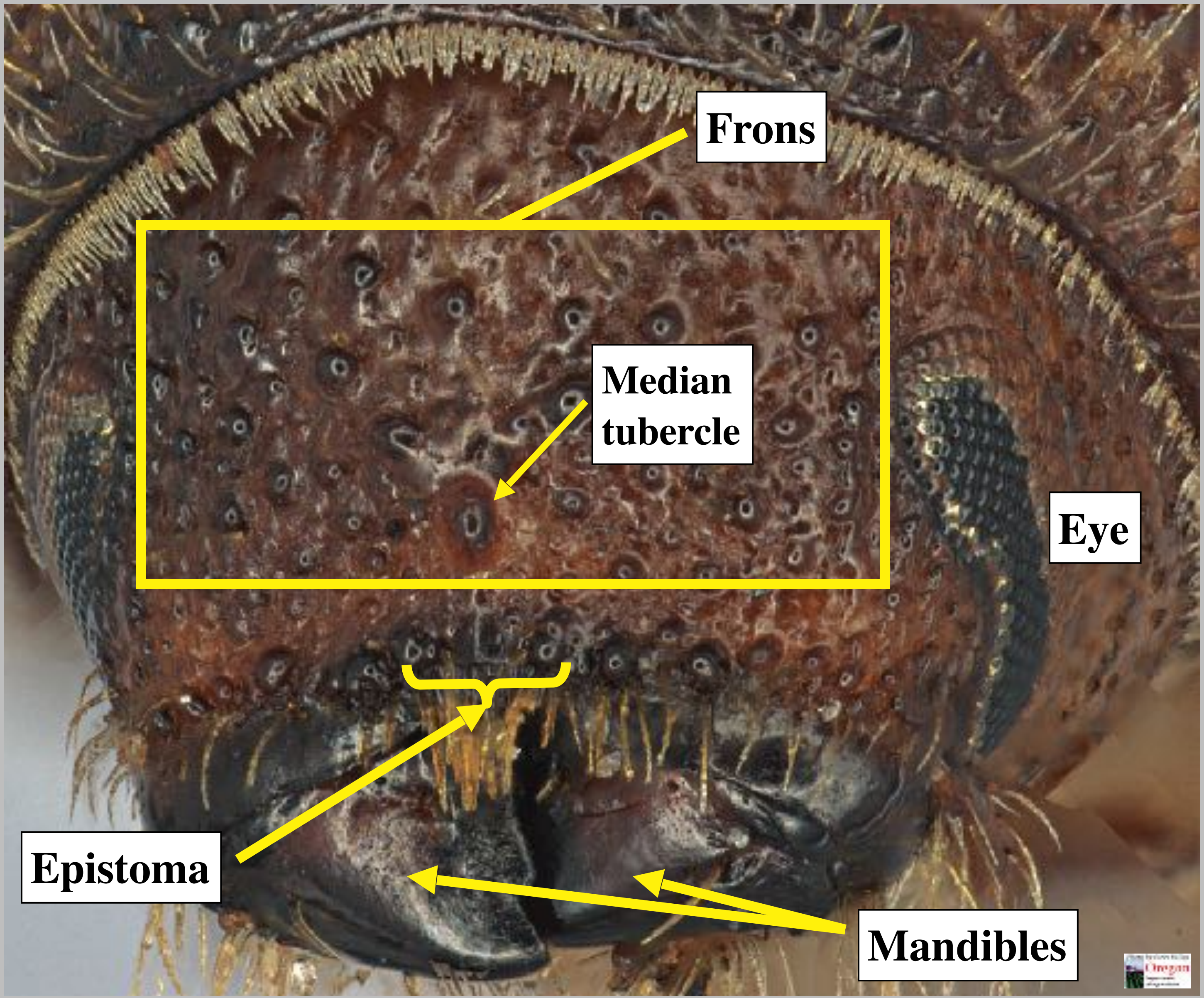
Interstriae are the more-or-less flattened ridges between striae. Interstriae may or may not be punctate - if these are, the punctures are normally smaller than those of the striae.

Counting spines

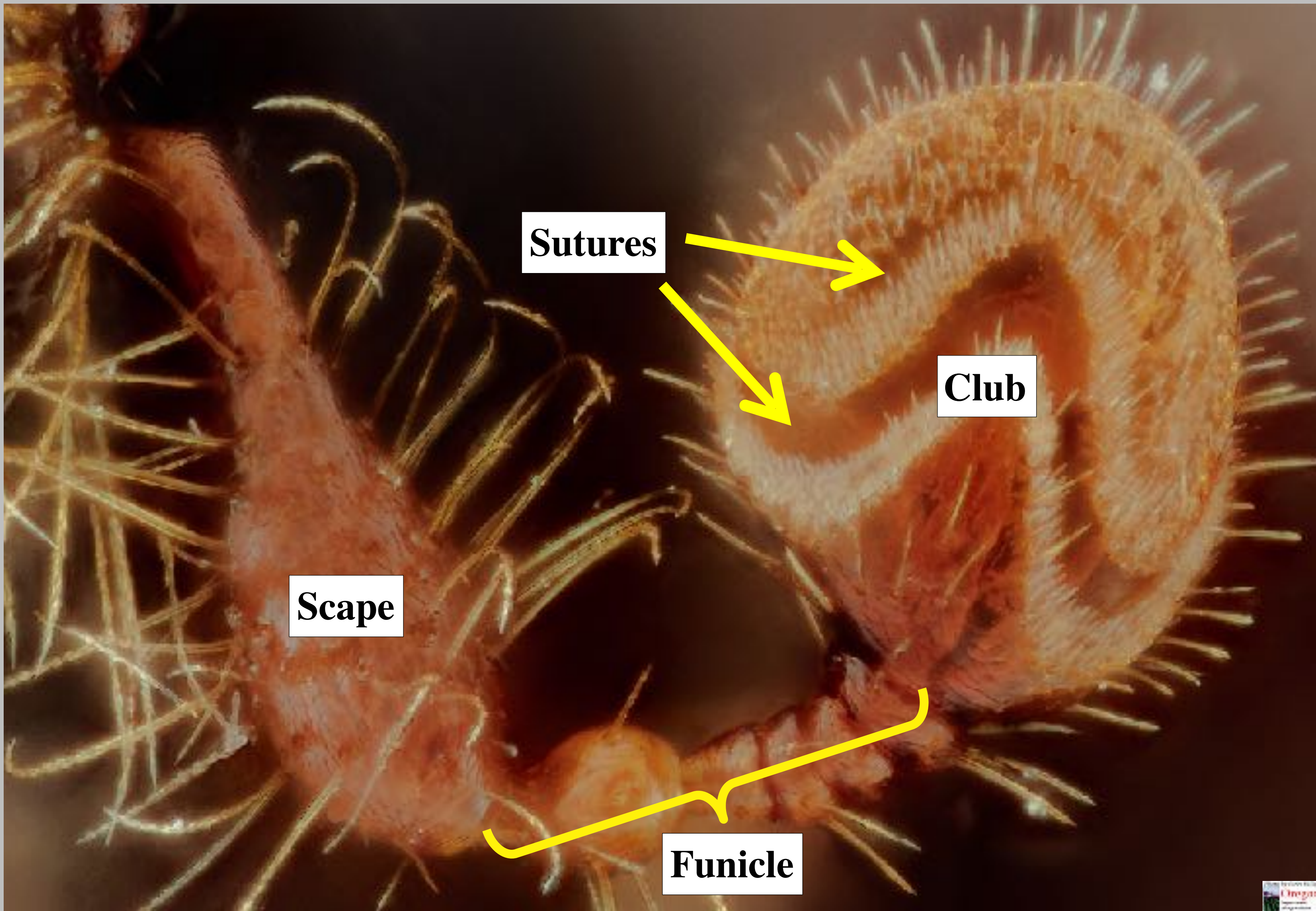


Counting the pairs of major spines on the elytral declivity of *Ips* and related bark beetles is essential for their identification. Spine pairs are numbered starting from the suture. There may be from 3 to 6 pairs. <u>Normally</u>, pair 3 is the largest. There may be pairs of minor spines near pair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

Parts of the head



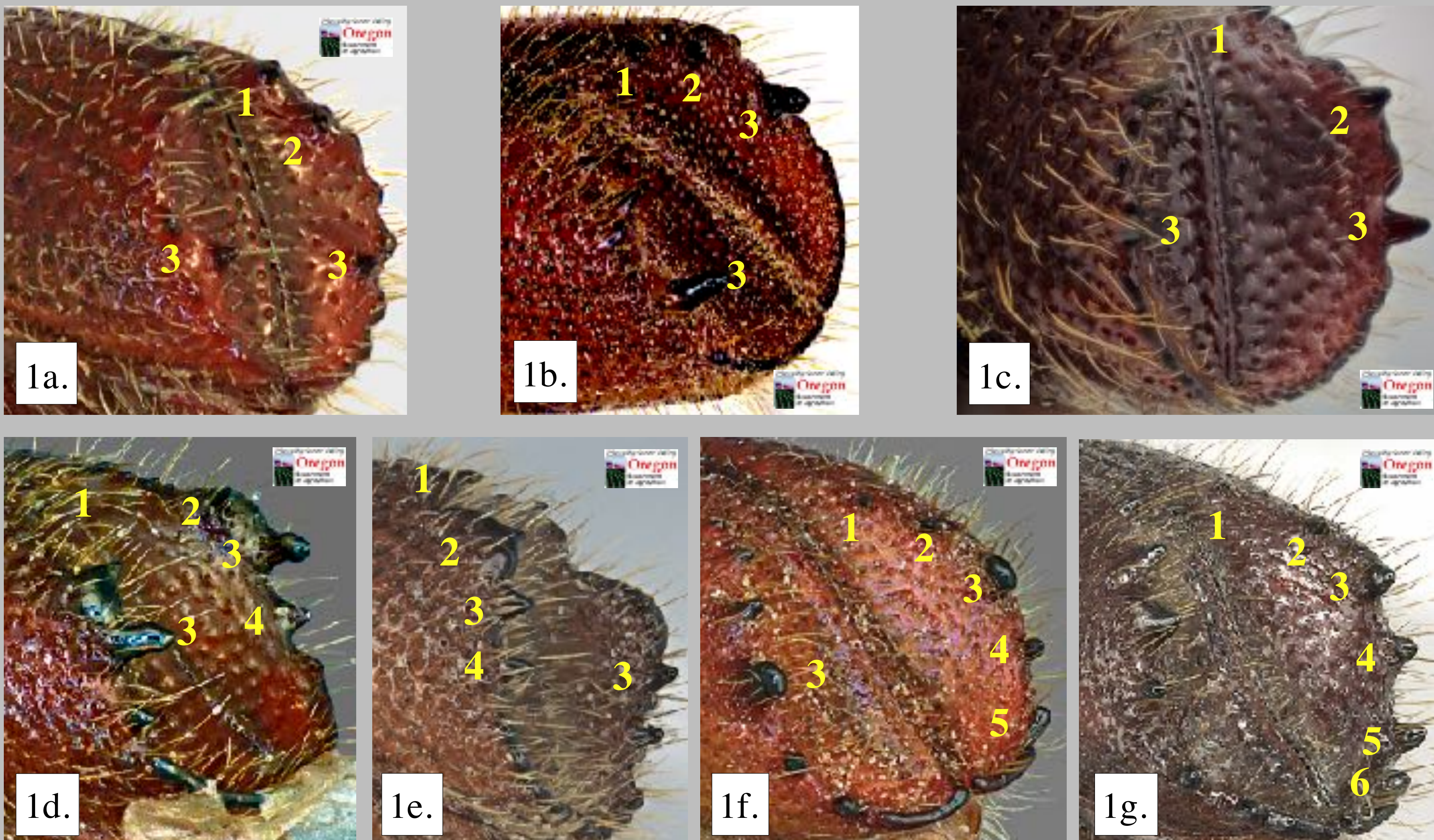
Parts of the antenna



1

Elytral declivity with 3 pairs of major spines (***numbers on images denote spine pairs**) (**a-c**)...2

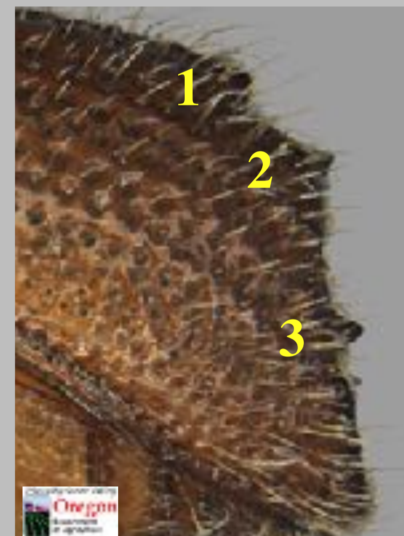
Elytral declivity with 4-6 pairs of major spines (**d-g**)..8



2 (1)

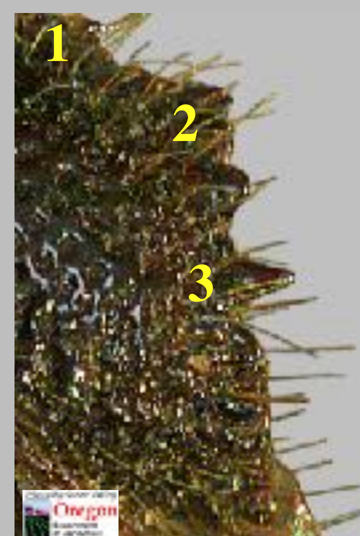
Elytral declivity with 3rd pair spines short, no longer than 2nd pair (**a-c**)……3

Elytral declivity with 3rd pair spines longer than 2nd pair (**d-f**)…………….....4



2a-c. Spines 3 no longer than spines 2.

2d-f. Spines 3 longer than spines 2.



3 (2): Part I

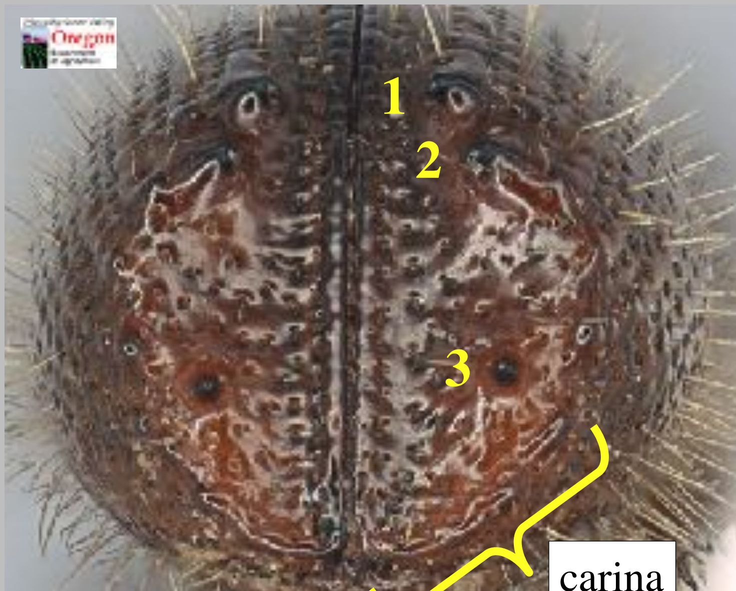
Antennal club sutures recurved (**a**); elytral declivity narrowly excavate, with lower declivital carinate margin not reaching bottom pair of spines, spines 1 and 2 approximate (2 & 3 at least twice distance between 1 and 2) (**c-d**); portraits (**g-h**)……………..……………………***Orthotomicus caelatus*** **(Eichoff)**

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**)..…………………..………..…
……………………………..………**female** ***Orthotomicus erosus*** **(Wollaston)** ☹

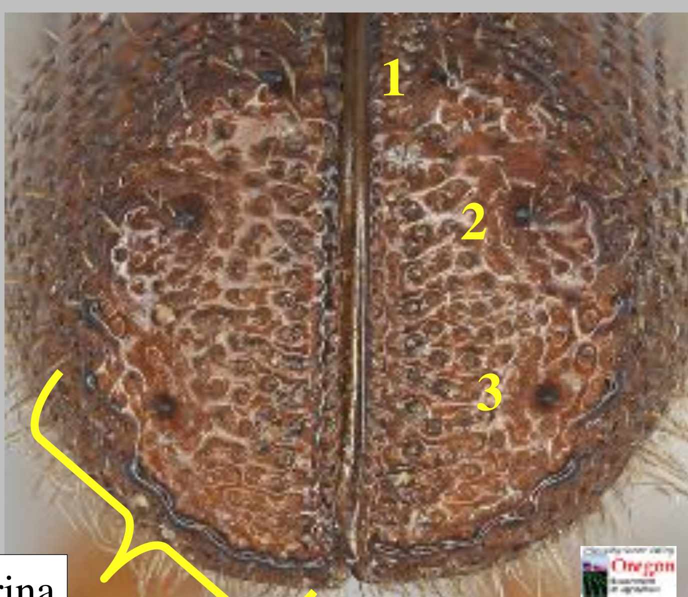
3a. *Orthotomicus caelatus*: antennal club sutures recurved.

3b. Female *Orthotomicus erosus*: antennal club sutures procurved.

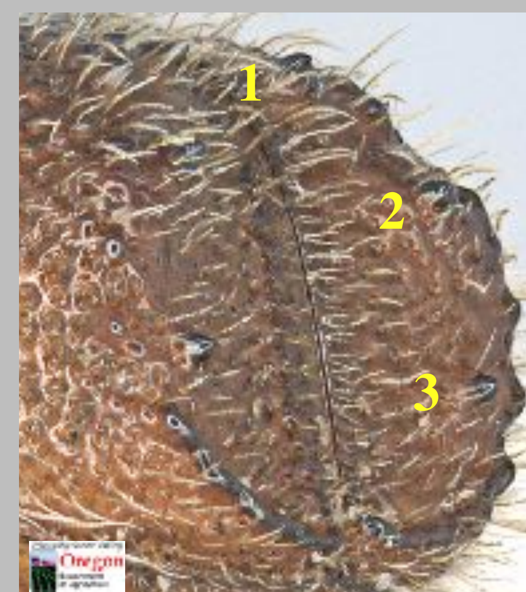
3 (2): Part II



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



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



3 (2): Part III

Orthotomicus caelatus (Eichoff)

2g. Female.

2h. Male.

3 (2): Part IV

Orthotomicus erosus (Wollaston) ☹

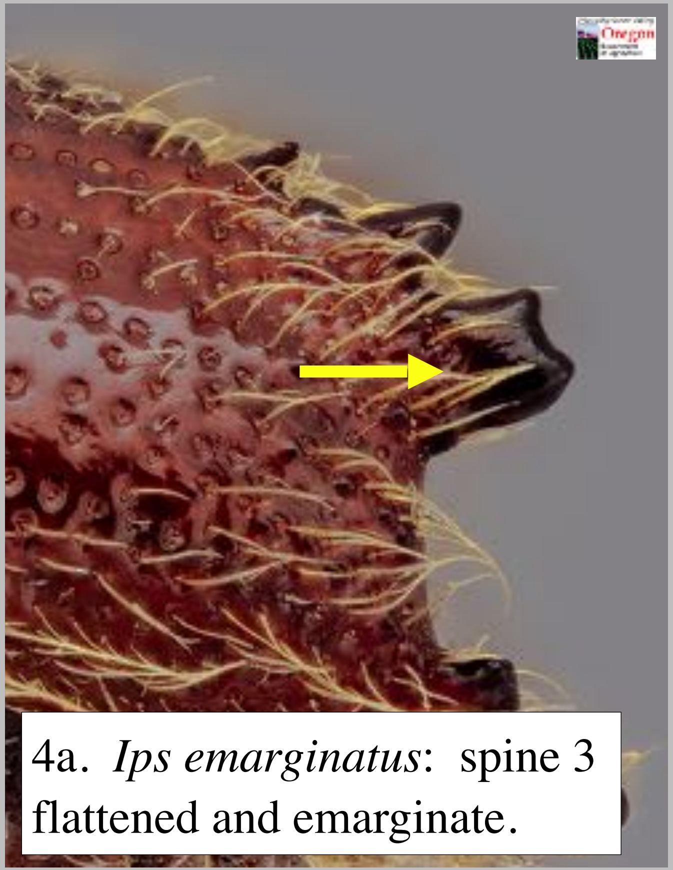
Female

4 (3): Part I

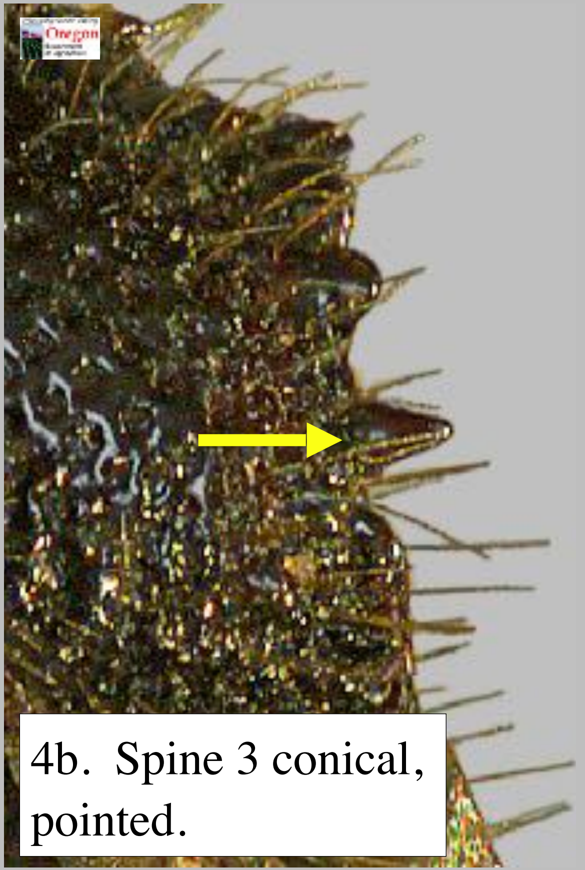
Elytral declivital spine 3 flattened, emarginate at apex (**a**); portraits (**d, e**)….
……………………………………………….*Ips emarginatus* (LeConte)*

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

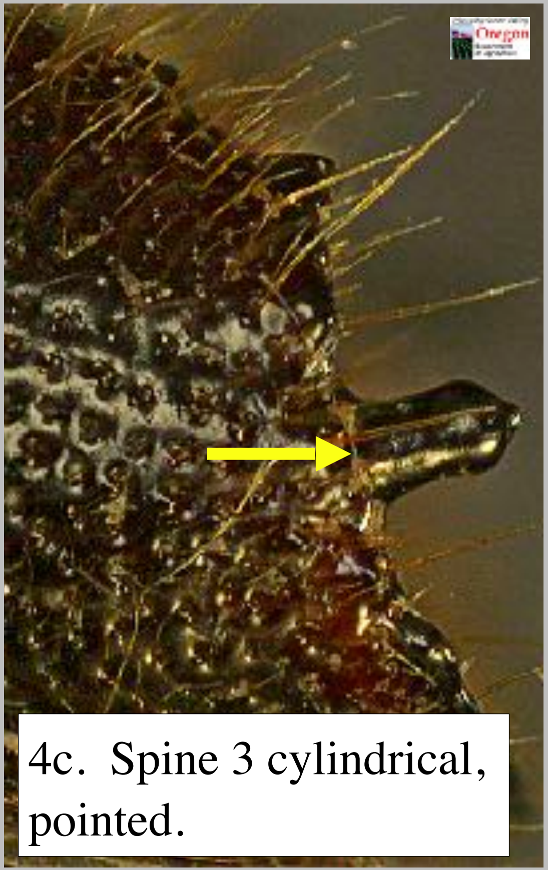
Elytral declivital spine 3 conical or cylindrical, pointed at apex (**b, c**)…..….5



4a. *Ips emarginatus*: spine 3 flattened and emarginate.



4b. Spine 3 conical, pointed.



4c. Spine 3 cylindrical, pointed.

4 (3): Part II

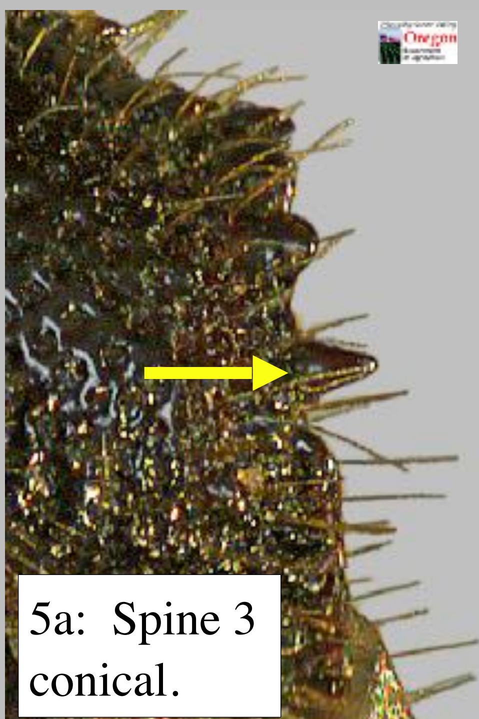
Ips emarginatus (LeConte)

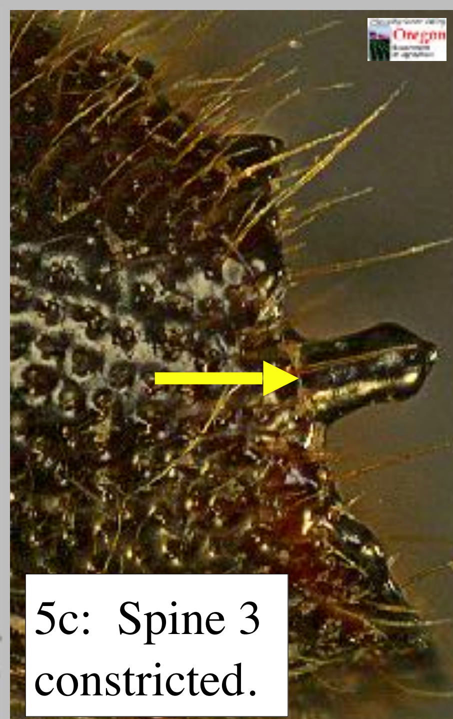
- three spined

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

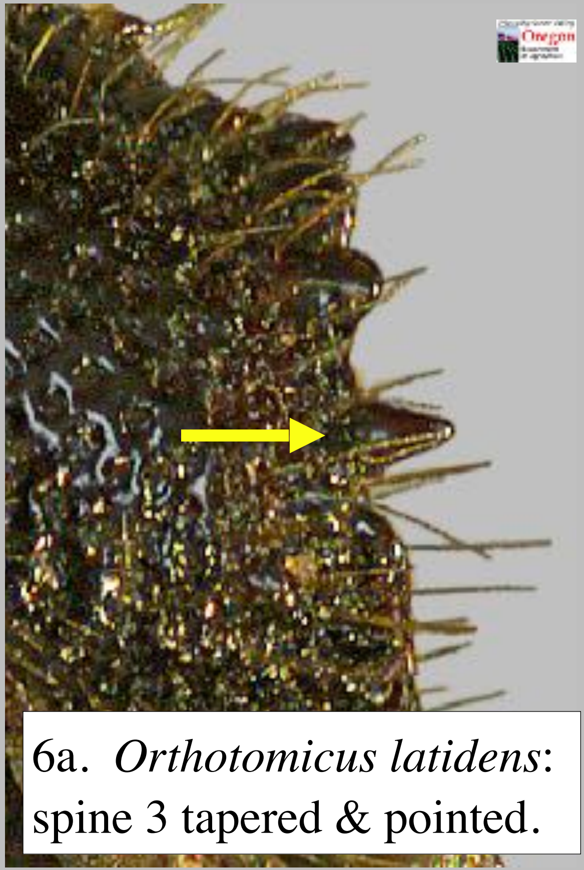




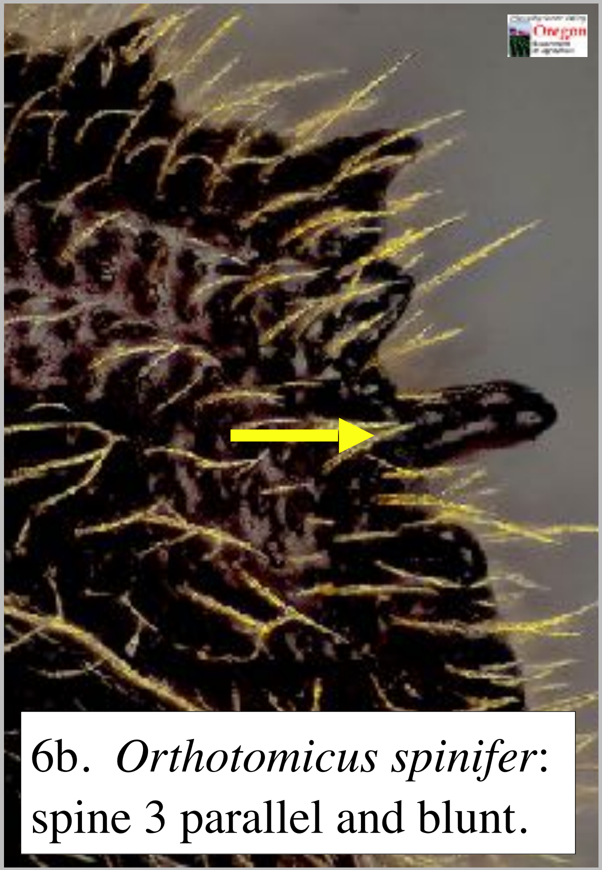
6 (5): Part I

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

Sides of elytral declivital spine 3 more or less parallel on basal 2/3 and blunt at apex (**b**); frons with a pair of large tubercles near center (**d**); portraits (**g, h**) (known only from California)……………*Orthotomicus spinifer* (Eichoff)



6a. *Orthotomicus latidens*: spine 3 tapered & pointed.



6b. *Orthotomicus spinifer*: spine 3 parallel and blunt.

6 (5): Part II

6c. *Orthtomicus latidens*:
frons without median tubercles.

6d. *Orthotomicus spinifer*:
frons with median tubercles.

6 (5): Part II

***Orthotomicus latidens* (LeConte)**

6 (5): Part III

Orthotomicus spinifer (Eichoff)

6f.

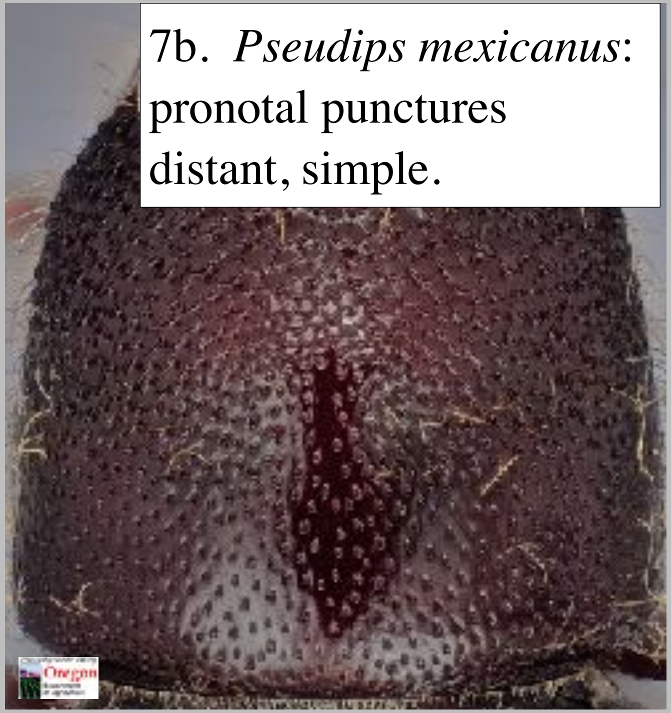
7 (5): Part I

Punctures on posterior 1/3 of pronotum closely spaced and those behind summit granulate or connected by strigose lines, pronotal pubescence more abundant, coarser (**a**); portraits (**c, d**)……………..…..…***Pseudips concinnus*** **(Manneheim)***

Punctures on posterior 1/3 of pronotum distantly spaced and those behind summit usually not granulate or connected by strigose lines, pronotal pubescence finer, apparently less abundant (**b**); portraits (**e, f**)…...***Pseudips mexicanus*** **(Hopkins)***

*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.

7a. *Pseudips concinnus*: pronotal punctures close, granulatostrigose.



7b. *Pseudips mexicanus*: pronotal punctures distant, simple.

7 (5): Part III

Pseudips concinnus (Mannerheim)

7c. Female.

7d. Male.

7 (5): Part IV

Pseudips mexicanus (Hopkins)

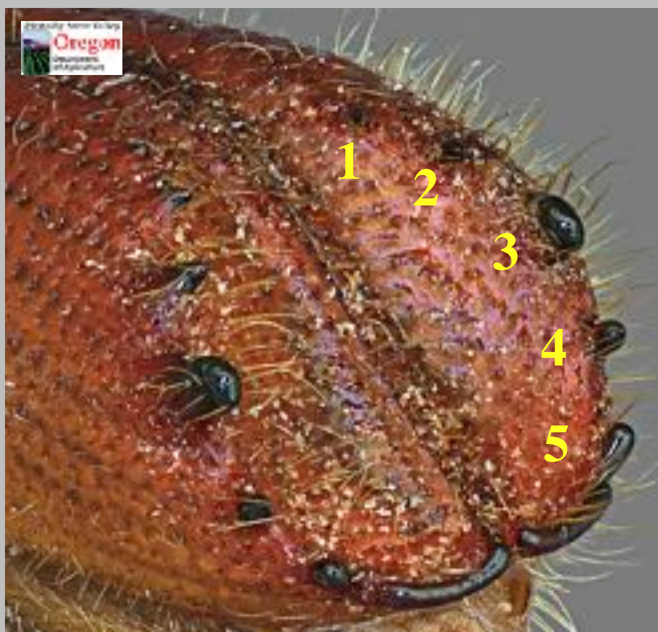
7e. Female.

7f. Male.

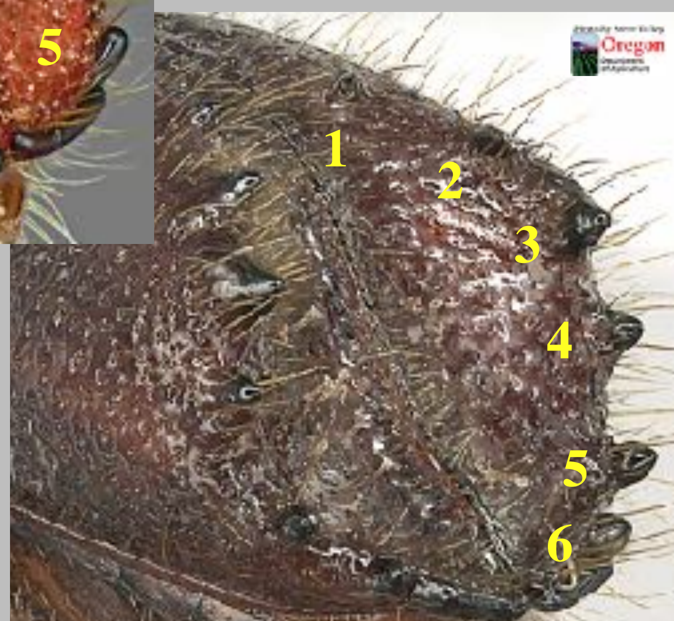
8 (1)

Lateral margins of elytral declivity with 5 (**a**) or 6 (**b**) pairs of spines……9

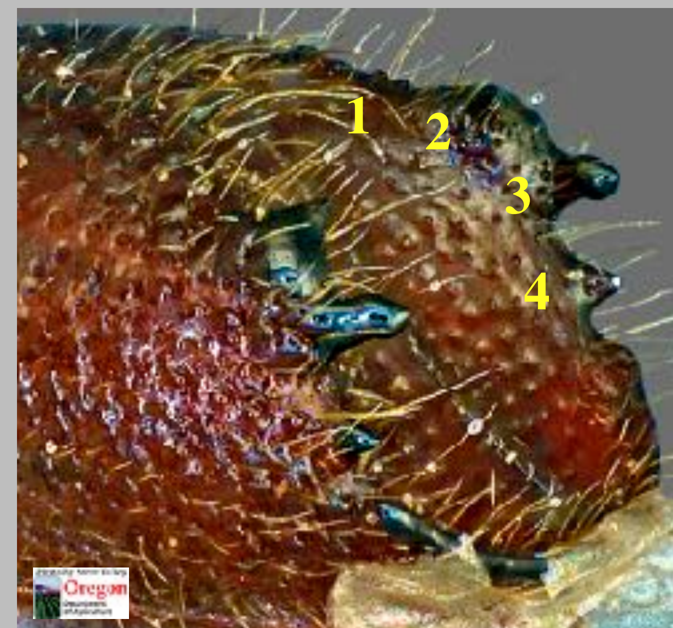
Lateral margins of elytral declivity with 4 pairs of spines (**c**)……………15



8a. 5 pairs spines.



8b. 6 pairs spines.



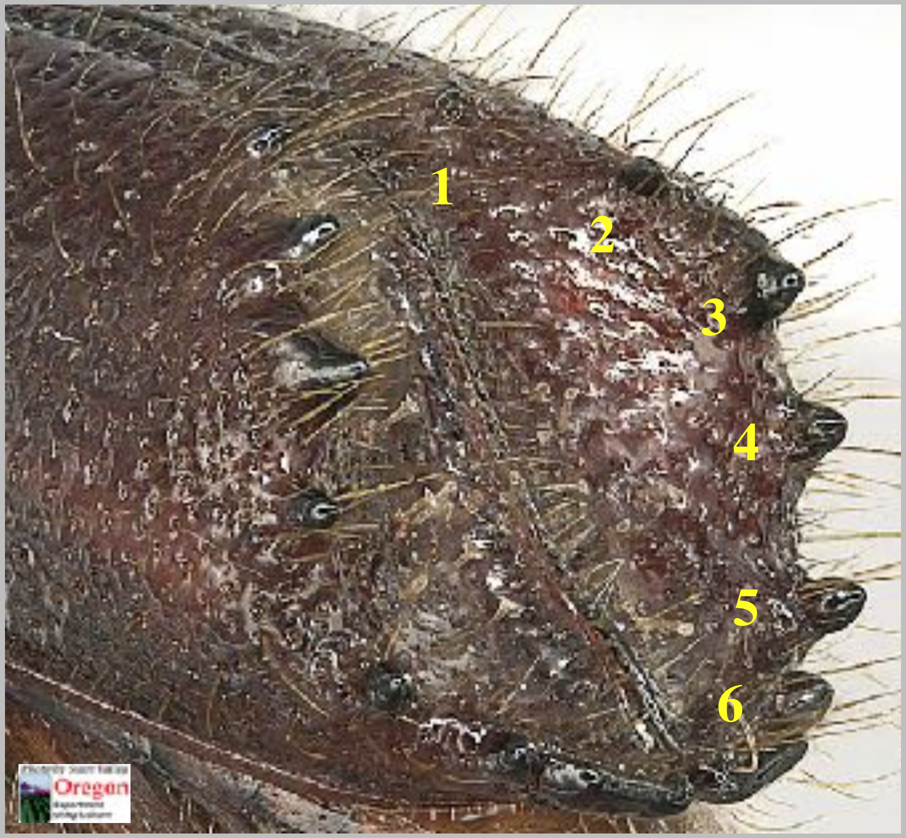
8c. 4 pairs spines.

9 (8)

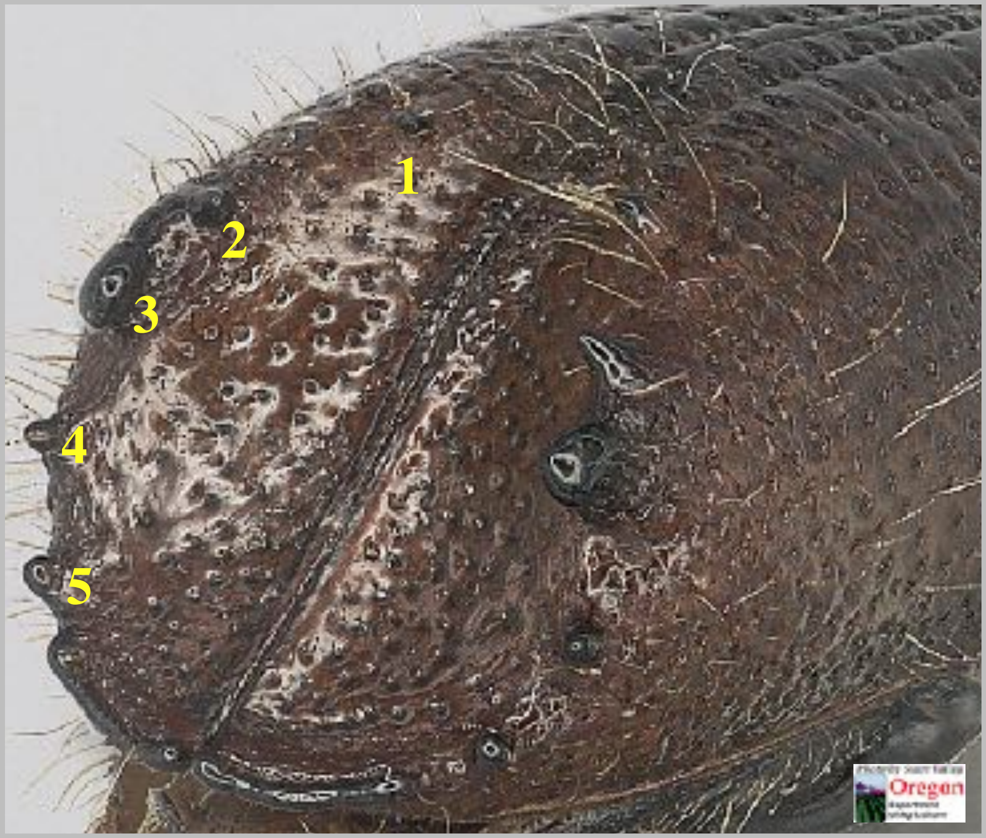
Lateral margins of elytral declivity with 6 pairs of spines (**a**)….10

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.



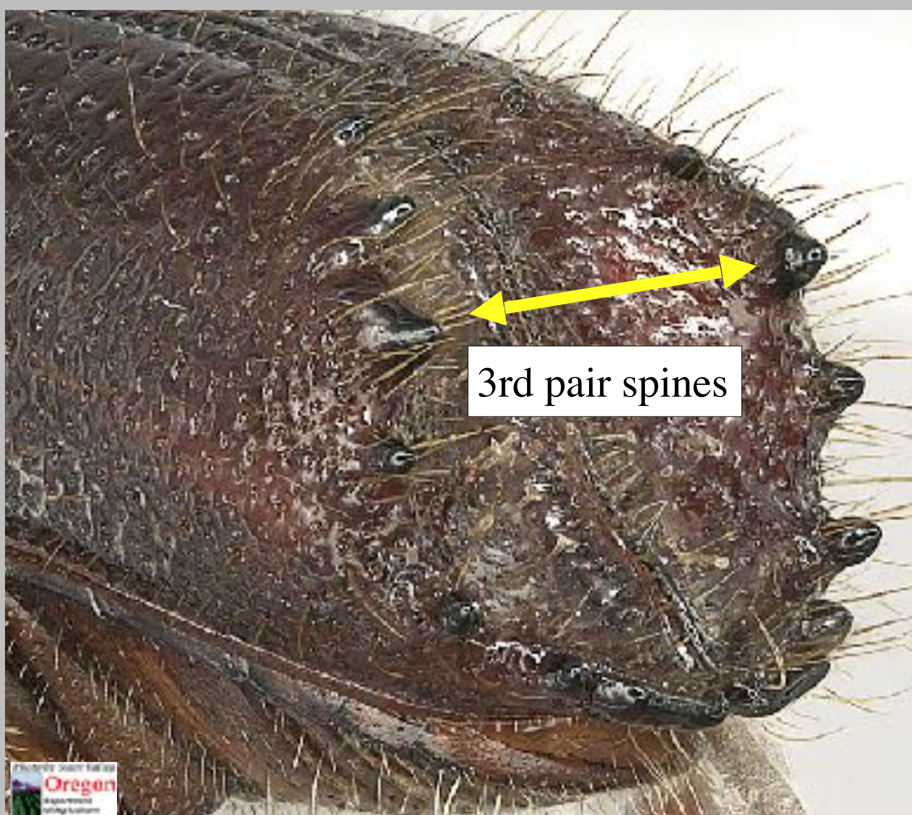
10 (9): Part I

3rd pair of declivital spines largest (**a**); frons without a raised line above the median tubercle (**c**); larger, 5.5-8.2 mm in length; portrait (**e**)…..*Ips calligraphus* **(Germar)**

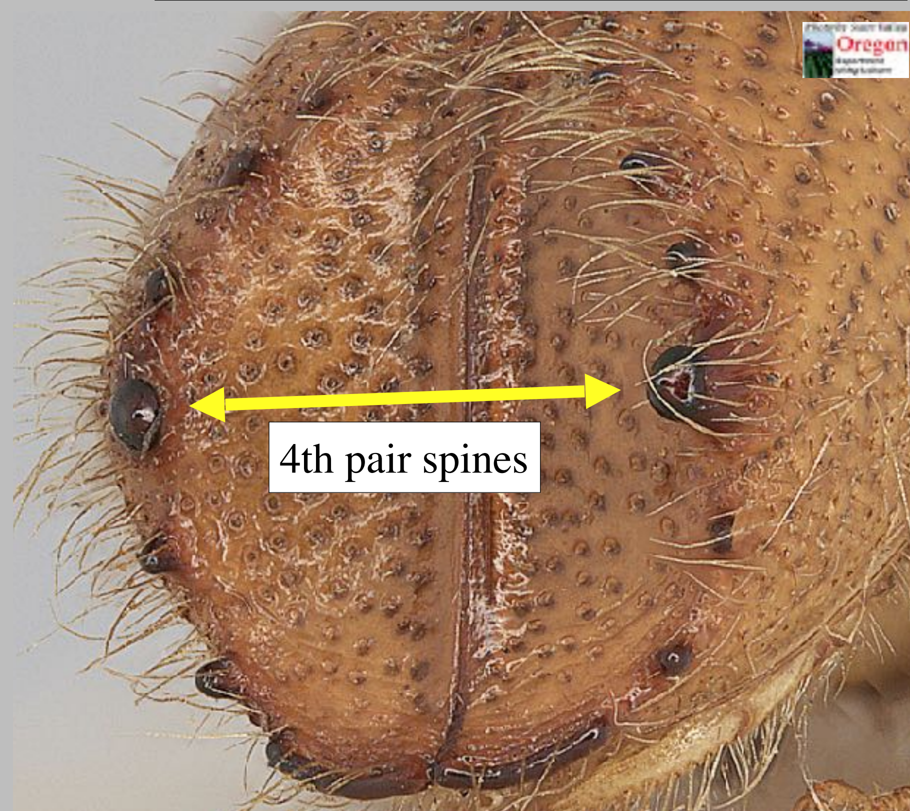
**Ips apache* Lanier, from s. AZ & MX, can only be reliably distinguished via DNA.

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**)………………
…………………………………………………………………......*Ips sexdentatus* **(Boerner)** ☹

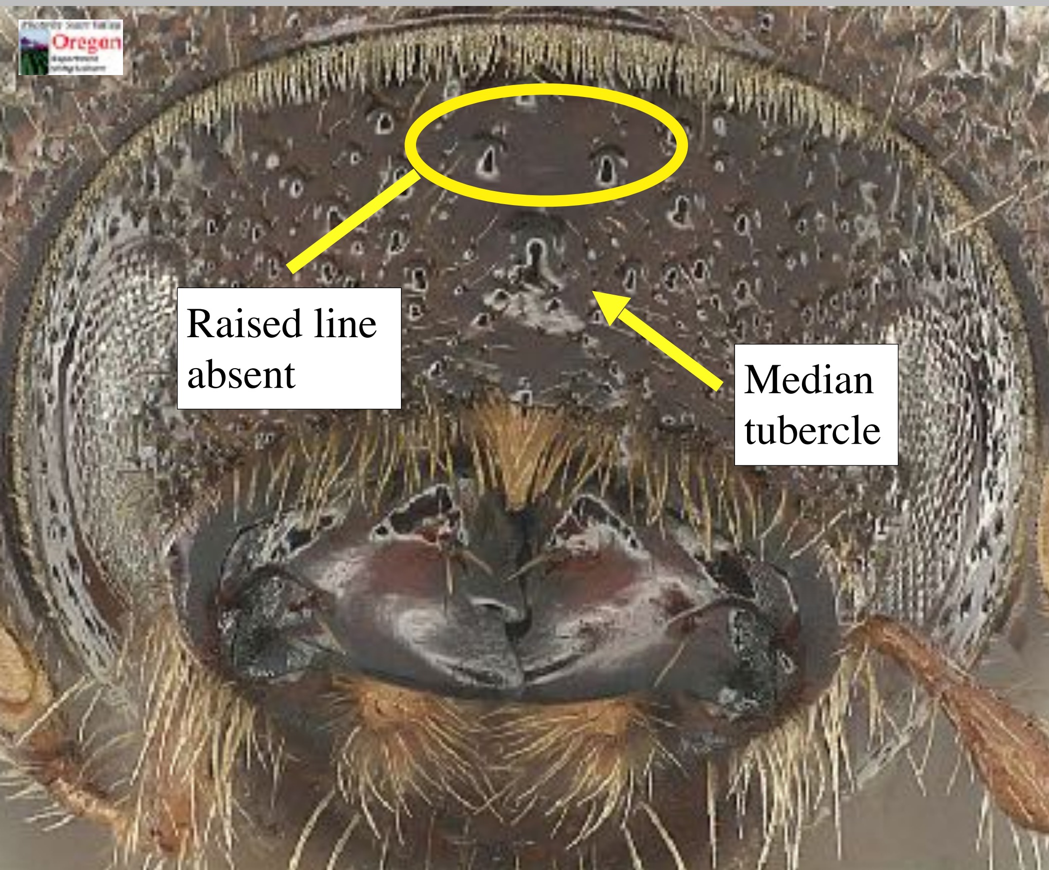
10a. 3rd pair declivital spines largest.



10b. 4th pair declivital spines largest.

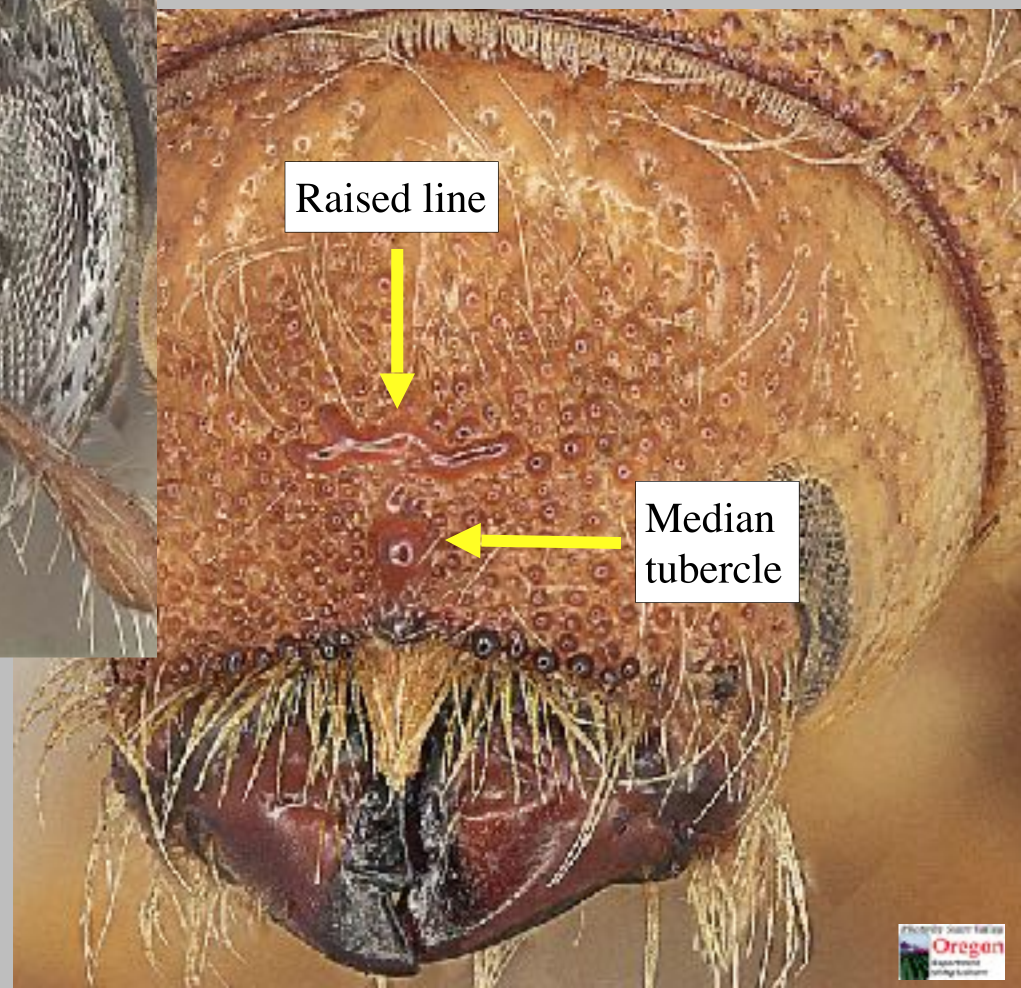


10 (9): Part II



10c. Frons without transverse raised line above median tubercle.

10d. Frons with transverse raised line above median tubercle.



10 (9): Part III

Ips calligraphus (Germar)

10e.

10 (9): Part IV

Ips sexdentatus (Boerner) ☹

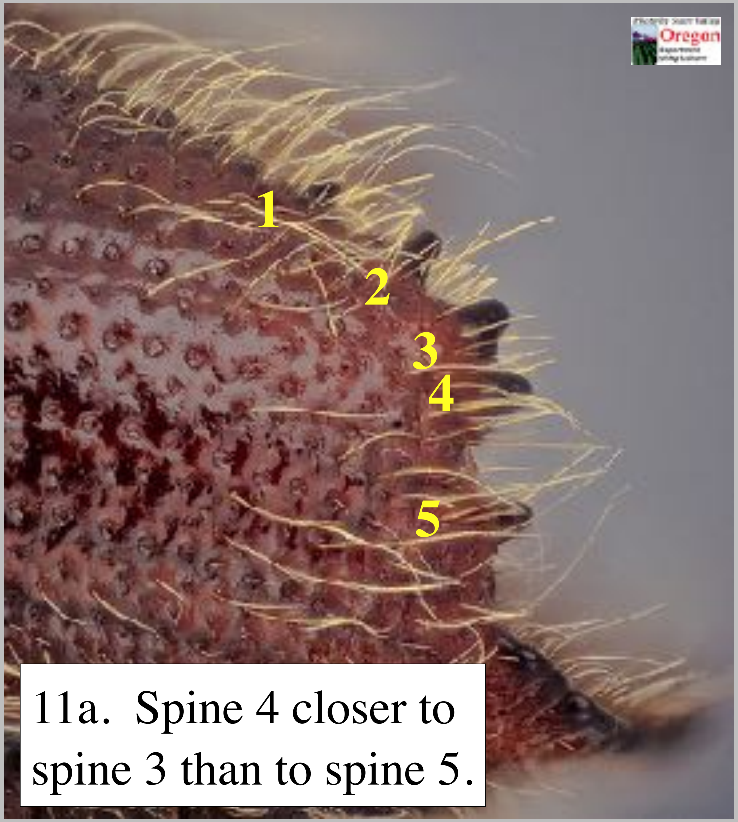
10f.

11 (9): Part I

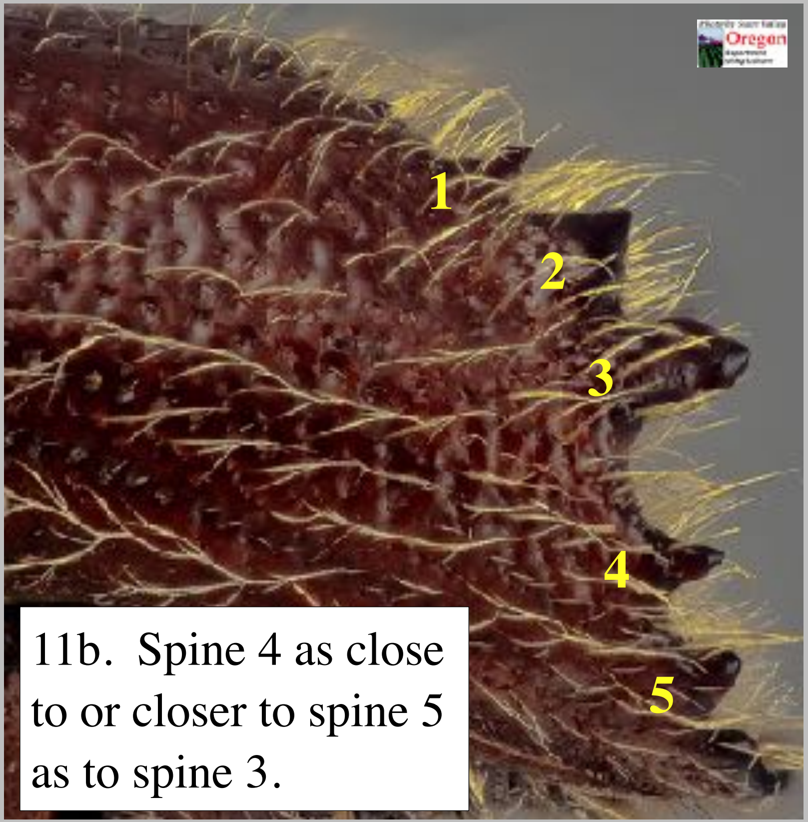
Elytral declivital spine 4 closer to spine 3 than to spine 5 (**a, c**); declivital surface dull (**c**); portrait (**e**)……..………………………*Ips knausi* **Swaine***

*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.

Elytral declivital spine 4 as close or closer to spine 5 as to spine 3 (**b, d**); declivital surface shiny (**d**)…………………………………………………12

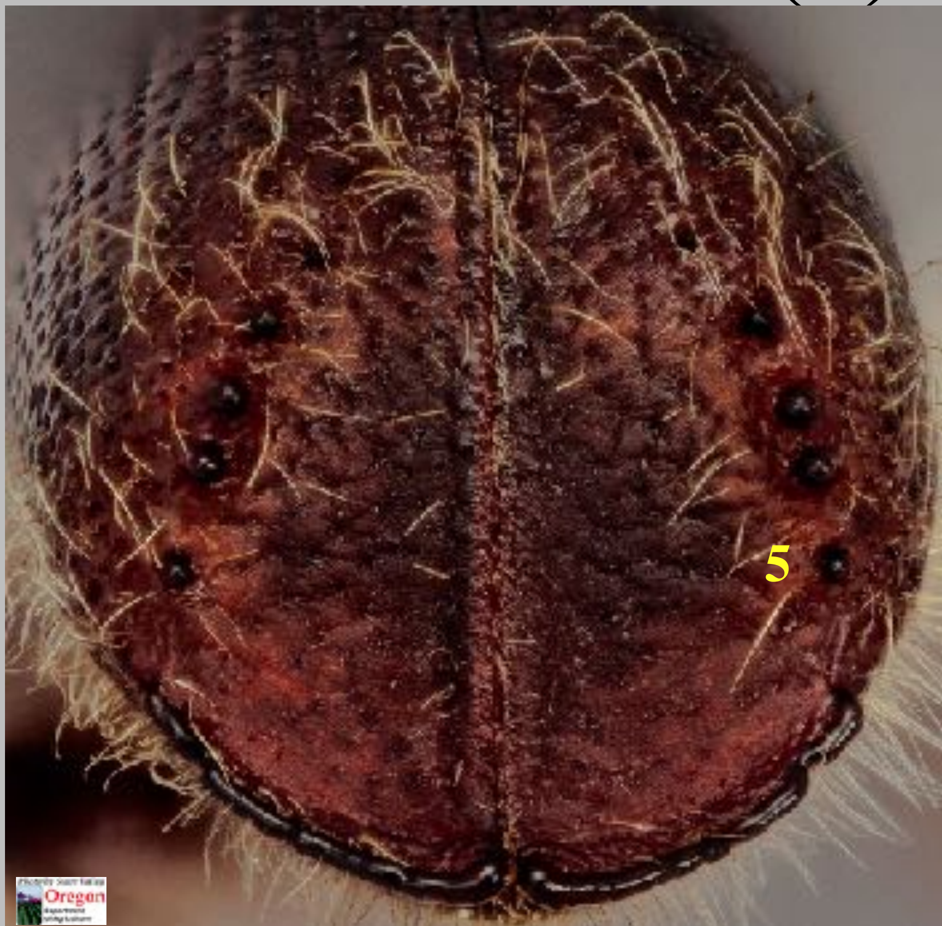


11a. Spine 4 closer to spine 3 than to spine 5.



11b. Spine 4 as close to or closer to spine 5 as to spine 3.

11 (9): Part II



11c. Elytral declivital surface dull.

11d. Elytral declivital surface shiny.

11 (9): Part III

Ips knausi Swaine*

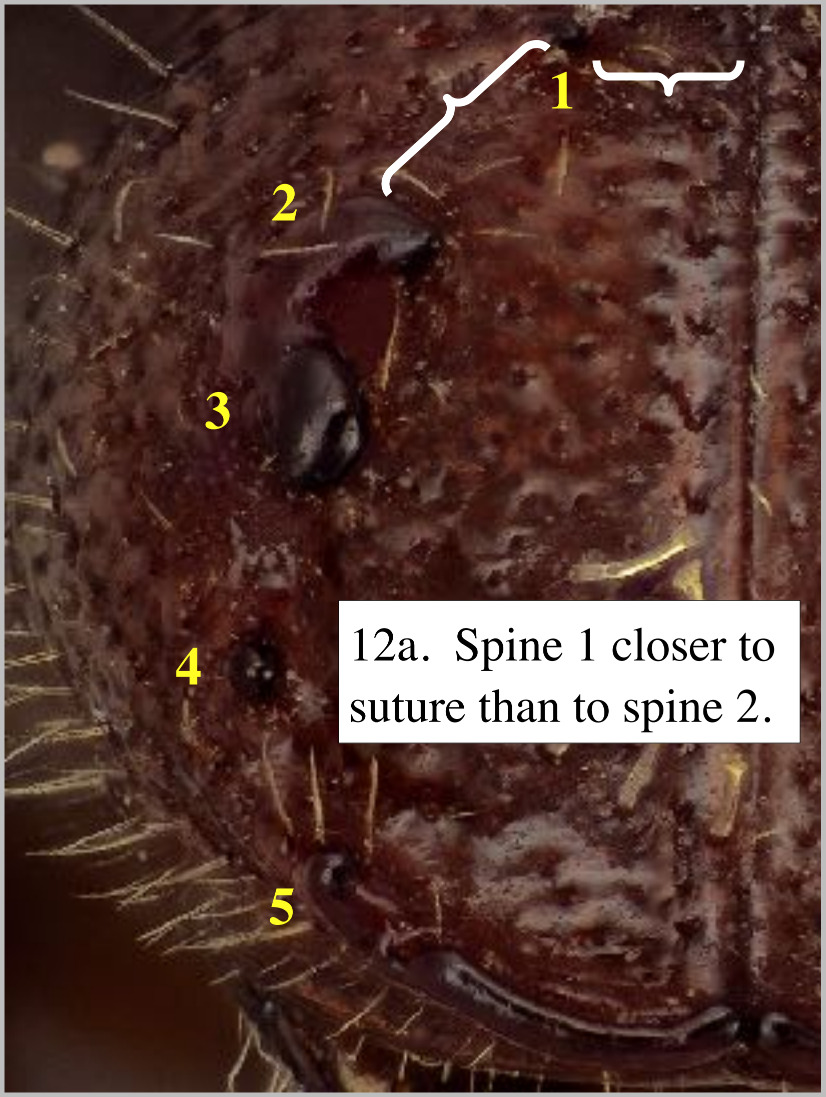
"5-spined"

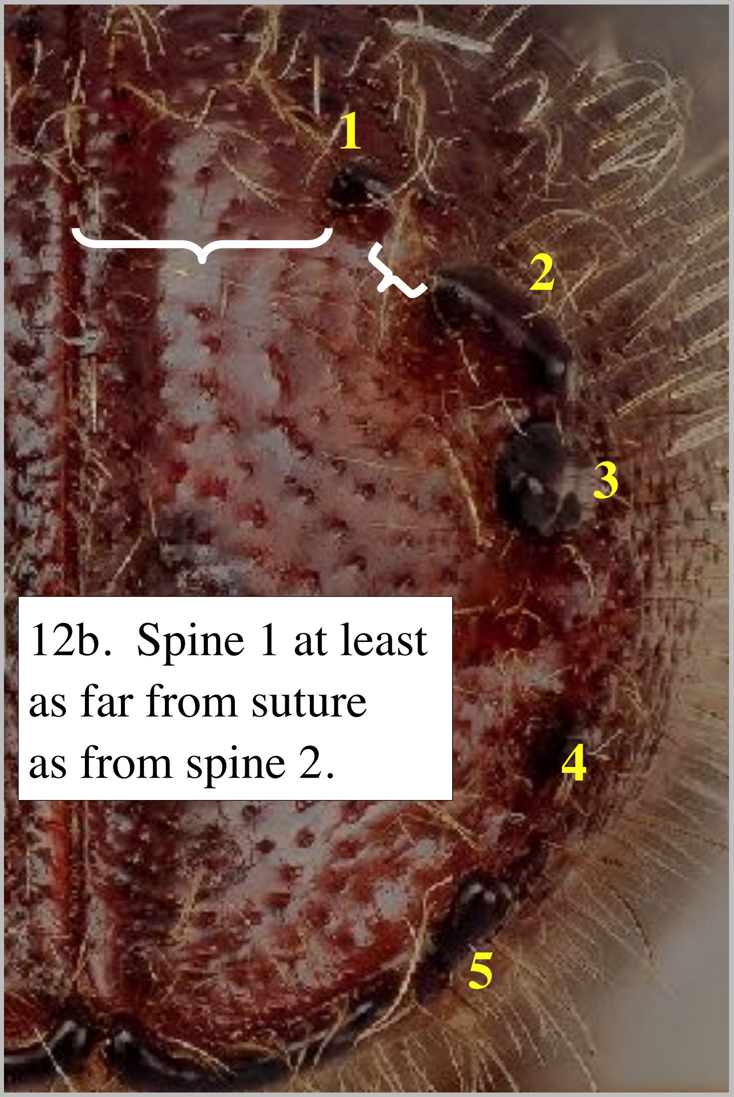
11e.

12 (11) I

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





12 (11) II

Ips grandicollis is now in the West: Idaho, Montana, & Utah. Existing *Ips* keys do not explicitly compare this species to the western "5-spiners". Although we have no images yet of the relevant characters, here is a list of character states to do so.

I. grandicollis

1. Lateral frons sparsely tuberculate, tubercles well separated.
2. Strial punctures much larger (esp. stria 1), (due to interstrial compression, these <u>appear</u> quadrate) and more-or-less contiguous, ~4 times the diameter of the interstrial punctures.
3. The interstriae just anterior of the elytral declivity have just a few low spines, so the interstriae and striae are clearly distinguished.
4. The first declivital spine is in the middle of of interstria 2.
5. The interstriae are <u>most often</u>, but not always, smooth and flat or slightly convex.

Western "5-spined" *Ips*

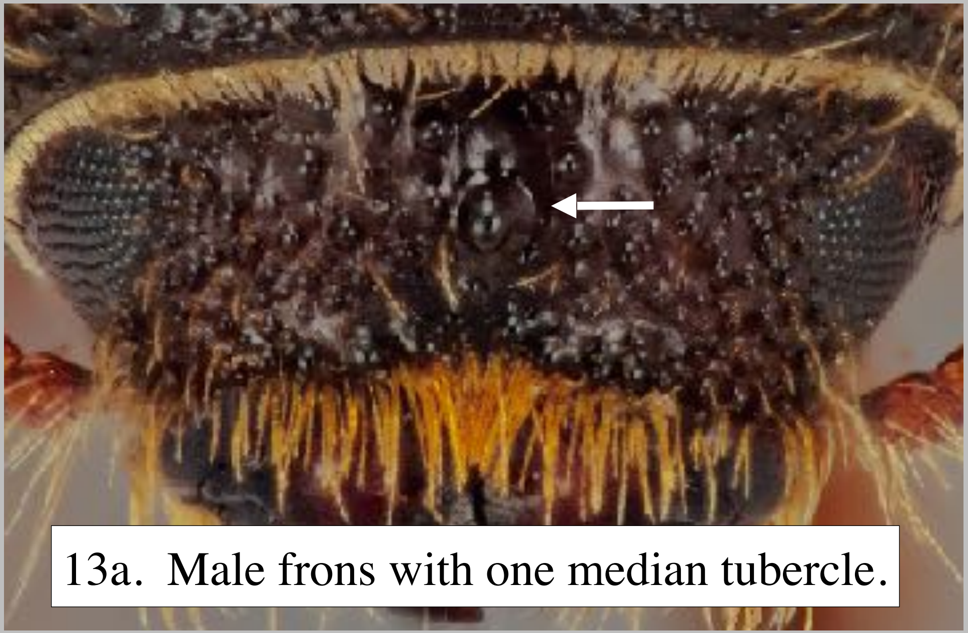
1. Lateral frons densely tuberculate, tubercles more-or-less contiguous.
2. Strial punctures much smaller (esp. stria 1) and well separated, all appear more-or-less round, ~twice the diameter of the interstrial punctures.
3. The interstriae just anterior of the elytral have many low spines, so distinguishing the interstriae and striae is difficult.
4. The first declivital spine is in interstria 3, although it is often shifted toward stria 2.
5. The interstriae are <u>most often</u>, but not always, distinctly wrinkled and convex.

13 (12): Part I

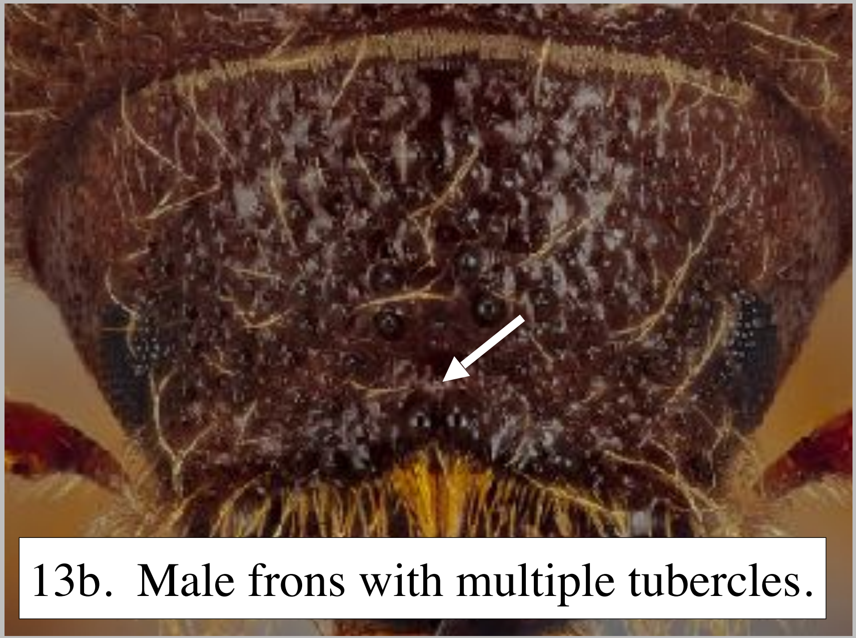
Male frons with <u>one</u> enlarged <u>median</u> tubercle at <u>or</u> above epistomal margin (**a**); female elytral declivital spines 2 & 3 connected at base by raised ridge (**c**); range extends from Canada to Honduras - specimens north of AZ are probably this species; portraits (**e, f**)..................***Ips grandicollis* (Eichoff)**

* *Ips cribricollis* Eichoff, from s. NM & MX, can only be reliably distinguished via DNA.

Male frons with <u>a row</u> of enlarged tubercles <u>along</u> epistomal margin, the transverse pair often largest (**b**); female elytral declivital spines 2 & 3 separate at base (**d**); northern limits of range Arizona and New Mexico; portraits (**g, h**)..***Ips lecontei* Swaine**



13a. Male frons with one median tubercle.

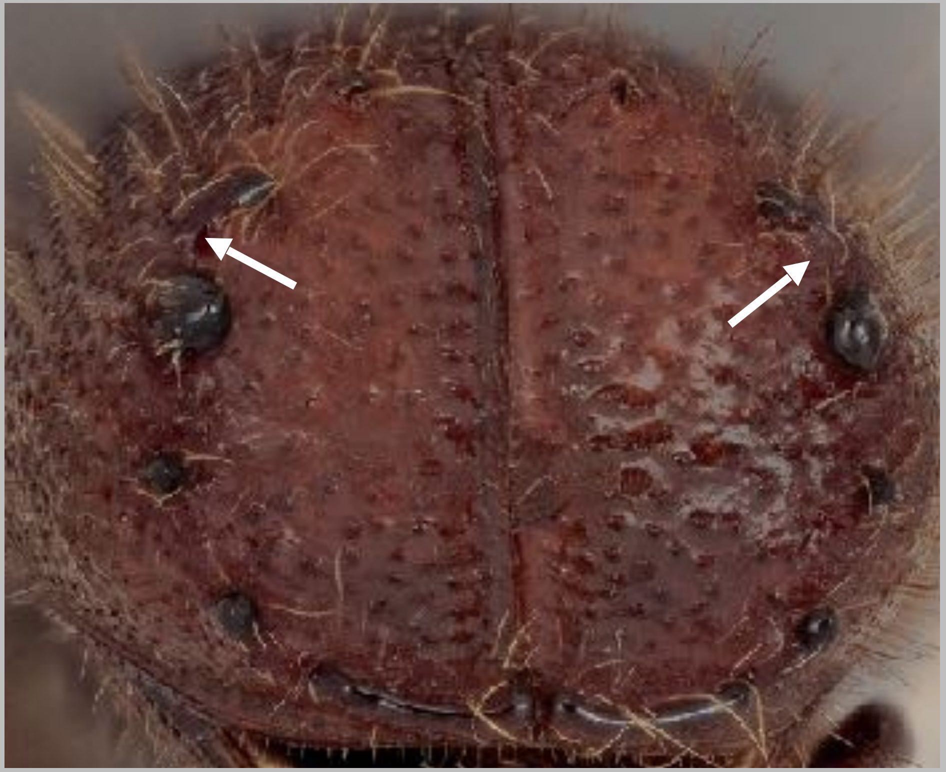


13b. Male frons with multiple tubercles.

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)

13e. Female.

13f. Male.

13 (12): Part IV

Ips lecontei Swaine

13g. Female.

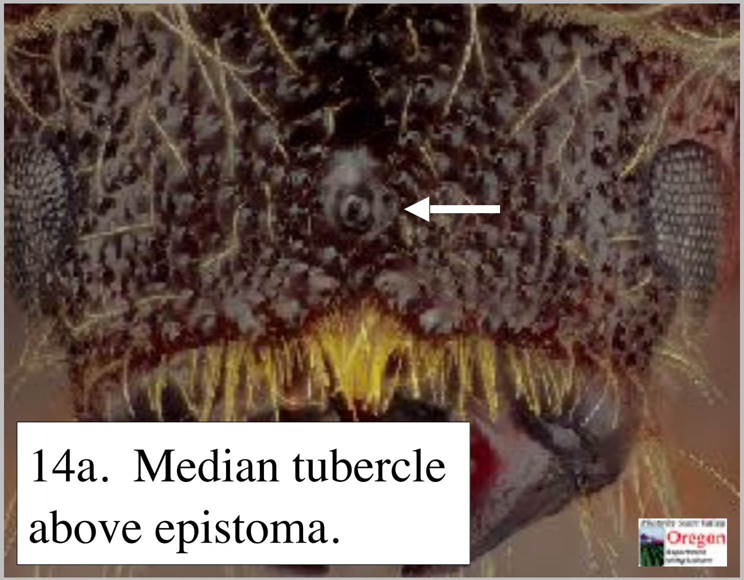
13h. Male.

14 (12): Part I

Fovea on frons shallow and small, upper margin of large median tubercle in in male distant from epistoma and as high as upper margin of eyes (**a**); at least 4.6 mm in total length; portraits (**c, d**)...…………......***Ips montanus*** **(Eichoff)**

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.



14a. Median tubercle above epistoma.

14b. Median tubercle on epistoma.

14 (12): Part II

Ips montanus (Eichoff)

14c. Female.

14d. Male.

14 (12): Part III

Ips paraconfusus Lanier*

14e. Female.

14f. Male.

14 (12): Part IV

Ips confusus (LeConte)*
Ips hoppingi Lanier*

14g. *Ips confusus*.

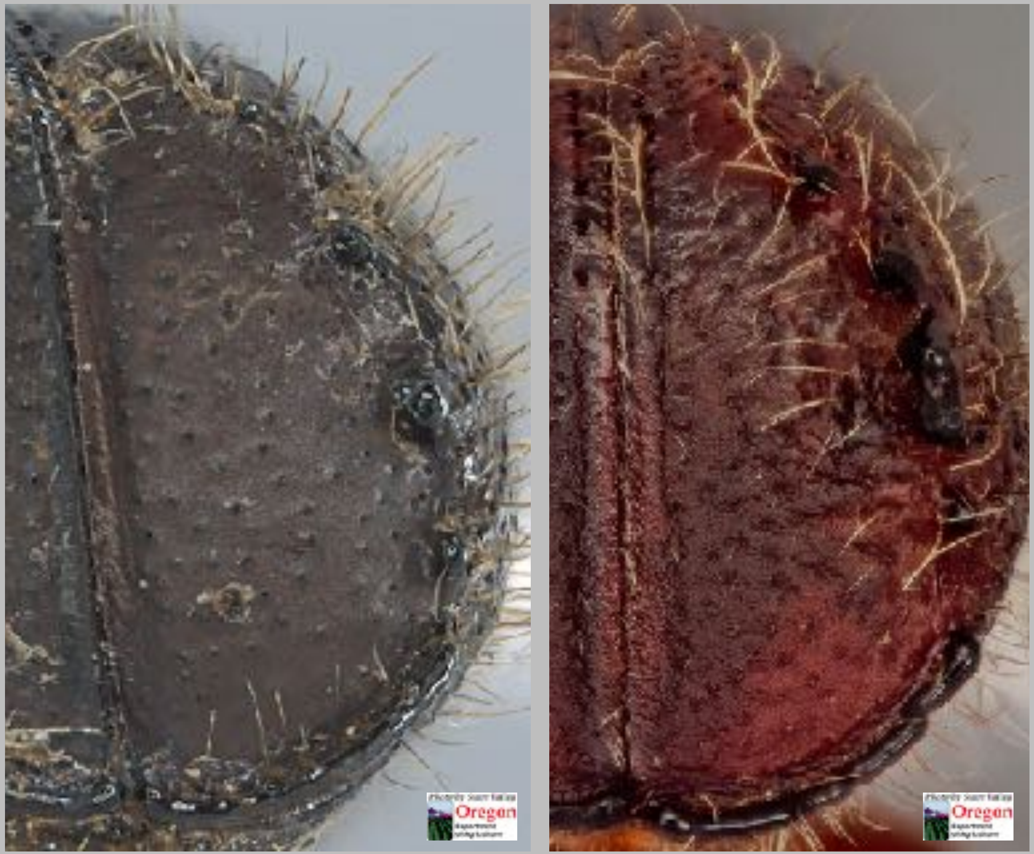
14h. *Ips hoppingi*.

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

Elytral declivital spine 3 smaller and cylindrical, capitate, and pointed at apex (**a**); portrait (**d**)……………….…*Ips typographus* **(Linnaeus)** ☹

Elytral declivital spine 3 very large, flattened, and emarginate at apex (**b-c**)………..………………………………………………….....17

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

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

16 (15): Part II

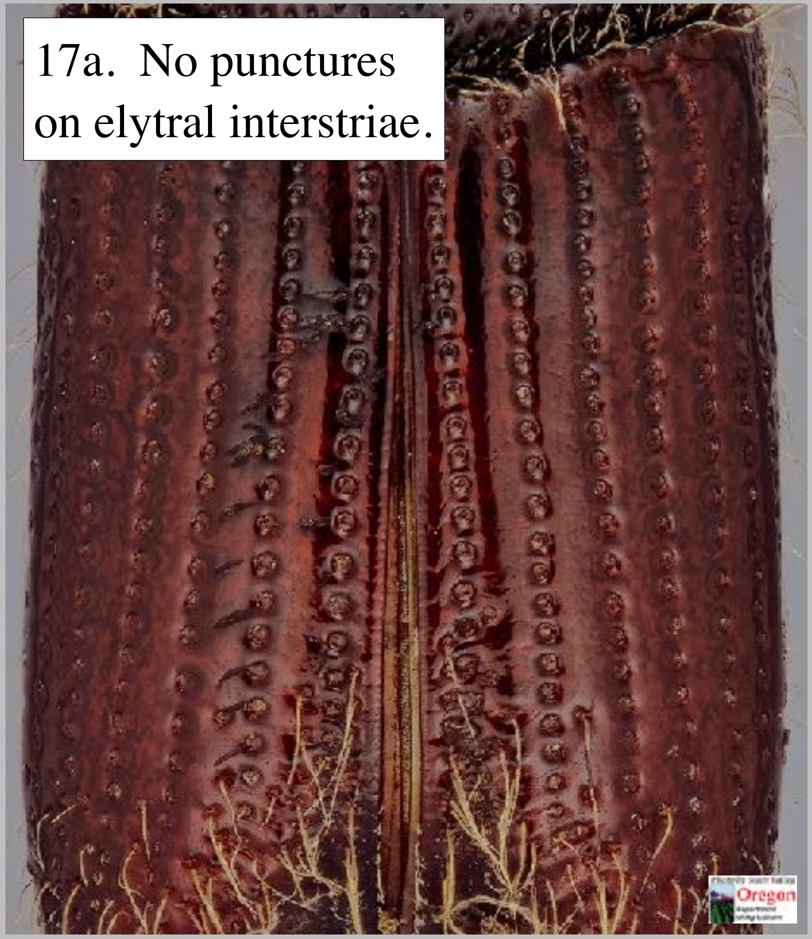
Ips typographus (Linnaeus) ☹

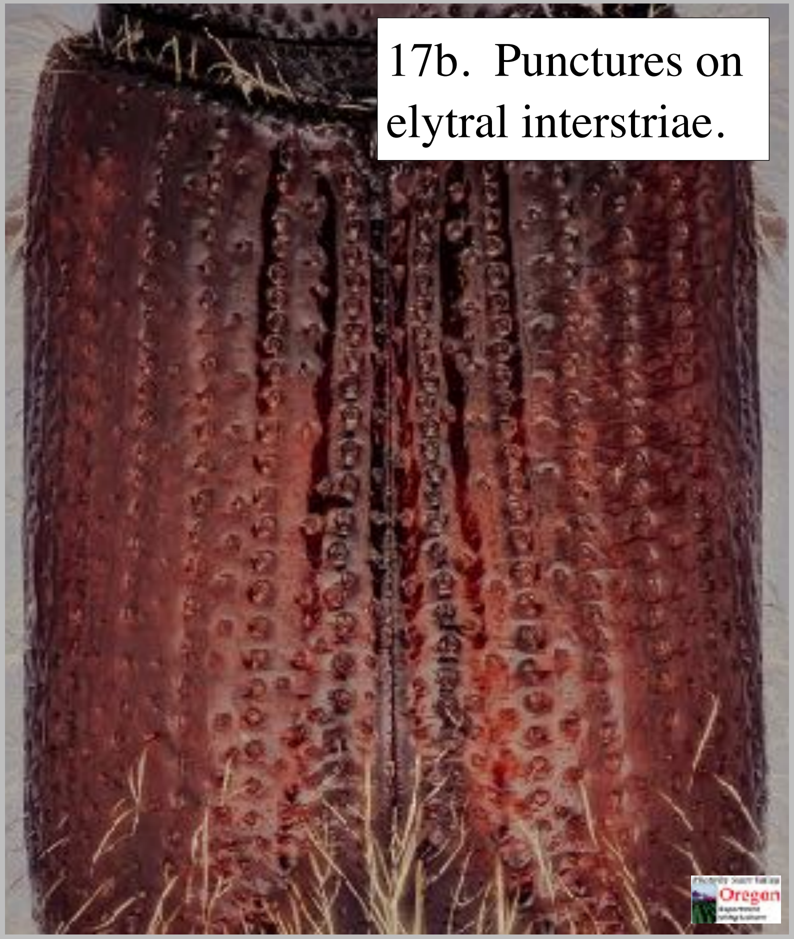
16d.

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

17c.

17 (16): Part III

Ips knausi Swaine

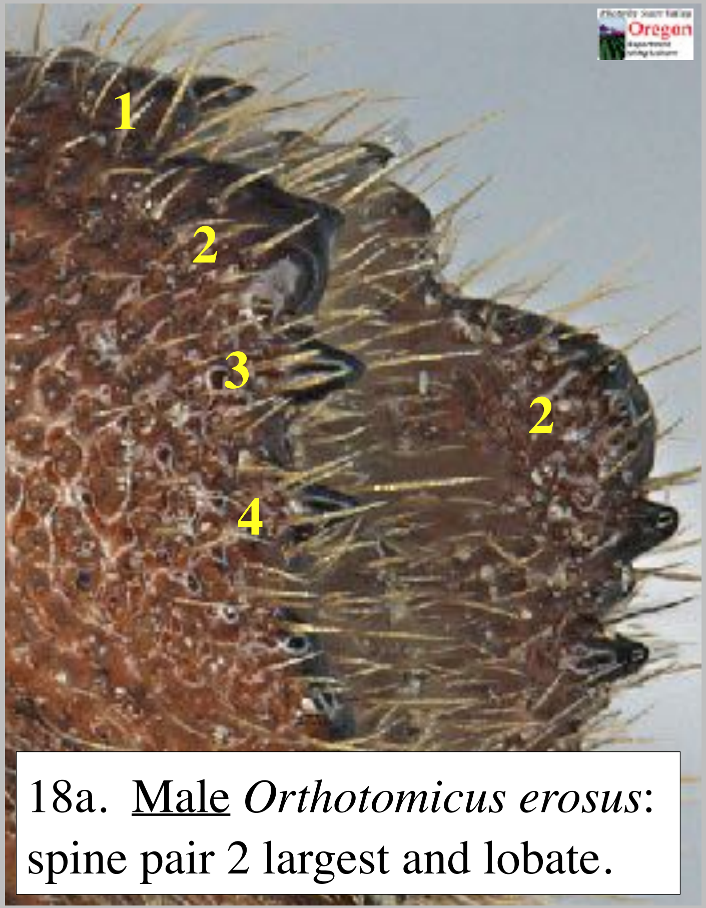
17d. Female.

17e. Male.

18 (15): Part I

Spine pair 2 on elytral declivity largest (much larger than 3rd) and broadly lobate (**a**); spine pair 4 is displaced toward suture, not on edge of declivity (**e**); portrait (**h**)………………..…**male** ***Orthotomicus erosus*** **(Wollaston)**

Spine pair 2 no larger than pair 3 (**b-c**) and if 2 is lobate and large, pair 3 is longest (**d**), all spine pairs on edge of declivity (**f-g**)…………………19



18a. Male *Orthotomicus erosus*: spine pair 2 largest and lobate.

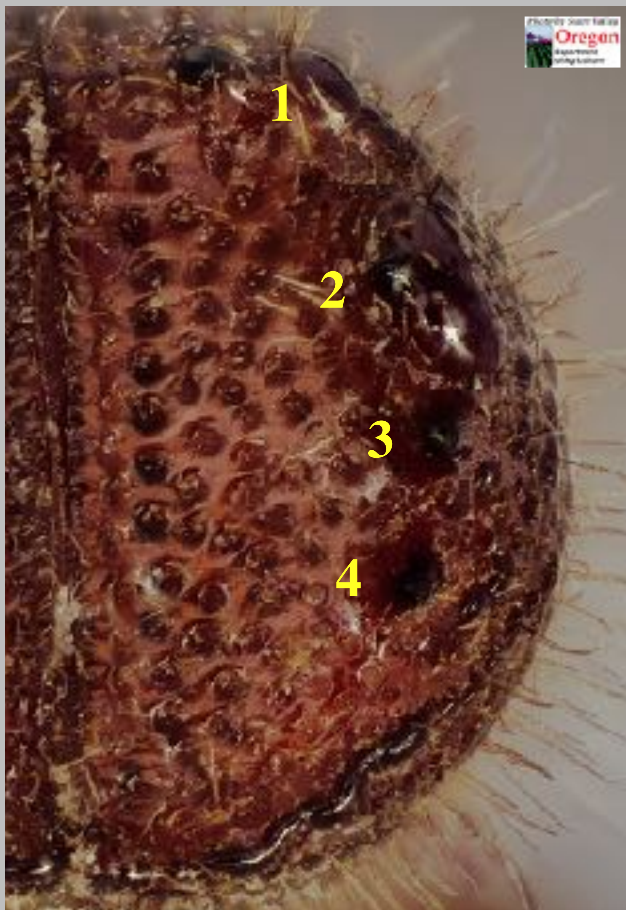
18b.

18c.

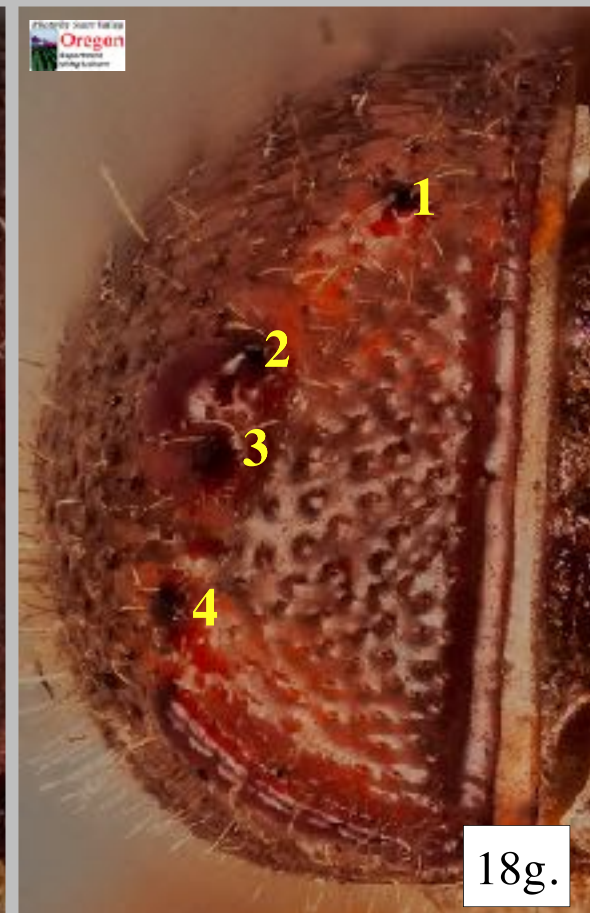
18d.

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

18 (15): Part II



18e. <u>Male</u> *Orthotomicus 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) ☹

<u>Male</u>

19 (18)

Discal interstriae impunctate (except near declivity in some species) (**a**)......20

Discal interstriae with irregular median row of setose punctures (**b**) (*some specimens may have this character restricted to the apical half of the elytra)…………….....27

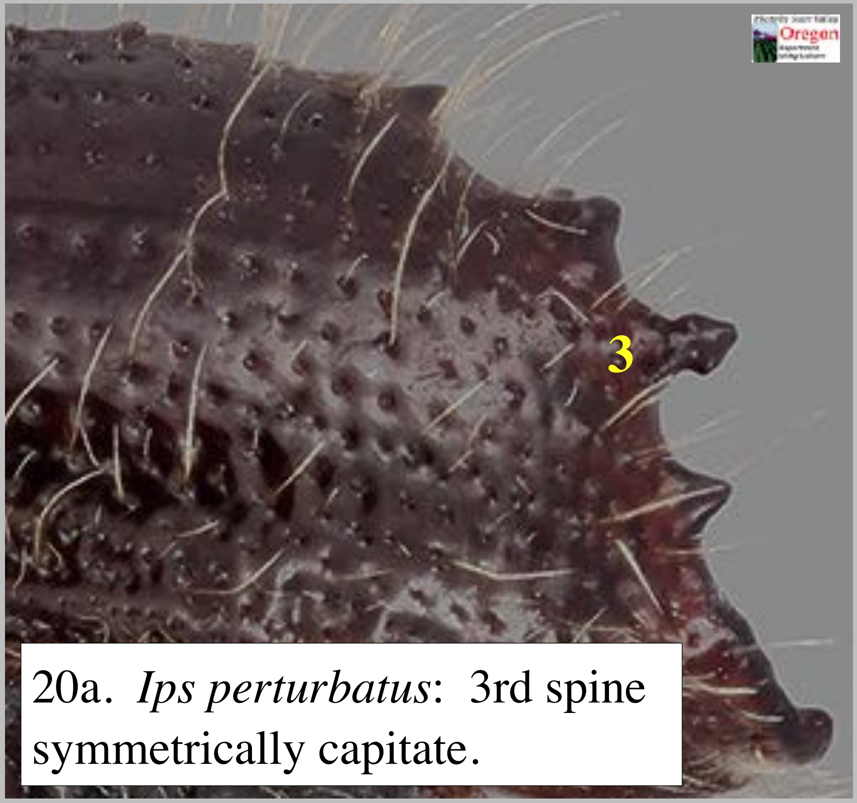
19a. Discal interstriae impunctate.

19b. Discal interstriae punctate, setose throughout.

20 (19): Part I

3rd spine on elytral declivity symmetrically and broadly capitate (**a**); frons with a transverse pair of large median tubercles (**d**); portraits (**g, h**)………… …………………………………………………***Ips perturbatus*** **(Eichoff)**

3rd declivital spine either asymmetrically and narrowly capitate (**b**) or conical and not capitate (**c**); frons with a single large median tubercle (**e**) or without a large median tubercle………………………………..…………………..….21

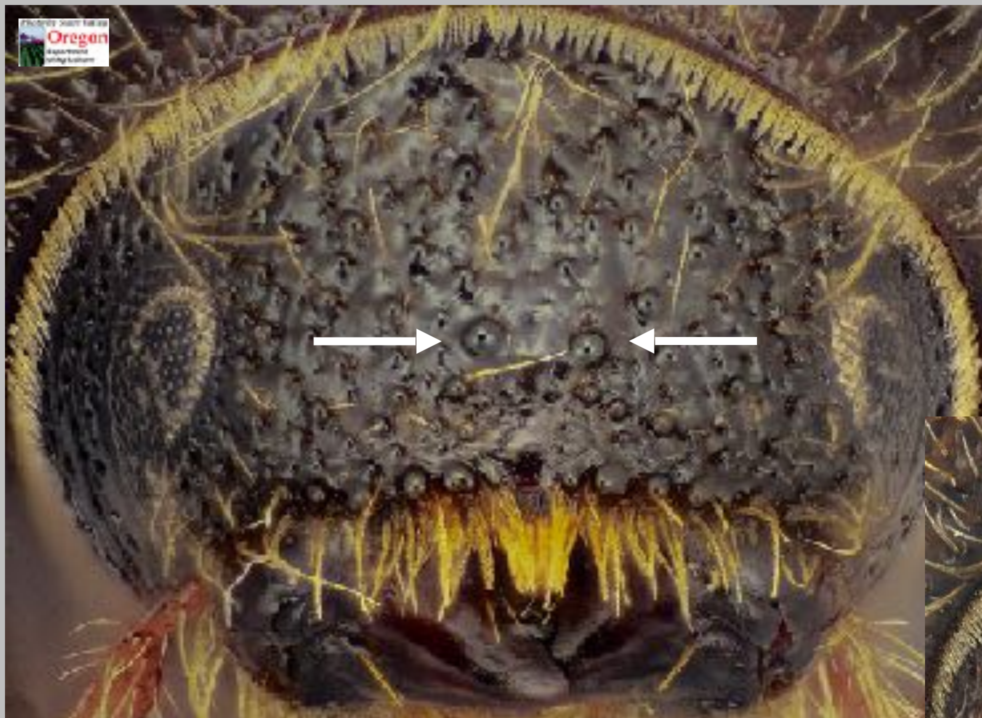


20a. *Ips perturbatus*: 3rd spine symmetrically capitate.

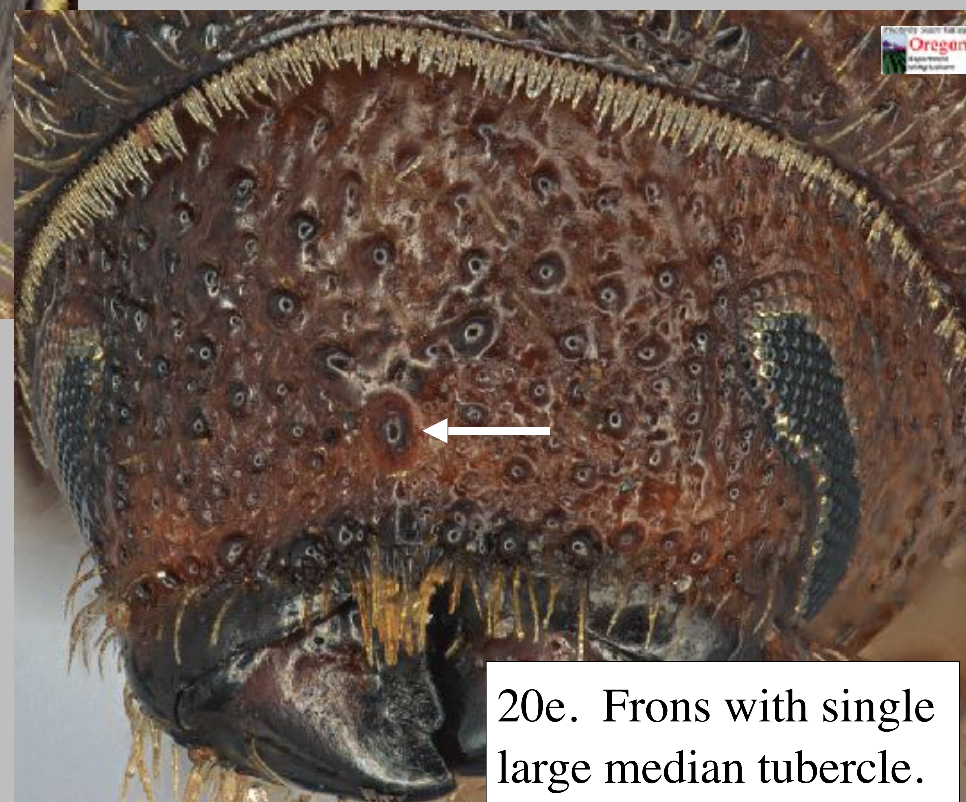
20b. Spine 3 asymmetrically capitate.

20c. 3rd spine not capitate.

20 (19): Part II



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



20e. Frons with single large median tubercle.

20 (19): Part III

Ips perturbatus (Eichoff)

20g. Female.

20h. Male.

21 (20)

Sutures of antennal club broadly bisinuate (first suture is normally the most distinct and diagnostic (**a**); no more than 4.3 mm in length…………….….….22

Sutures of antennal club narrowly, strongly bisinuate (the first suture is normally the most distinct and diagnostic) (**b**); 4.2 to 5.4 mm in length……26

21a. Sutures broadly bisinuate.

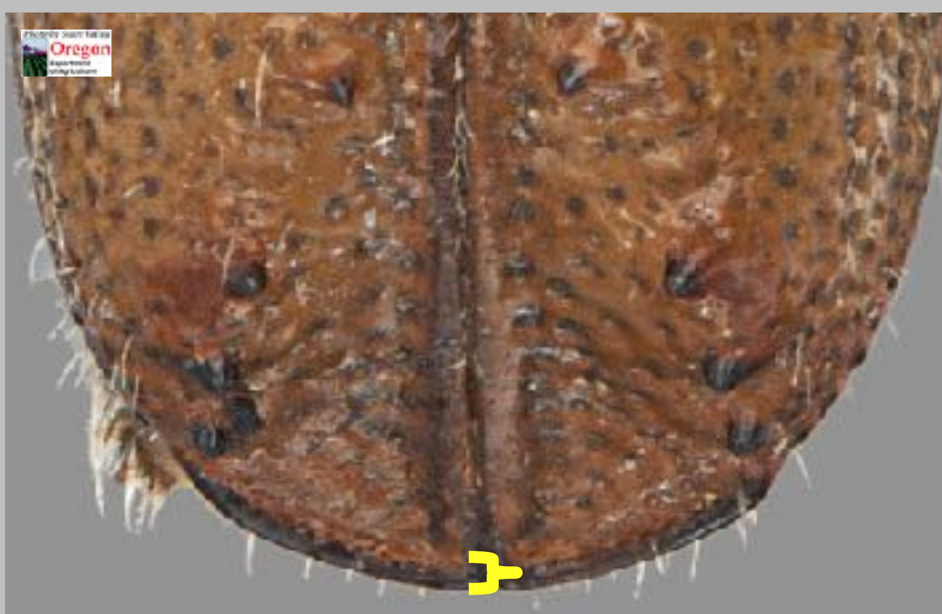
21b. Sutures narrowly bisinuate.

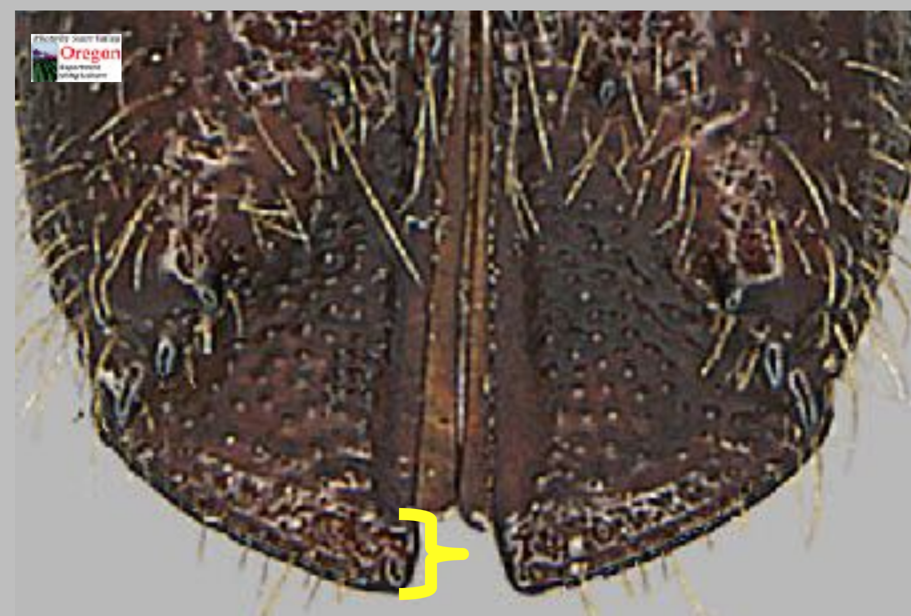
22 (21): Part I

In dorsal view, the apex of elytron is a narrow ridge perpendicular to the posterior slope of the declivity (**a**); declivital spines are short cones in both sexes (**c, d**); portraits (**g, h**)……………………..***Ips avulsus*** **(Eichoff)**

In dorsal view, the apex of elytron projects as a broad shelf perpendicular to the posterior slope of the declivity (**b**); spine 3 is capitate in male (**e, f**); portraits (**i, j**)…….…………..……………………………………..….23

22a. *Ips avulsus*: apex of elytron a narrow ridge.

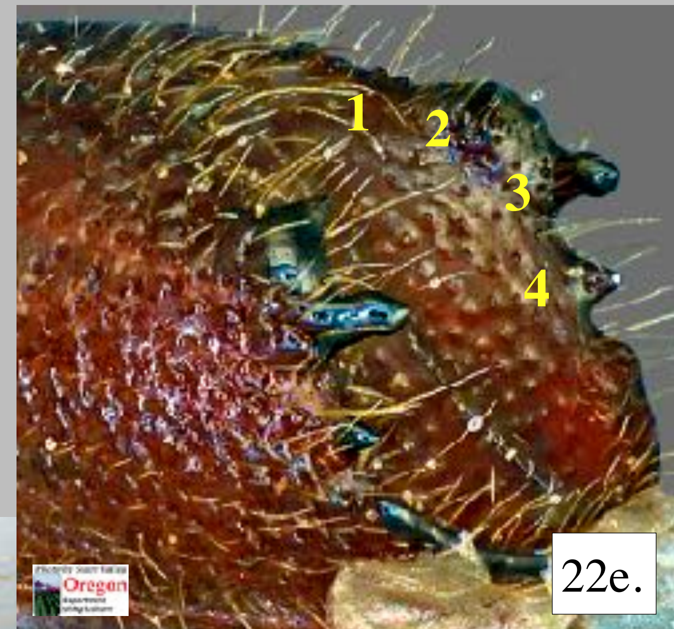




22b. Apex of elytron a strongly projecting shelf.

22 (21): Part II

Ips avulsus: declivital spine 3 not capitate in either male (c) or female (d).



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

22 (21): Part III

Ips avulsus (Eichoff)

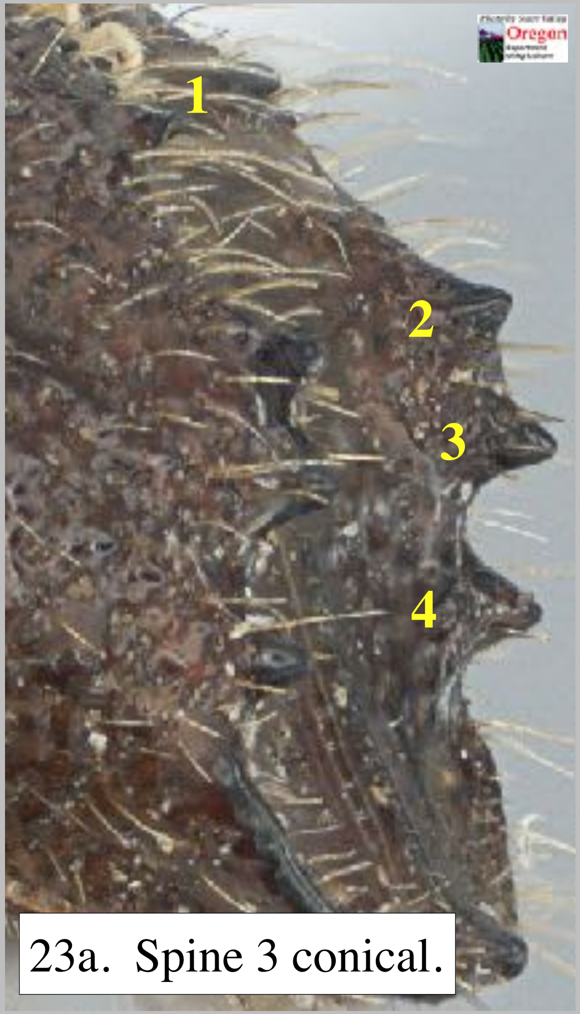
22g: Female.

22h: Male.

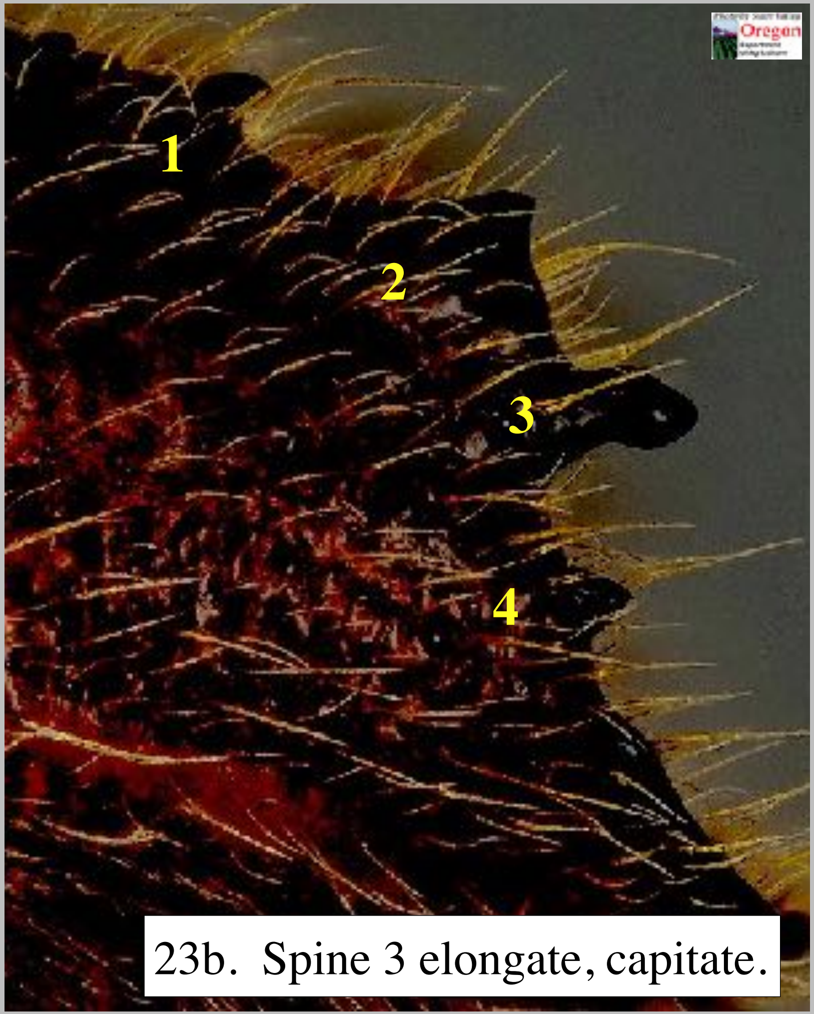
23 (22)

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



23a. Spine 3 conical.

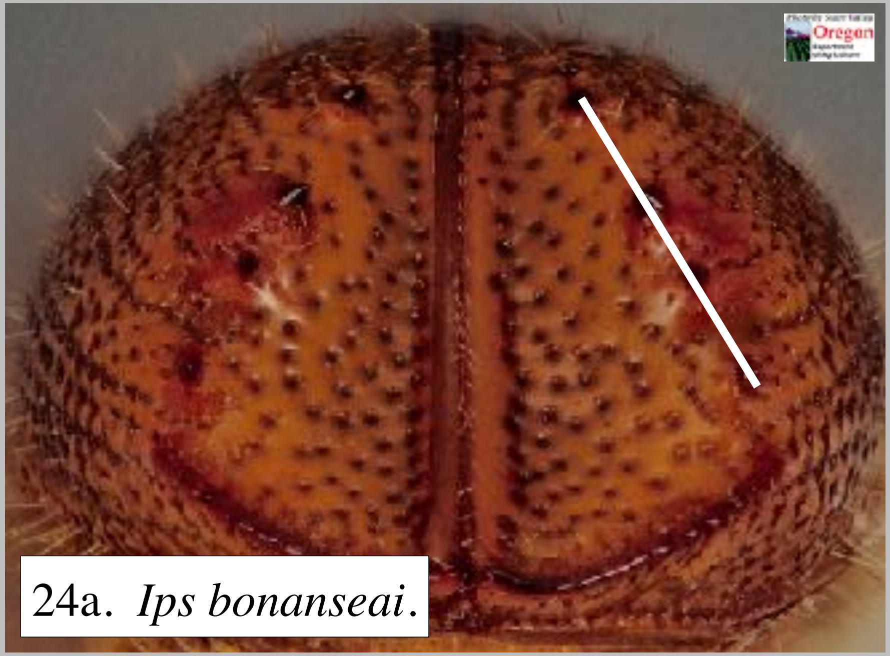


23b. Spine 3 elongate, capitate.

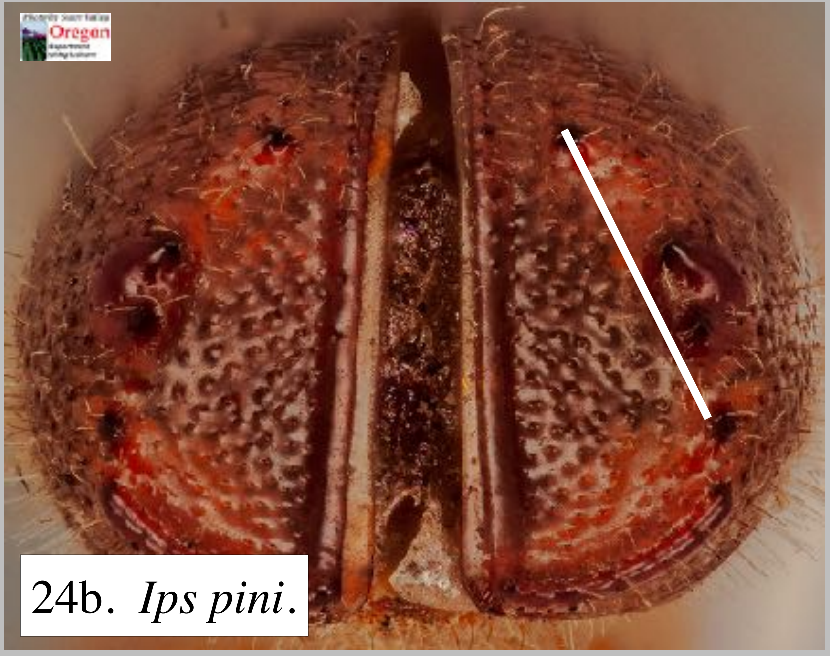
24 (23): Part I

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)**

In posterior view, elytral declivital spines 2 & 3 laterad of a line drawn between spines 1 & 4 (**b**); in lateral view, spines 2 & 3 longer, larger (**d**); in dorsal view, spines 2 & 3 erect (**f**); portrait (**h**); distributed throughout much of North America…..……………………………………………..……………..*Ips pini* (Say)

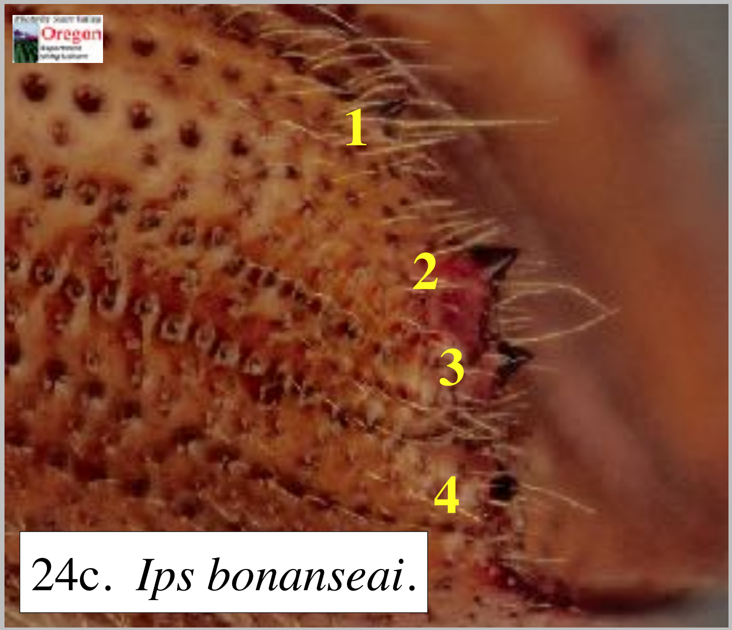


24a. *Ips bonanseai*.

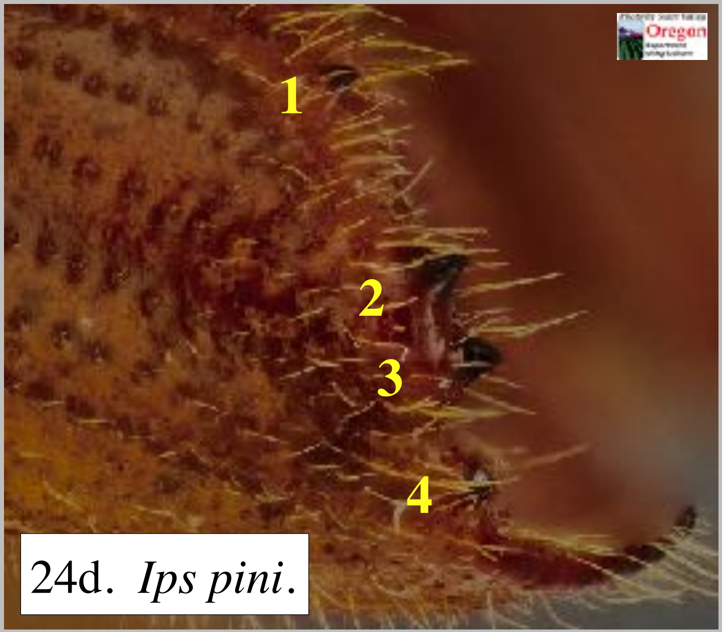


24b. *Ips pini*.

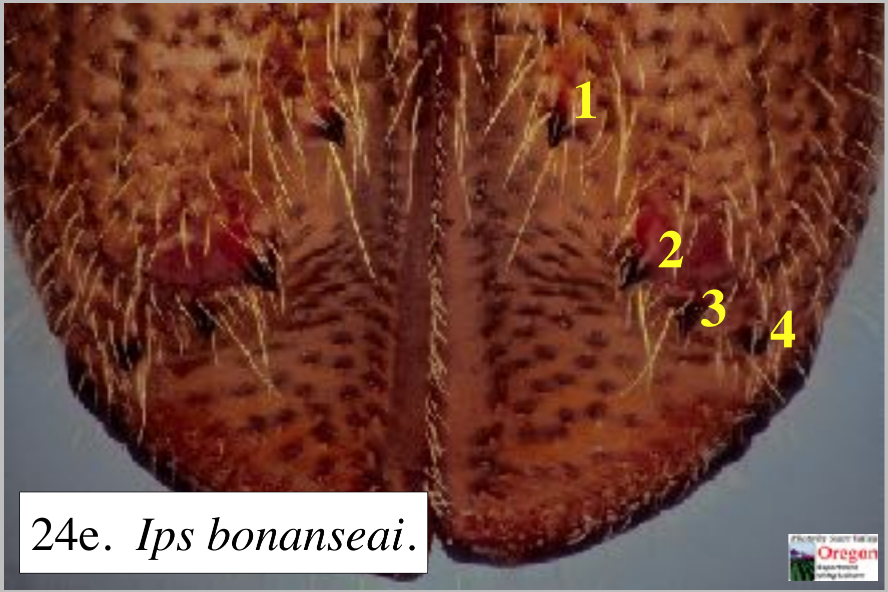
24 (23): Part II



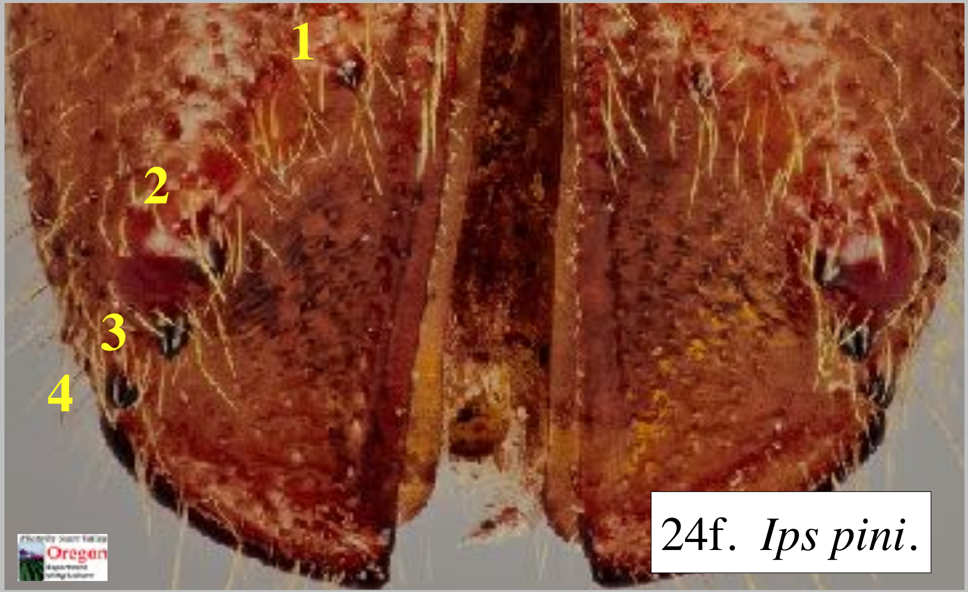
24c. *Ips bonanseai*.



24d. *Ips pini*.



24e. *Ips bonanseai*.



24f. *Ips pini*.

24 (23): Part III

Ips bonanseai (Hopkins) - female

24 (23): Part IV

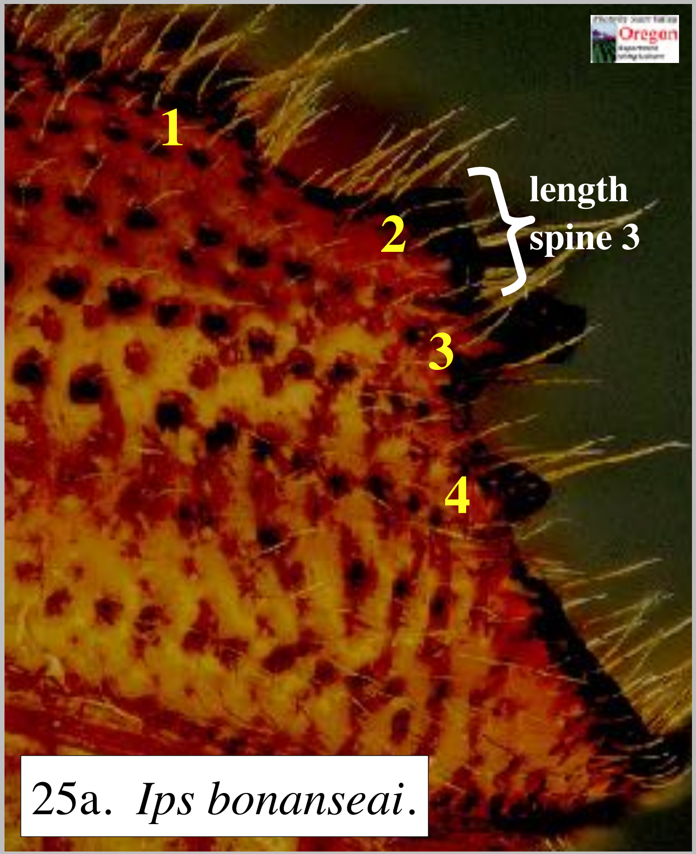
Ips pini (Say) - female

24h.

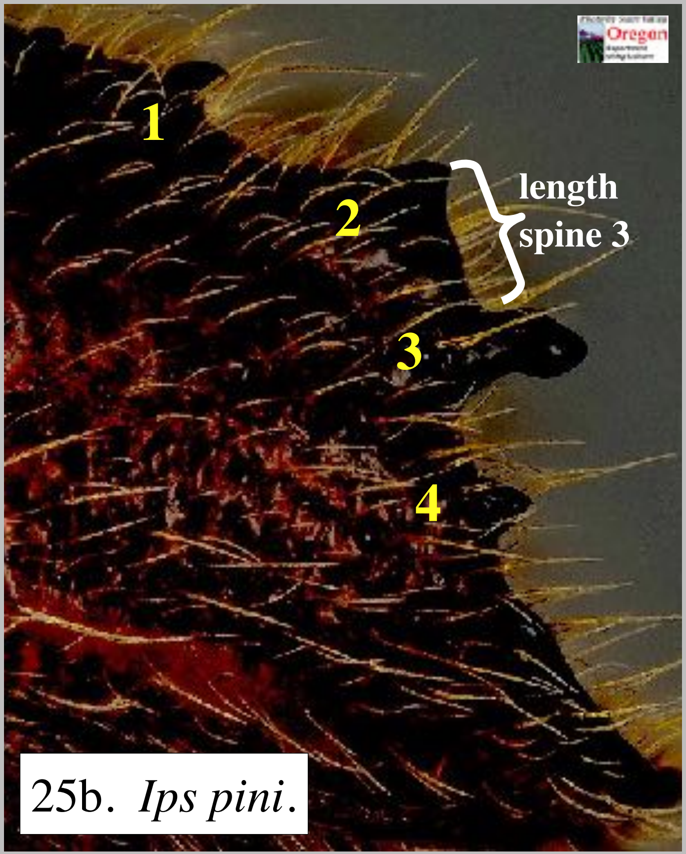
25 (23): Part I

In lateral view, spines 2 & 3 shorter and smaller, spine 3 separated from spine 2 by less than the height of spine 3 (**a**); portrait (**c**); distribution AZ & MX…...…...……..….***Ips bonanseai* (Hopkins)**

In lateral view, spines 2 & 3 longer and larger, spine 3 separated from spine 2 by about the height of spine 3 (**b**); portrait (**d**); throughout much of North America………………..***Ips pini* (Say)**



25a. *Ips bonanseai*.



25b. *Ips pini*.

25 (23): Part II

Ips bonanseai (Hopkins) - male

25c.

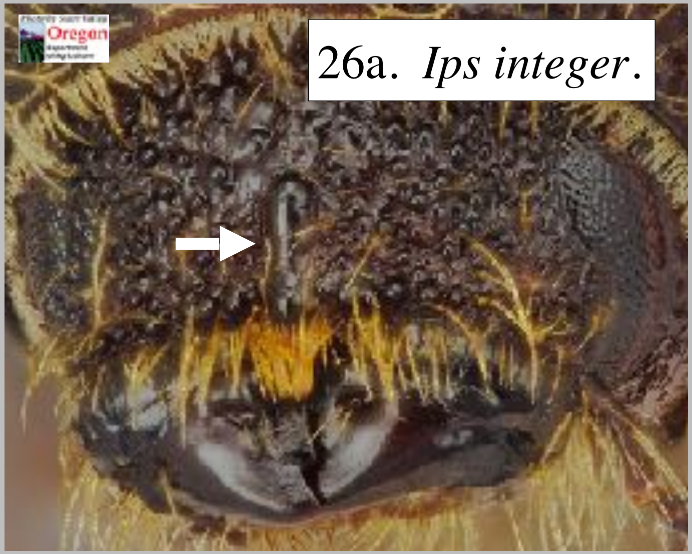
25 (23): Part III

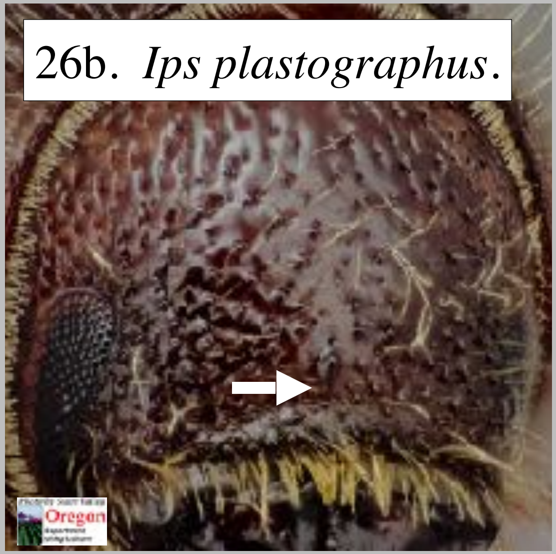
Ips pini (Say) - male

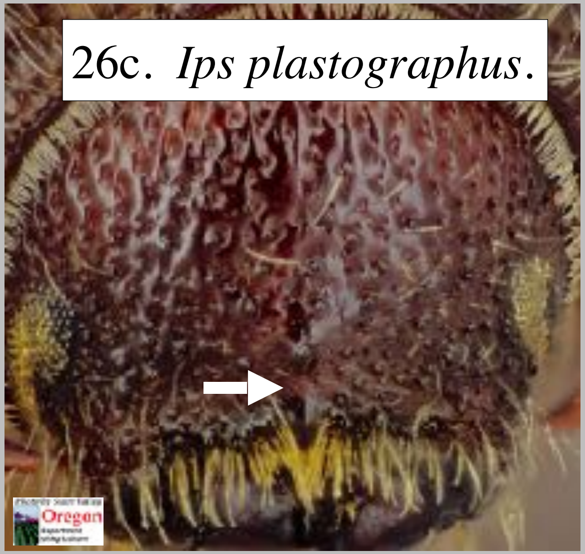
26 (21): Part I

Frons with median tubercle connected to epistoma tubercle by a ridge (**a**); elytral strial punctures larger, interstriae only slightly broader than puncture diameter (**d**); elytral declivital spine 1 about equidistant from spine 2 and suture, spine 4 closer to posterior ridge than to spine 3 (**f**); portraits (**h, i**)……………………… ……………………………………………………………***Ips integer*** **(Eichoff)**

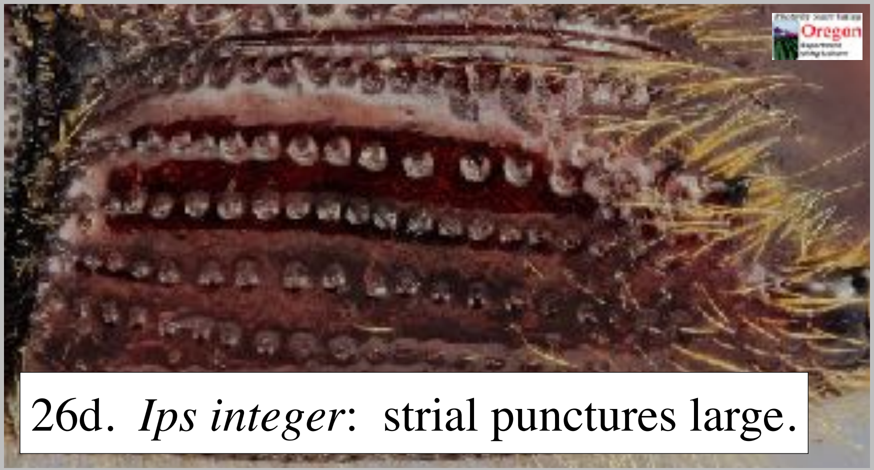
Median tubercle of frons <u>not</u> connected to a median epistomal by a ridge (**b, c**); elytral strial punctures smaller, interstriae about twice as broad as puncture diameter (**e**); elytral declivital spine 1 closer to suture than to spine 2, spine 4 about equidistant from posterior ridge and spine 3 (**g**); portraits (**j, k**)…………… …………………………………………………..***Ips plastographus*** **(LeConte)**



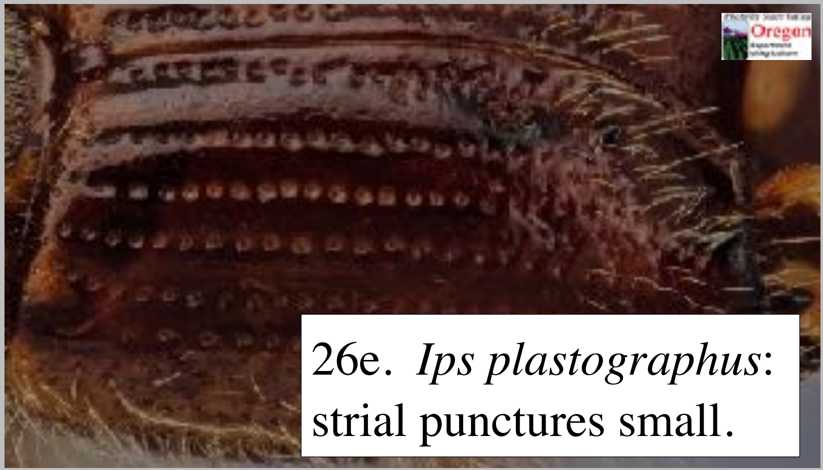




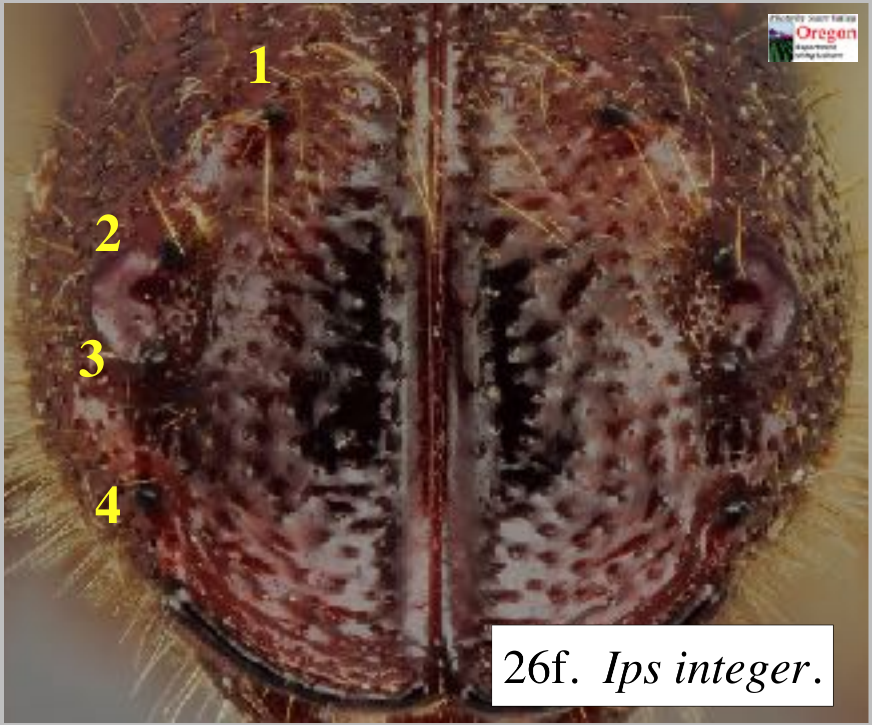
26 (21): Part II



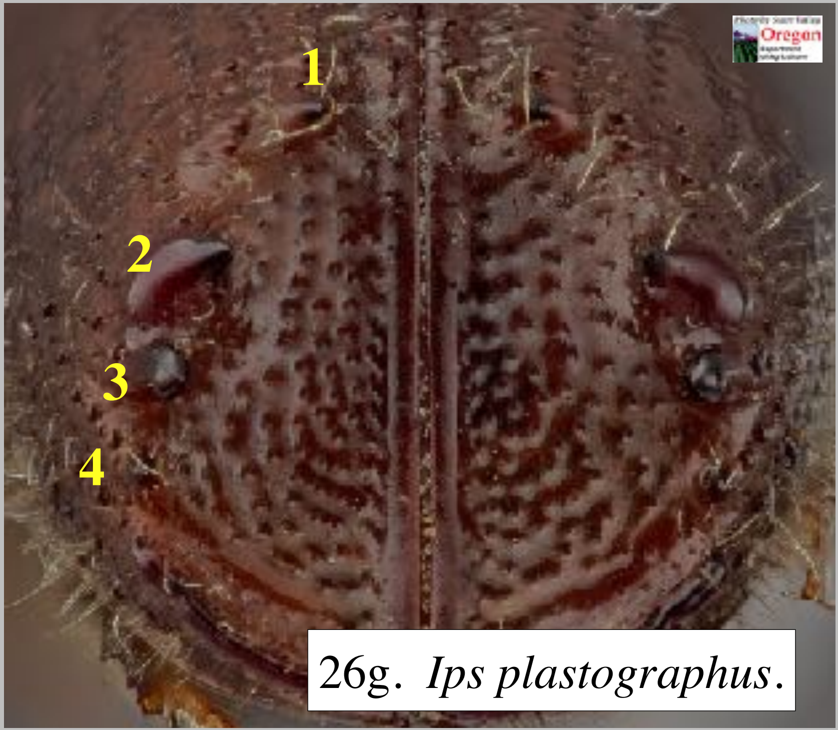
26d. *Ips integer*: strial punctures large.



26e. *Ips plastographus*: strial punctures small.



26f. *Ips integer*.



26g. *Ips plastographus*.

26 (21): Part III

Ips integer (Eichoff)

26h. Female.

26i. Male.

26 (21): Part IV

Ips plastographus (LeConte)

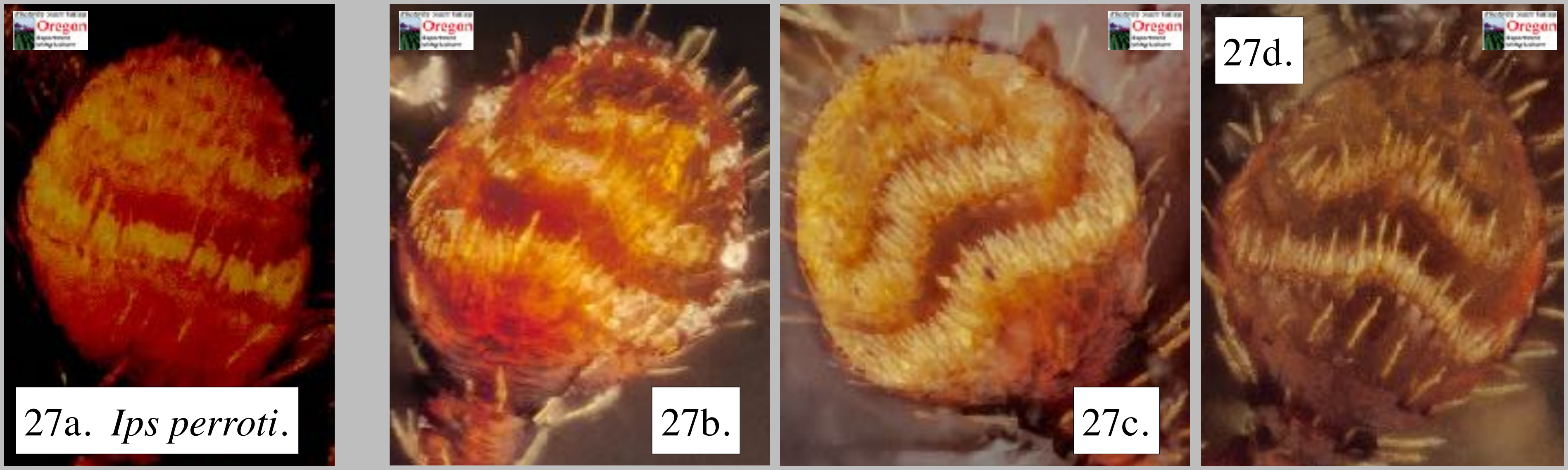
26j. Female.

26k. Male.

27 (19): Part I

Antennal club with sutures straight (**a**); first five elytral interstriae with setose punctures only in about posterior half of elytra (**e**); female frons not protruberant and pilose (**g**); portraits (**l, m**)…………………………..………..***Ips perroti*** **Swaine**

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 frons 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.



27a. *Ips perroti*.

27b.

27c.

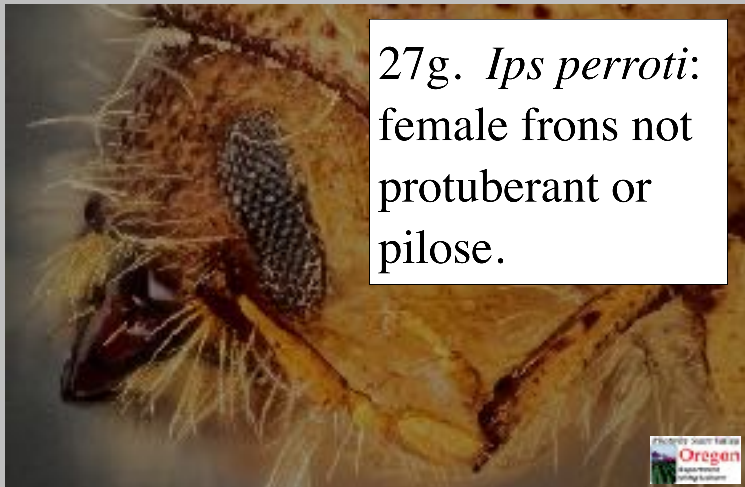
27d.

27 (19): Part II

27e. *Ips perroti*: interstriae 1-5 setose only in posterior half.

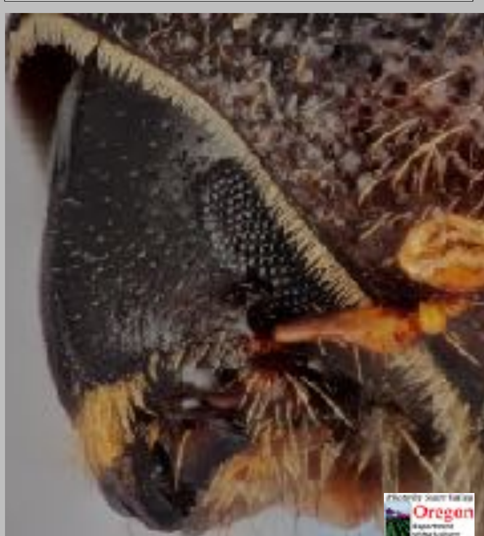
27f. Interstriae setose the length of the elytra.

27 (19): Part III



27g. *Ips perroti*: female frons not protuberant or pilose.

27h. Female frons protuberant, not pilose.



27i-k. Female frons protuberant, pilose.

27 (19): Part IV

Ips perroti Swaine

27l. Female.

27m. Male.

27 (19): Part V

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


27n. *Ips borealis*.


27o. *Ips hunteri*.


27q. *Ips tridens*.


27p. *Ips pilifrons*.


27r. *Ips woodi*.