

- Length 6 mm.; elytra reddish; pronotum darker; elytral striæ moderately impressed, punctures of striæ of dorsal area small, obscure, and those of the lateral area moderately coarse; interspaces flat, with rugosities moderately coarse, obtuse, and rather densely placed; pronotum with punctures more regular in size than usual. Alaska..... 16. *borealis* n. sp., page 133.
- Length 6 to 7 mm.; black; elytral striæ but faintly impressed; punctures rather coarse; interspaces flat; rugosities moderately coarse, not dense, acute toward vertex; pronotum with fine punctures, moderately dense, coarser toward sides. Pacific coast, Oregon to Sitka, in *Picea sitchensis*..... 17. *obesus* (Mann.), page 135.

## Subsection b4.

- Striæ of declivity with *fine* punctures..... Series c3, page 72.
- Striæ of declivity with *coarse* punctures..... Series c4, page 72.

## Series c3.

- Length 5 to 7.3 mm.; elytra red; pronotum brown to black; body rather stout; elytral striæ scarcely impressed, except on dorsal area; stria punctures moderately coarse; rugosities of interspaces moderately coarse, acute, not dense; pronotal punctures coarse, deep, moderately dense; elytral declivity with interspaces moderately punctured. Lake Superior, in *Pinus strobus*.

18. *rufipennis* (Kirby), page 138.

- Length 5.4 to 6.5 mm.; elytra dark reddish; pronotum dark; body somewhat slender, as compared with species 18; elytral striæ moderately impressed; punctures coarse, shallow; pronotal punctures coarse, not distinctly irregular and moderately dense; elytral declivity with interspaces finely densely produced. Yellowstone National Park and Keystone, Wyoming; Alberta, and British Columbia, in *Pinus*..... 19. *murrayana* n. sp., page 140.

## Series c4.

- Length 6.5 mm.; brownish; elytral striæ impressed; punctures coarse, interspaces narrow and moderately coarse, acute, rugosities coarser toward the suture. New York to West Virginia, in *Picea*..... 20. *punctatas* Lec., page 142.

- Length 7 to 8 mm.; brownish; elytral striæ not impressed on dorsal or lateral areas, punctures moderately coarse, shallow; interspaces broad, flat, shining; rugosities small, obtuse, sparse. Europe, etc., in *Picea*, *Larix*,? and *Abies*?

21. *micans* (Kug.), page 143.

## SUBDIVISION D.

- Pronotum somewhat elongate, slightly narrower than elytra, moderately constricted toward head, median and posterior dorsal areas without long hairs, but hairs present on anterior and lateral areas; head broad, epistomal process usually broad, concave, with sides strongly oblique; elytral rugosities variable, usually coarse. Body black.

- Length 5 to 8 mm.; black; epistomal process moderately broad, with apical angles usually tuberculate; pronotal punctures very coarse, regular, moderately dense, scarcely decreasing in size toward base; elytra without long hairs toward base. Long Island, New York, south to Florida, west to West Virginia and Texas, in *Pinus*..... 22. *terebrans* (Oliv.), page 147.

Body reddish.

- Length 5.7 to 9 mm.; reddish, never black; epistomal process broad, with apical angles obtuse, never tuberculate; pronotum with punctures smaller and denser toward base; elytra with long hairs toward base. Eastern United States and Canada, north of mountains of North Carolina, westward to Pacific coast, south from British Columbia into Mexico, in *Pinus* and *Picea*.

23. *valens* Lec., page 151.

## SYNOPSIS OF SECONDARY SEXUAL CHARACTERS.

## DIVISION I.

- Females*: Anterior pronotal area *with* transverse ridge..... Subdivision A.
- Females*: Anterior pronotal area *without* transverse ridge..... Subdivision B.

## SUBDIVISION A.

- Females*: *With* transverse ridge across the anterior area; elytral declivity slightly smoother, more shining, and less rugose..... Species 1 to 8, inclusive.
- Males*: *Without* transverse ridge across the anterior area, but with broad impression. Species 1 to 8, inclusive.

## SUBDIVISION B.

- Females*: Elytral declivity with interspaces more shining, rugosities less prominent. Species 9 to 11, inclusive.
- Males*: Elytral declivity with interspaces more opaque, rugosities more prominent. Species 9 to 11, inclusive.

## DIVISION II.

- Elytral declivity *with* distinct sexual characters in both sexes..... Subdivision C.
- Elytral declivity *without* distinct sexual characters in either sex.... Subdivision D.

## SUBDIVISION C.

- Females*: Interspaces of elytral declivity rugose. *Males*: Interspaces of elytral declivity smooth.

Striæ of elytral declivity *impressed*; interspaces convex in both sexes.

Section a3, Species 12 and 13.

Striæ of elytral declivity *not impressed*; interspaces flat..... Section a4.

## Section a4.

- Females*: Striæ of elytral declivity slightly impressed; interspaces subconvex. Species 14 to 21, inclusive.

*Males*: Striæ of elytral declivity not impressed; interspaces flat.

Species 14 to 17, inclusive.

- Males*: Striæ of elytral declivity slightly impressed; interspaces subconvex, but smoother than in female..... Species 18 to 21, inclusive.

## SUBDIVISION D.

- Females*: Head with front moderately broad; mandibles shining, moderately stout; antennal club broader..... Species 22 and 23.

*Males*: Head with front broad; mandibles opaque, stout; antennal club narrow, more elongate and less compressed..... Species 22 and 23.

## SYNOPSIS OF PUPAL CHARACTERS.

Vertex of head *distinctly to faintly grooved*, and with two small or prominent frontal spines on or toward the vertex each side of groove..... Division I.Vertex of head *faintly impressed*, flat or convex, and with two small, widely separated frontal granules toward vertex..... Division II.

## DIVISION I.

Frontal spines *small*; elytral pads smooth; abdominal tergites 2 to 6 with or without small pleural spines..... Subdivision A.Frontal spines *large*, prominent; elytral pads rugose; abdominal tergites 2 to 6 with prominent pleural spines..... Subdivision B.

## SUBDIVISION A.

- Anterior and middle femora *smooth*; abdominal tergites 3 to 6 with small pleural spines; 1 and 2 without distinct dorsal and lateral spines. Section a1, Species 1, 2, and 3.  
 Anterior and middle femora *with small apical spines*..... Section a2.

## Section a2.

- Abdominal tergites 2 to 6 *without* distinct pleural spines; 7 and 8 with small granules..... Species 4.  
 Abdominal tergites 2 to 6 *with* small pleural spines of *equal size*; 7 and 8 with small granules..... Species 5.  
 Abdominal tergites 1 to 6 *with* small pleural spines, *increasing in size*; 7 and 8 smooth. Species 8.

## SUBDIVISION B.

- Apex of anterior and middle femora with *two spines*..... Species 9.  
 Apex of anterior and middle femora with *one spine*; abdominal spines and elytral rugosities coarser than in species 9..... Species 10.  
 Apex of anterior and middle femora with *two spines*; abdominal spines apparently less prominent than in species 9 and 10..... Species 11.

## DIVISION II.

- Vertex of head *flattened* or faintly impressed; apex of front and middle femora smooth or with minute granule; abdominal tergites with pleural and dorsal spines moderately prominent..... Subdivision C.  
 Vertex of head *convex*; front and middle femora each with a minute pilated, subapical granule; abdominal tergites with less distinct pleural and dorsal spines. Subdivision D.

## SUBDIVISION C.

- Tergal spines of abdomen *with pale or white tips*; segment 7 smooth..... Section a3.  
 Tergal spines of abdomen *with pale, dark, or black tips*; segment 7 with a few setigerous granules..... Section a4.

## Section a3.

- Anterior and middle femora *with* minute apical spines; abdominal tergites 2 to 6 with stout, prominent pleural spines; 3 to 6 with prominent dorsal spines. Species 12.  
 Anterior and middle femora *without* apical spines; abdominal tergites 2 to 6 with moderately stout pleural spines, and 3 to 6 with small dorsal ones..... Species 13.

## Section a4.

- Vertex of head *moderately impressed*; anterior and middle femora without apical spines; abdominal tergites 2 to 6 with very small pleural spines; 4 to 6 with small dorsal spines, all with pale tips..... Species 14.  
 Vertex of head *distinctly impressed*; abdominal tergites 2 to 6 with distinct pleural spines, and 3 to 6 with distinct dorsal ones..... Species 15.  
 Abdominal tergites 2 to 6 with very small pleural, lateral, and dorsal spines, all with dark tips..... Species 17.

## SUBDIVISION D.

- Abdominal tergites 1 to 6 with moderately small pleural spines, 2 to 6 with small dorsal and lateral ones, all with pale tips..... Species 22.  
 Same as preceding, except spines have darker to black tips..... Species 23.

## SYNOPSIS OF LARVAL CHARACTERS.

- Abdominal tergites 8 and 9 *without* dorsal plates..... Division I.  
 Abdominal tergites 8 and 9 *with* dorsal plates, except in section a3..... Division II.

## DIVISION I.

- Front *with or without* median convexity..... Subdivision A.  
 Front *with transverse* elevation slightly more prominent toward the sutures. Subdivision B.

## SUBDIVISION A.

- Front *without* median convexity..... Section a1.  
 Front *with* median convexity..... Section a2.

## Section a1.

- Clypeus with apex *subacutely* emarginate..... Species 1.  
 Clypeus with apex *broadly* emarginate..... Species 2.

## Section a2.

- Prothoracic lobes *without* foot calli..... Subsection b1.  
 Prothoracic lobes *with* distinct foot calli..... Subsection b2.

## Subsection b1.

- Front smooth, with shining convexity; clypeus with apex broadly emarginate. Species 3.

## Subsection b2.

- Front smooth, with median *smooth* convexity; clypeus with apex deeply emarginate..... Species 4.  
 Front with anterior third transversely *rugose* and with transverse median convexity, produced toward apex; clypeus with apex broadly emarginate..... Species 5.  
 Front with broad convexity; clypeus with apex truncated..... Species 8.

## SUBDIVISION B.

- Front of head with posterior apex *subacute*; frontal elevation moderately stout in the middle; clypeus with faint median tubercle toward the base..... Species 9.  
 Front of head with posterior apex *subobtuse*; frontal elevation stout slightly posterior to the middle; clypeus with a faint median groove and elevation toward base. Species 10.  
 Front of head with posterior apex *subacute*; frontal elevation narrow, situated in the middle, not more distinctly elevated toward suture; clypeus with faint median groove, without elevation..... Species 11.

## DIVISION II.

- Abdominal tergites 8 and 9 without dorsal plate, or with *unarmed* plates. Subdivision C.  
 Abdominal tergites 8 and 9 with *armed* plates..... Subdivision D.

## SUBDIVISION C.

- Abdominal tergites 8 and 9 *without* dorsal plates..... Section a3.  
 Abdominal tergites 8 and 9 *with* dorsal plates, excepting *micans*, in which 8 is unarmed..... Section a4.

## Section a3.

- Front with *indistinct* transverse elevation; clypeus with distinct median impression. Species 12.  
 Front with *distinct* transverse elevation; clypeus with median impressed line. Species 13.

## Section a4.

- Abdominal tergites 8 and 9 with rugose but unarmed plates; front with faint transverse elevation anterior to middle; clypeus with median groove. Species 14.  
 Frontal elevation *near the middle*. Species 15.  
 Frontal elevation *distinctly anterior to middle*. Species 16.  
 Front with lateral impressions toward the anterior angles, and frontal elevation anterior to middle. Species 19.  
 Abdominal tergite 9 with dorsal plate; frontal elevation anterior to middle; clypeus with median groove. Species 21.

## SUBDIVISION D.

- Abdominal tergites 8 and 9 each with dorsal plate and armed with three permanent teeth; front of head without elevation; clypeus with faint median groove. Species 22 and 23.

## SYNOPSIS OF GALLERY CHARACTERS.

- Egg galleries *winding to straight*; eggs *isolated or in approximate groups*, but never in masses; larval mines exposed or concealed in inner bark. Division I.  
 Egg galleries *longitudinal*, straight to slightly winding; eggs *in groups or masses*; larval mines and pupal cells exposed in inner bark. Division II.

## DIVISION I.

- Pupal cells in *outer bark*; eggs *isolated*, never in groups; egg galleries winding; larval mines short, narrow to broad, exposed or concealed. Subdivision A.  
 Pupal cells in *inner bark*; eggs in *approximate groups*; egg galleries slightly winding to straight; larval mines short, broad, always exposed. Subdivision B.

## SUBDIVISION A.

- Larval mines *concealed* in inner bark. Section a1.  
 Larval mines *exposed* or concealed. Section a2.

## Section a1.

- Egg galleries *subtransverse*, winding. Species 1.  
 Egg galleries *distinctly transverse*. Species 2.

## Section a2.

- Larval mines *exposed*.  
 Egg galleries *longitudinal*, winding. Species 3.  
 Egg galleries *sublongitudinal*, winding. Species 4.  
 Larval mines *concealed*.  
 Egg galleries evidently transverse, or subtransverse, winding, with concealed larval mines. Species 5.  
 Egg galleries *subtransverse*, winding. Species 6.  
 Egg galleries *longitudinal*, winding, with transverse branches. Species 7 and 8.

## SUBDIVISION B.

- Egg galleries *winding to straight*. Species 9.  
 Egg galleries *usually straight*. Species 10 and 11.

## DIVISION (I).

- Larval mines *separate*, especially beyond the middle. Subdivision C.  
 Larval mines *contiguous*, forming broad larval chamber. Subdivision D.

## SUBDIVISION C.

- Egg galleries slightly winding to straight; eggs in groups, but larval mines separate from the beginning. Section a3.  
 Egg galleries broad, nearly straight; eggs in small to large groups, the larval mines usually contiguous toward the egg gallery. Section a4.

## Section a3.

- Larval mines normally *short* and *broad*. Species 12.  
 Larval mines normally *long*. Species 13.

## Section a4.

## Subsection b3.

- Larval mines separated beyond the middle. Species 14, 15, and 16.

## Subsection b4.

- Larval mines usually not separated beyond the middle, but forming a common chamber. Species 19 to 21.

## SUBDIVISION D.

- Egg galleries broad to very broad, short to very long, straight to winding; larval mines forming a large common chamber. Species 22 and 23.

TABLE OF DISTRIBUTION.<sup>a</sup>

- America, north of Guatemala, and in northern Europe. The genus.

## DIVISION I.

## SUBDIVISION A.

- North American continent, in South Atlantic and Gulf States and Southwestern States, southward to Guatemala and northward in Sierra Nevada and Cascade Mountains to British Columbia. Sections a1 and a2.

## Section a1.

- West of western Montana and southwestern Idaho, and southward to Santa Barbara County, California. Species 1, page 81.  
 South of southern Colorado and Utah, into Texas and Mexico, and westward into southern California, and possibly in the Coast Range and northward along the forested foothills into northern California. Species 2, page 85.

## Section a2.

- Southern Colorado and Utah, southward into Mexico. Species 3, page 87.  
 Atlantic and Gulf States, southwestward into Texas. Species 4, page 90.  
 Central to southern Arizona. Species 5, page 95.  
 Southern Mexico. Species 6 and 7, pages 97, 99.  
 Central Colorado and southern Utah, southward to southern Arizona, and New Mexico. Species 8, page 101.

<sup>a</sup> For exact and probable distribution see maps under description of each species.

## SUBDIVISION B.

- West of western Montana and southwestern Idaho, south through the Sierra Nevada Mountains of California..... Species 9, page 105.  
 Western South Dakota and southern Wyoming, southward through Utah, Colorado, to southern Arizona and New Mexico..... Species 10, page 109.  
 Northern California, southward in Sierra Nevada, into San Bernardino County, California..... Species 11, page 114.

## DIVISION II.

## SUBDIVISION C.

- Maine to western Michigan, southward into northwestern West Virginia. Species 12, page 117.  
 Northern Idaho and Montana, south to southern Arizona and New Mexico, and northern Washington, south into Santa Barbara County, California. Species 13, page 121.

## Section a4.

- Maine to northeastern Minnesota, southward to central Pennsylvania. Species 14, page 126.  
 Northern Idaho, east to western South Dakota, southward to southern Arizona and New Mexico..... Species 15, page 130.  
 Alaska..... Species 16, page 133.  
 Alaska?, along the coast to northwestern California..... Species 17, page 135.  
 Lake Superior region..... Species 18, page 138.  
 Western Montana southeast to central Colorado..... Species 19, page 140.  
 Higher mountains of New York, Pennsylvania, and West Virginia. Species 20, page 142.  
 Central Europe to Denmark, Russia, and eastward into Siberia. Species 21, page 143.

## SUBDIVISION D.

- Atlantic States south of Massachusetts, to Tampa, Florida, westward to western West Virginia and Texas..... Species 22, page 147.  
 Mountains and foothills of North Carolina, northward into Maine and northwestern Washington, southward into Guatemala..... Species 23, page 151.  
 Guatemala..... Species 24, page 157.

## TABLE SHOWING RELATION OF SPECIES TO HOST TREES.

## DIVISION I.

## Section a1.

- Species 1. *Pinus lambertiana*, *ponderosa*.  
 Species 2. *Pinus ponderosa* var. *scopulorum*, *edulis*; *Pseudotsuga taxifolia*.

## Section a2.

- Species 3. *Pinus scopulorum*.  
 Species 4. *Pinus strobus*, *taeda*, *rigida*, *virginiana*, *pungens*, *echinata*, *glabra*, *palustris*; *Picea rubens* and *excelsa*.  
 Species 5. *Pinus scopulorum*.  
 Species 6. *Pinus teocott*?, *lejoPhillia*, and *ayacahuite*?  
 Species 7. Same as 6.  
 Species 8. *Pinus arizonica*, *scopulorum*, and *chihuahuana*.

## SUBDIVISION B.

- Species 9. *Pinus monticola*, *lambertiana*, *ponderosa*, *murrayana*; *Picea engelmanni*.  
 Species 10. *Pinus flexilis* and *strobiformis*.  
 Species 11. *Pinus lambertiana* and *ponderosa*.

## DIVISION II.

## Section a3.

- Species 12. *Larix laricina*.  
 Species 13. *Larix occidentalis*; *Pseudotsuga taxifolia* and *macrocarpa*.  
 Species 14. *Picea mariana*, *rubens*, *canadensis*.  
 Species 15. *Picea canadensis* and *engelmanni*.  
 Species 16. *Picea canadensis*.  
 Species 17. *Picea sitchensis*.

## Subsection b4.

- Species 18. *Pinus strobus*.  
 Species 19. *Pinus murrayana*; *Picea engelmanni*.  
 Species 20. *Picea rubens*.  
 Species 21. *Pinus*, *Picea*, *Abies*?, *Larix*.

## SUBDIVISION I.

- Species 22. *Pinus strobus*, *taeda*, *rigida*, *serotina*, *echinata*, *palustris*.  
 Species 23. *Pinus strobus*, *monticola*, *lambertiana*, *strobiformis*, *ponderosa*, *scopulorum*, *jeffreyi*, *chihuahuana*, *murrayana*, *radiata*, *rigida*, *virginiana*; *Larix laricina*; *Picea rubens*, *canadensis*, *excelsa*.

## TABLE OF HOST TREES.

|                            | <i>Dendroctonus</i> species number. |                                    | <i>Dendroctonus</i> species number. |
|----------------------------|-------------------------------------|------------------------------------|-------------------------------------|
| <i>Pinus strobus</i> ..... | 4, 18, 22, 23.                      | <i>Pinus echinata</i> .....        | 4, 22.                              |
| <i>monticola</i> .....     | 9, 23.                              | <i>glabra</i> .....                | 4.                                  |
| <i>lambertiana</i> .....   | 1, 9, 11, 23.                       | <i>palustris</i> .....             | 4, 22.                              |
| <i>flexilis</i> .....      | 10.                                 | <i>sylvestris</i> .....            | 23.                                 |
| <i>strobiformis</i> .....  | 10, 23.                             | <i>teocott</i> .....               | 6, 7.                               |
| <i>edulis</i> .....        | 2, 23.                              | <i>lejoPhillia</i> .....           | 6, 7.                               |
| <i>arizonica</i> .....     | 8, 23.                              | <i>ayacahuite</i> .....            | 6, 7.                               |
| <i>ponderosa</i> .....     | 1, 9, 11, 23.                       | <i>Larix laricina</i> .....        | 12, 23.                             |
| <i>scopulorum</i> .....    | 2, 3, 5, 8, 10, 23.                 | <i>occidentalis</i> .....          | 13.                                 |
| <i>jeffreyi</i> .....      | 11, 23.                             | <i>Picea mariana</i> .....         | 14.                                 |
| <i>chihuahuana</i> .....   | 3, 8, 23.                           | <i>rubens</i> .....                | 4, 14, 20, 22, 23.                  |
| <i>murrayana</i> .....     | 9, 10, 19, 23.                      | <i>canadensis</i> .....            | 14, 15, 16, 23.                     |
| <i>radiata</i> .....       | 23.                                 | <i>engelmanni</i> .....            | 9, 10, 15, 19.                      |
| <i>taeda</i> .....         | 4, 22.                              | <i>sitchensis</i> .....            | 17.                                 |
| <i>rigida</i> .....        | 4, 22, 23.                          | <i>excelsa</i> .....               | 4, 23.                              |
| <i>serotina</i> .....      | 22.                                 | <i>Pseudotsuga taxifolia</i> ..... | 2, 13.                              |
| <i>virginiana</i> .....    | 4, 23.                              | <i>macrocarpa</i> .....            | 13.                                 |
| <i>pungens</i> .....       | 4.                                  |                                    |                                     |

## REVISION AND SYSTEMATIC NOTES, WITH DESCRIPTIONS OF NEW SPECIES.

## DISTINCTIVE GENERIC CHARACTERS.

*Adult* (figs. 1, 2, 3).—Antennal funiculus 5-jointed; club broad, thickened at base, compressed toward apex, and usually with 4 distinct segments, the sutures curved or nearly straight; tarsi with joint 3 bilobed; tibia with inner angle produced and armed with a single tooth; outer angle oblique and armed with 3 or more stout teeth; distinct dorsal impression toward apex for the retractile tarsus.

Anterior cœxæ approximate or subcontiguous. Abdominal sternites with ends of sutures 4, 5, and 6 strongly recurved. Body cylindrical, subelongate to stout, ranging in color from reddish and brown to deep black. Head prominent and large, with distinct epistomal process at anterior margin of front. Eyes transversely placed and oblong-oval to oblong-ovate. Antennal insertion in front of ventral end of eye. Pronotum with sides nearly parallel to narrowed and constricted toward head, one-fourth to one-third broader than long. Elytra with base elevated and rugose, remaining surface rugose, with punctured striæ and the declivity convex to subconvex.

*Pupa* (figs. 37, 38).—The pupa is of the general size of the adult, and is distinguished by its broad prominent head, and the form of the prothorax. The sculpture and armature vary with the age of the specimen. In the preimaginal stage the granules and spines become more obscure.

*Larva* (text fig. 39; Pl. VIII).—The body of a matured larva of a given species is somewhat longer than the adult or pupa, and is cylindrical, deeply wrinkled, legless, and with a few long hairs on each segment, becoming longer on the posterior ones. The head is moderately large, shining, yellowish, and with a few hairs on the scutellar lobes. Front distinct; antennæ present, but obscure; eye spots not present. The thoracic segments are larger and more prominent in some species than in others. Abdominal segments 1 to 9 are of about equal width and length; 10 is represented by the anal lobe.

*Egg*.—Short, oval to oblong-oval, pearly white and shining, and apparently without sculpture and specific characters, except in relative size, corresponding with the size of adult representatives of the species.

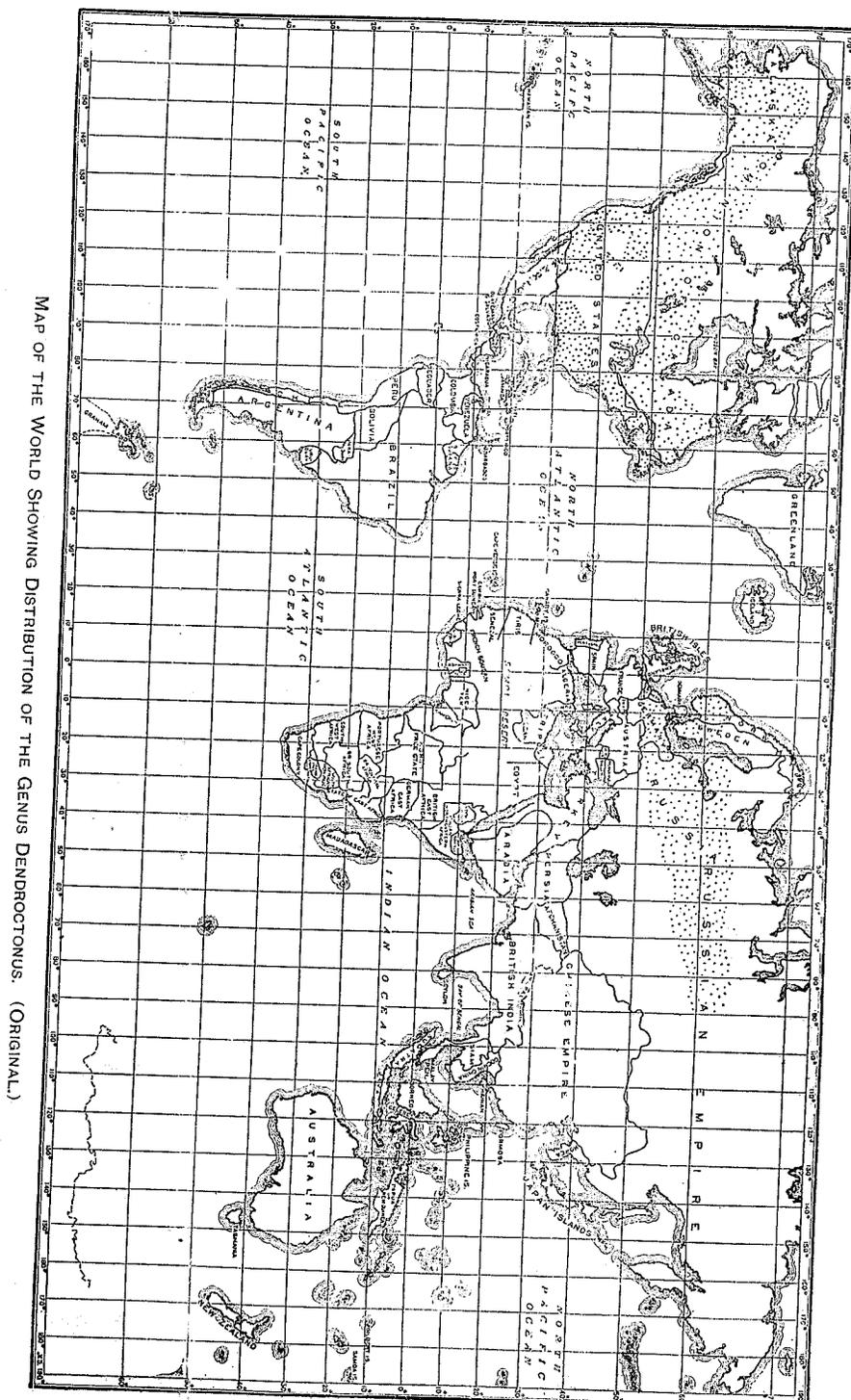
*Galleries*.—The primary or egg galleries are excavated in the inner bark and sometimes mark or groove the wood and vary in their course in the bark of the tree from transverse and winding to longitudinal and straight, and normally are of the single unbranched type.

*Distribution* (Pl. II).—Eastern continent: Central and northern Europe, from Denmark into Siberia. Western continent: Guatemala, northward through the United States into Alaska and Labrador.

*Host trees*.—*Pinus*, *Picea*, *Pseudotsuga*, *Larix*, and *Abies*, the latter rarely, if at all.

#### BIBLIOGRAPHY AND SYNONYMY OF GENUS.

Erichson, 1836, pp. 52-53, original description, to include *D. micans* (Kug.) (type), *D. terebrans* (Oliv.) (cotype), *Myelophilus piniperda* (L.), *Myelophilus minor* (Hartig), and *Carphoborus minimus* (Fab.). Eichhoff, 1864, pp. 26-27, Pl. I, figs. 5, 6, 7, tibia, maxilla, labium, revised description to include the single European species, *D. micans* (Kug.). Lacordaire, 1866, pp. 360-361, revision to include *D. micans* (Kug.) and *D. terebrans* (Oliv.). Zimmerman, 1868, pp. 148-149, revision to include *Carphoborus bifurcus* Eich., *D. terebrans* (Oliv.), and *D. frontalis* Zimm. Le Conte, 1868, pp. 172-173, revision to include *D. terebrans* Lac., *D. obesus* (Mann.), *D. rufipennis* (Kirby), *D. punctatus* Lec.



*D. simplex* Lec., *D. frontalis* Zimm., eliminating *Carphoborus bifurcus* Eichh. Eichhoff, 1881, pp. 125, brief revision, including *D. micans* (Kug.). Le Conte and Horn, 1883, p. 523, in synoptic table. Dietz, 1890, pp. 27-28, revision and synopsis to include *D. terebrans* (Oliv.), *D. rufipennis* (Kirby), *D. similis* Lec., *D. simplex* Lec., *D. approximatus* n. sp., and *D. frontalis*; revised description of species, with synonymy, figs. 1-6, epistomata and antennæ. Hopkins, 1894b, p. 280, author's extra, p. 7, sexual characters of *D. terebrans* (Oliv.), *D. frontalis* Zimm. Blandford, 1897, p. 143, synoptic table. Lovendal, 1398, pp. 86-87, Pl. II, fig. 7, antenna, fig. 8, tarsus. Hopkins, 1902a, pp. 3-4, secondary sexual characters, statistics, etc. Hopkins, 1906b, pp. 143-147, larval mouthparts.

## DIVISION I.

The distinctive characters common to the species of the first division are as follows:

*Adult.*—Prothorax somewhat elongate and as broad as elytra; anterior dorsal half of elytra without long erect hairs.

*Pupa.*—Vertex of head distinctly to faintly grooved, and with two prominent to small frontal spines or granules on or toward the vertex each side of groove.

*Larva.*—Abdominal tergites 8 and 9 without dorsal plates.

*Galleries.*—Egg galleries winding to straight; the eggs isolated or in approximate groups, but never in masses; larval mines exposed or concealed in inner bark.

## SUBDIVISION A.

(Species numbers 1 to 8, inclusive.)

The distinctive characters common to the species of the first subdivision are as follows:

*Adult.*—Body somewhat slender; prothorax with sides but slightly narrowed and not constricted toward the head; elytra with second stria of declivity straight; second interspace not distinctly broader in middle:

*Sexes.*—Female: Pronotum *with* transverse ridge across anterior area. Male: Pronotum *without* transverse ridge, but usually with anterior area broadly impressed.

*Pupa.*—Elytra smooth; vertex of head faintly grooved and with two small, widely separated frontal tubercles.

*Larva.*—Front with or without median convexity.

*Galleries.*—Egg galleries winding; larval mines exposed or concealed. Pupal cells in outer bark; eggs isolated, never in groups.

1. *Dendroctonus brevicornis* Le Conte.

(Pl. III, fig. 1.)

*Adult.*—Typical female: Length, 4.6 mm.; light brown. Elytral declivity without long hairs. Head with front convex, slight elevations each side of a faint median groove. Elytral rugosities fine, densely placed; striæ obscure and but faintly or not at all impressed.

Pronotum with a few reclining long hairs on the anterior half, remaining areas with very few and stout pubescence. Secondary sexual characters: Pronotum with transverse ridge extending across the anterior area to near the sternum. Elytral declivity moderately smooth and shining; interspaces finely and densely punctured; striae fine, with punctures scarcely visible.

Typical female labeled "type of revision," name label, "Hopk. 4/18/02," second name label, "Hopk. Jan 16/08, *Pinus ponderosa*, Hopkins, collector, 3/24/99, Grant's Pass, Or., ♀, Hopk. U. S. 34."

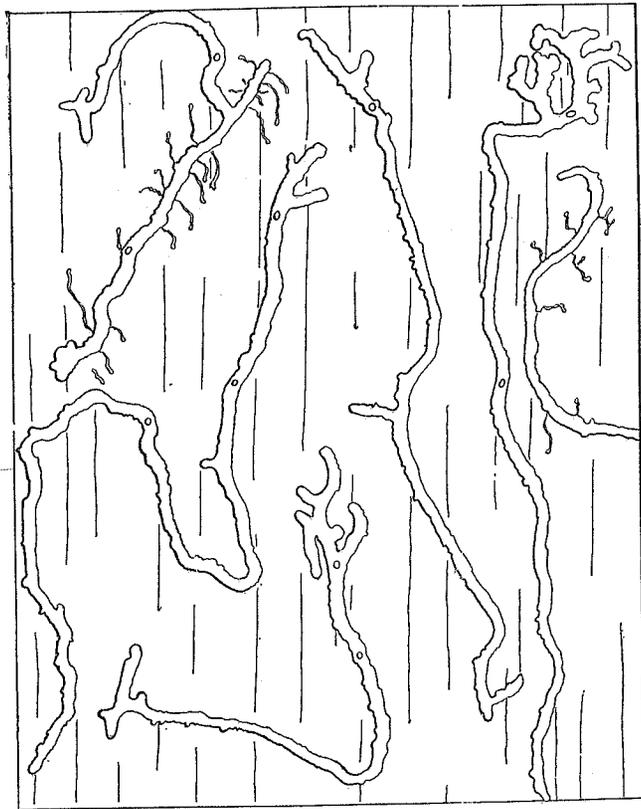


FIG. 44.—*Dendroctonus brevicomis*: Egg galleries. (Original.)

Type male in Le Conte collection, labeled "Cal.," examined by writer.

Typical male: Length 4.6 mm. Agrees with female, except in the more prominent frontal tubercles each side of a distinct groove and a transverse impression instead of an elevation across the anterior area of the pronotum, and the elytral declivity slightly less shining.

Typical male labeled "type of drawing," name label, "Hopk. 1/16/08, *Pinus ponderosa*, Hopkins, collector, 3/24/99, Grant's Pass, Or., ♂, Hopk. U. S. 34."

*Variations*.—Length, 3 to 5 mm.; color light brownish to nearly black; punctures of pronotum ranging from moderately coarse to very fine, elytral striae not at all impressed in some examples, in others the impression and punctures more distinct, but never as distinct as in the majority of *D. barberi*. The elytral rugosities also vary from very fine to moderately coarse. The front varies greatly, from convex without tubercles to deeply grooved and with prominent tubercles. The epistomal process varies from the normal concave form with angles elevated and lateral margins strongly oblique to flat with rounded apex and lateral margin suboblique.

*Distinctive characters*.—The adults of this species are at once distinguished from its nearest ally, *D. barberi*, by the finer rugosities of the elytral interspaces and the much less distinctly impressed striae.

*Revisional notes*.—The labeled type in the Le Conte collection agrees with the description, except that the prothorax is not nearly twice as broad as long. It is certainly distinct from *D. frontalis*. The specimens in the Horn collection under *D. frontalis* that evidently represent part of the material on which Doctor Dietz based his revision, include

one specimen of *D. frontalis* labeled with red disk, one specimen of *D. brevicomis* labeled "Cal.," one specimen of *D. barberi* labeled "Williams, Ariz. 7. 28," one specimen of *D. arizonicus* (?) "Williams, Ariz. 7. 28," and one specimen without locality label. One specimen was also received from Dietz, under *D. frontalis*, labeled "Arizona," which proved to be *D. barberi*. In 1898 *D. brevicomis* Lec. was not represented in the U. S. National Museum. Therefore it appears that up to 1899 there were only two specimens of the species in the large collections of the country.

*Pupa*.—In addition to the divisional and subdivisive characters, the pupae range in length about the same as adults; the apices of the front and middle femora are smooth; abdominal tergites 3, 4, 5, and

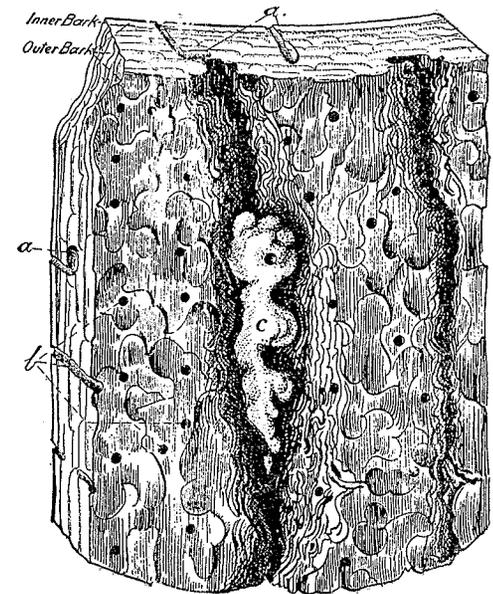


FIG. 45.—*Dendroctonus brevicomis*: Bark showing, a, pupal cells; b, exit burrows; c, pitch tubes. (From Webb.)

6 with small pleural spines, 1 and 2 without distinct dorsal and lateral spines. Pupal type labeled "Hopk. U. S. 34."

*Larva* (Pl. VIII, fig. 1).—In addition to the divisional and subdivisional characters the larvæ range slightly longer than the pupæ. Epistoma distinctly elevated. Front without median convexity; clypeus with apex subacutely emarginate; thoracic segments with prominent sternal lobes; the sternellar lobes with distinct foot calli; apex of abdomen subtruncate. Larval type labeled "Hopk. U. S. 25a."

*Galleries* (figs. 44, 45).—Egg galleries subtransversely winding; eggs isolated; larvæ concealed in inner bark; pupal cells in outer bark.

*Distribution* (fig. 46).—(Hopk. U. S.) *California*: McCloud, Badger, Chester, Wawona, Sterling, Summerdale, Yosemite, Ballard. *Montana*:

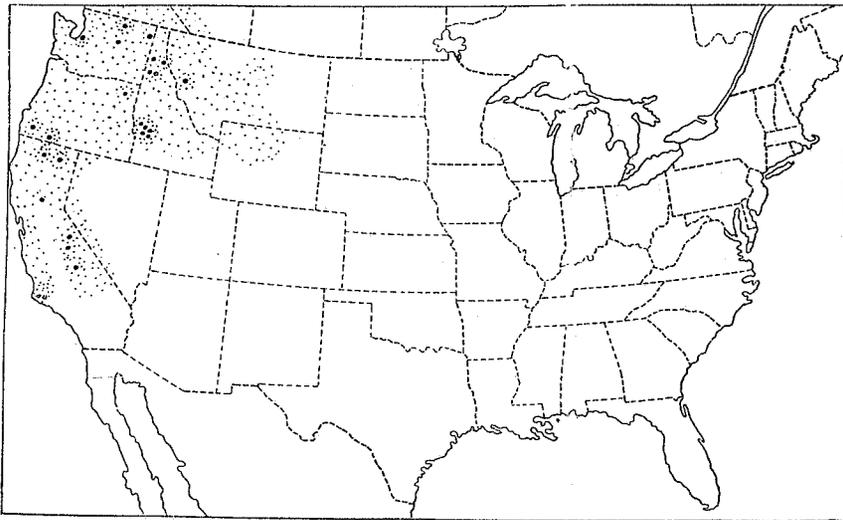


FIG. 46.—*Dendroctonus brevicornis*: Distribution map. (Original.)

Missoula. *Oregon*: Grants Pass, Joseph. *Washington*: Buckeye (near Spokane), Chelan. *Idaho*: Moscow, Smiths Ferry, Centerville, Stites, Kooskia (Harris Ridge), Pioneer (Grimes Pass), Garden Valley, Placerville, Cedar Mountains, Troy.

*Host trees*.—*Pinus ponderosa* and *P. lambertiana*.

*Identified specimens*.—Le Conte, 1; Horn, 1; Hopk. U. S., several hundred, including all stages and work.

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kins, 1903b, p. 281, mentioned. Hopkins, 1904, p. 18, habits, distribution, etc. Webb, 1906, bulletin, Pls. II, III, figs. 7-12, stages and work illustrated, full account of habits, life history, etc. Hopkins, 1908, pp. 162-163, depredations. *Dendroctonus frontalis* (not of Zimm.) Dietz, 1850, p. 32 (in part), California. *Dendroctonus brevicornis* Dietz, 1890, p. 32 (in part), California.

#### 2. *Dendroctonus barberi* n. sp.

(Pl. III, fig. 2.)

*Adult*.—Type of species, female: length, 4.5 mm.; very dark brown. Elytra and elytral declivity without long hairs. Head with front convex, with slight elevation each side of a faint median groove. Elytral rugosities moderately coarse and dense; striae distinctly impressed. Pronotum with a few long hairs on the anterior half of the lateral area, the remaining area with very fine and short pubescence. The secondary sexual characters are the same as in the preceding species.

Type labeled "Type No. 7444, U.S.N.M.," name label, "Hopk. 1/15/08, ♀, individual ♂, Barber & Schwarz, Coll[ectors], Williams, Ar., 7.6" (= June 7).

Male type: Length, 4 mm. Front with prominent tubercles each side of a distinct groove. Pronotum without transverse ridge across the anterior area, but with a broad transverse impression. The elytral declivity shining, with striae punctures distinct and interspaces slightly more rugose than in the female.

Male type labeled "♂ type," otherwise same as female, except type number.

*Variations*.—Length 2.5 to 4.7 mm., color from brownish to black. The frontal and prothoracic variations are similar to those of *D. brevicornis*. The elytra vary from rugosities moderately coarse and obtuse to distinctly coarse and acute, and striae from moderately to very distinctly impressed, and the punctures from obscure to distinct.

*Distinctive characters*.—The adults of *D. barberi* are at once distinguished from the next species by the absence of long hairs on the elytral declivity, and from *D. brevicornis*, to which it is closely allied, by the prevailing coarser rugosities of the elytral interspaces and the distinctly impressed striae. Some systematists might concede these characters of no more than subspecific or varietal value, but it must be remembered that in this genus there is a close general resemblance of allied species and that the characters which in other genera would be of special value in specific distinction are so variable and inconstant in this as to be of no value. Therefore any constant or prevailing character of distinction, even if it does seem insignificant, is of vastly higher value than would otherwise be allowable, especially when it is supported by differences in physiological characteristics.

*Revisional note.*—This species is not represented in the Le Conte collection. One specimen labeled "Williams, Ariz., 7.28, 151," and one without label found in the Horn collection, both under *D. frontalis*, and one specimen labeled "Ariz.," received from Doctor Dietz under *D. frontalis*, all belong to *D. barberi*. These were evidently before Doctor Dietz when he prepared his revision of *D. frontalis*, *ibid.*

*Pupa.*—In addition to the generic, divisional, and subdivisional characters, the apex of the front and middle femora is smooth; abdominal tergites 3 to 6 with very small dorsal, lateral, and pleural spines; 1 and 2 without dorsal or lateral spines; 3 to 6 with minute dorsal and lateral spines; 7 and 8 smooth, and 9 with small pleural spines. Pupal type, labeled "Hopk. U. S. 5030" (in alcohol), differs from pupa of *D. brevicomis* in the absence of lateral spines on abdominal tergites 3 and 4; but these, with other pupal characters, are so variable that

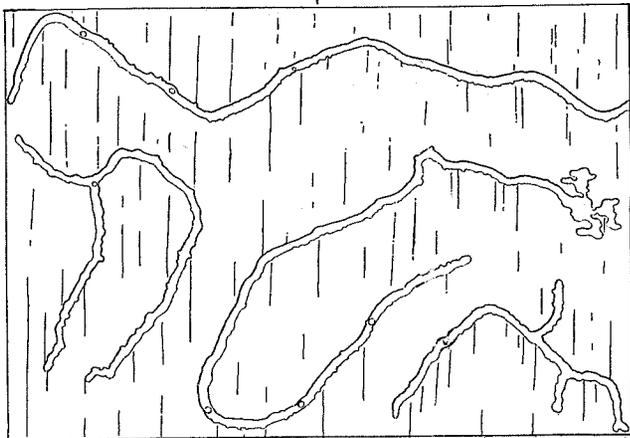


FIG. 47.—*Dendroctonus barberi*: Egg galleries. (Original.)

not much reliance can be placed on any of them to separate closely allied species.

*Larva.*—In addition to the generic, divisional, and subdivisional characters, the clypeus has the apex broadly emarginate instead of subacutely emarginate, as in *D. brevicomis*. It also differs in the more rounded apex of the labrum and in the more distinctly rugose mandibles. Larval type labeled "Hopk. U. S. No. 5129" (mounted and alcoholic).

*Galleries* (fig. 47).—In addition to the divisional and subdivisional characters, the egg galleries are usually distinctly transversely winding, thus differing from *D. brevicomis*; otherwise there is little difference.

*Distribution* (fig. 48).—(Hopk. U. S.) *Arizona*: Williams, Flagstaff, San Francisco Mountains, Grand Canyon, Walnut Canyon, Dead Man's

Flat, Show Low, Santa Catalina Mountains. *New Mexico*: Vermejo, Santa Fe, Meeks, Capitan (Mountains), Cloudcroft. *Texas*: Davis Mountains. *Colorado*: Fort Garland and Monte Vista. *Utah*: Escalante and Panguitch. *Additional localities from other collections.* (H. & S.) Chiricahua Mountains, Ariz.

*Host trees.*—*Pinus ponderosa* var. *scopulorum* (very common), *P. edulis* (rare), and *Pseudotsuga taxifolia* (rare, probably abnormal).

*Identified specimens.*—Horn collection, 2; Dietz, 1; U. S. N. M., H. & S., 2, B. & S., 62; Hopk. U. S., more than 400, including all stages and work.

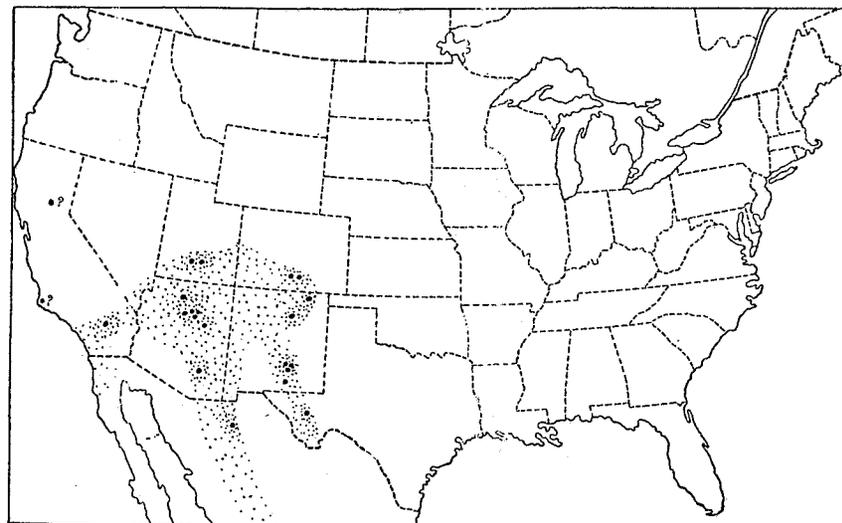


FIG. 48.—*Dendroctonus barberi*: Distribution map. (Original.)

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- Dendroctonus frontalis* (not of Zimm.) Dietz, 1890, p. 32 (in part), Arizona.  
*Dendroctonus arizonicus* Hopkins, 1902a, p. 3 (in part), manuscript name only.  
*Dendroctonus* n. sp. Hopkins, 1904, pp. 42, 44, habits, host, distribution, etc.  
*Dendroctonus brevicomis* var. *barberi* Hopkins, 1906b, p. 147, Pl. IV, fig. 9, anatomy of larval head, manuscript name.

#### 3. *Dendroctonus convexifrons* n. sp.

(Pl. III, fig. 2.)

*Adult.*—Type of species, female: Length, 6 mm.; reddish-brown, shining. Elytral declivity with long hairs. Head with front convex; without median frontal groove or tubercles, but with posterior impression. Elytral rugosities moderately coarse, but not densely placed, except toward the base; striae faintly impressed and with rather coarse, indistinct punctures. Pronotum with long, erect hairs on the entire

lateral area, the remaining area with short, erect, and sparse pubescence. Secondary sexual characters: Pronotum with transverse ridge across the anterior area, extending to the sternum. Elytral declivity shining; striae very slightly impressed; punctures obscure; interspaces granules sparse and small, but distinct.

Type labeled "Type No. 7445 U.S.N.M.," name label, "Hopk. 1/16/08, *Pinus ponderosa*, Hopkins, Colr., 9/8/02, Williams, Ariz., ♀, Hopk. U. S. 1109."

Male type: Length, 5.6 mm. Front convex and with faint anterior and posterior impressions, but without frontal groove or tubercles. Pronotum without transverse elevation. Elytral declivity less shining; striae more impressed, with more distinct punctures and the interspaces granules distinctly coarser than in the female.

Male type labeled "♂ type;" otherwise same as female, except type number.

*Variations.*—The length varies from 4 to 6 mm., with the average at about 5.5 mm.; the color ranges from reddish to black, with reddish-brown prevailing; front ranges from completely convex without median impression to more or less distinctly impressed, but never with frontal tubercles. The punctures of the pronotum vary as usual, and the dorsal area ranges from the absence of a longitudinal median space or line to a distinct elevated line.

*Distinctive characters.*—The adults of *D. convexifrons* are at once distinguished from *D. approximatus* by the more slender form and shining appearance, and the prevailing convex front in both sexes, which latter character also distinguishes small examples of the species from large examples of *D. arizonicus*. The long hairs on the elytral declivity render it absolutely distinct from *D. barberi*, to which it appears to be more closely allied on account of pupal characters.

*Revisional notes.*—This species is not represented in the Le Conte collection, but among the three specimens in the Horn collection, under *D. approximatus* Dietz, there was one labeled "N. M.," which certainly must be referred to it.

*Pupa.*—In addition to the divisional and subdivisional characters, the front and middle femora are smooth or with minute apical granule; abdominal tergites 1 and 2 without dorsal spines but with one or two lateral granules; 2 to 6 with very small lateral spines, and 3 to 6 with very small dorsal and lateral spines, becoming more prominent toward the sixth; 7 and 8 smooth and 9 with widely separated caudal spines. Pupal type labeled "Hopk. U. S. No. 5090."

*Larva.*—In addition to the divisional characters, the front has a median smooth, shining convexity; mandibles distinctly rugose on lateral area toward base; labrum with apex broadly rounded and

clypeus with apex broadly emarginate. Sternellar lobes of thoracic segment without foot calli. Larval type labeled "Hopk. U. S. No. 5078."

*Galleries* (fig. 49).—Egg galleries longitudinally winding; eggs isolated; larval mines exposed in inner bark; pupal cells in outer bark.

The galleries of this species are at once distinguished from those of *D. barberi* and *D. approximatus* by the exposed larval mines.

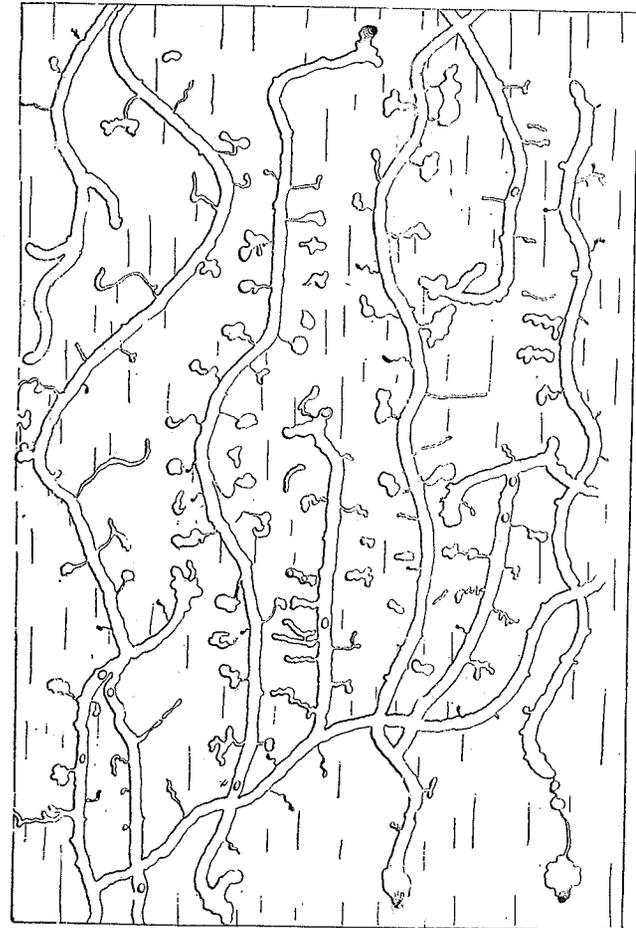


FIG. 49.—*Dendroctonus convexifrons*: Egg galleries and larval mines. (Original.)

These three species usually infest the same tree, and often all of their galleries are represented in a piece of bark.

*Distribution* (fig. 50).—(Hopk. U. S.) *Arizona*: Williams, Flagstaff, Show Low, Paradise, Santa Catalina Mountains, and Chiricahua Mountains. *Colorado*: Las Animas County, La Veta, Fort Garland, and Monte Vista. *New Mexico*: Cloudercraft, Meeks, Capitan, Fort

Wingate Military Reservation, Vermejo, Lincoln National Forest, and Sierra Blanca Mountains. *Utah*: Escalante, La Salle National Forest, and Panguitch Lake. *Additional locality from other collections*: (B. & S.) Las Vegas, N. Mex.

*Host trees*.—*Pinus ponderosa* var. *scopulorum* (very common) and *P. chihuahuana* (rare).

*Identified specimens*.—Hopk. U. S., more than 100 specimens, including all stages and work; Horn, 1 specimen under *D. approximatus*, labeled "N. M."; U.S.N.M., B. & S., 7 specimens, Las Vegas, N. Mex., 17-8, No. 164, and Williams, Ariz., 5-6, 5-7, and 5-10.

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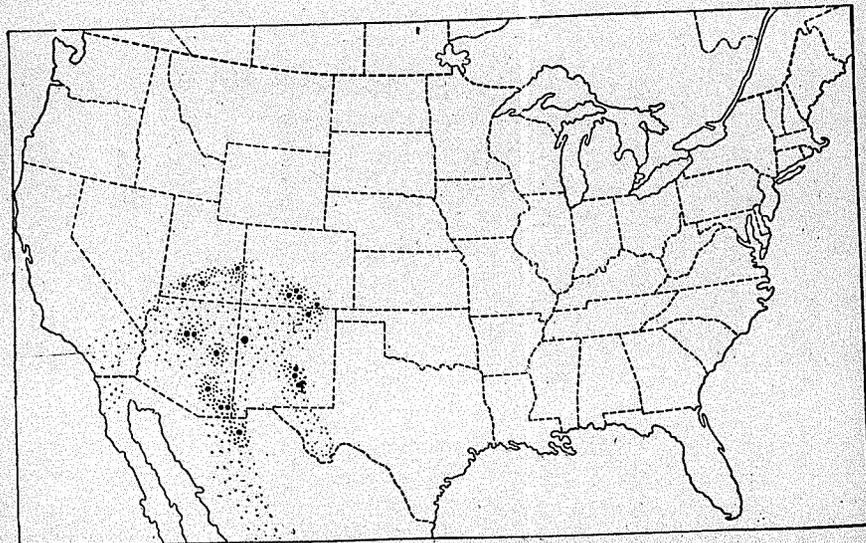


FIG. 50.—*Dendroctonus convexifrons*: Distribution map. (Original.)

4. *Dendroctonus frontalis* Zimmerman.

(Pl. III, fig. 4.)

*Adult*.—Typical female: Length, 3.6 mm.; reddish-brown. Elytral declivity with long hairs. Front with a moderately prominent tubercle each side of a distinct median groove. Elytral striae distinctly punctured; interspatial rugosities moderately coarse, obtuse, not very densely placed, and not very distinctly coarser toward the base and vertex. Pronotum with a few long hairs on the anterior section of the lateral area. Secondary sexual characters: Pronotum with transverse ridge across the anterior area, the elytral declivity shining and with finely granulate interspaces, the striae distinctly impressed, but the punctures obscure.

Typical female labeled "type of revision, type of drawing," name label, "Hopk. 4-18-02, ♀, H. S. 58, S. C."

Type in Le Conte collection labeled "Type 1, *D. frontalis* (Fab.) Zimm.," red disk (= Carolinas).

Male type: Length, 3.5 mm. Front with prominent frontal tubercle each side of a broad, deep frontal groove. Pronotum without transverse elevation or impression across the anterior area. Elytral declivity with striae more impressed and the interspatial granules coarser and more sparse than in the female.

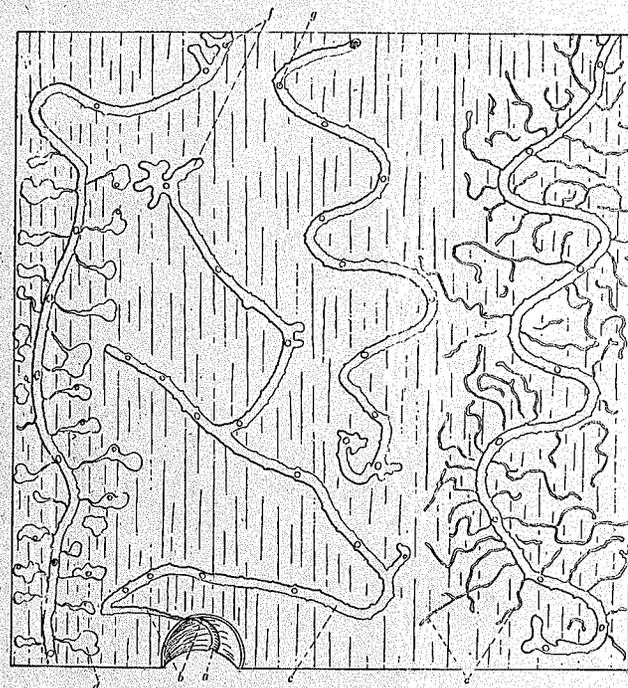


FIG. 51.—*Dendroctonus frontalis*: Egg galleries and larval mines. a, Entrance; b, entrance burrow; c, egg gallery; d, normal larval mine; e, abnormal larval mine; f, terminal; g, ventilating burrows. (Original.)

Typical male labeled with name, "Hopk. 1-16-08, ♂, U.S.N.M. 37, sp., N. C."

*Variations*.—The length varies from 2.5 to 4 mm., with the average at about 3.2 mm. The color ranges from light brown to nearly black; the epistoma, front, prothoracic punctures, and elytral rugosities vary as usual. The anterior area of the pronotum, which is glabrous in the typical females and males, usually has a few long hairs.

*Distinctive characters*.—This species is distinguished from *D. arizonicus*, its nearest ally, by its smaller size, broader pronotum, with finer punctures, and finer and less acute rugosities of the elytra.

*Revisional notes*.—The type series in the Le Conte collection is represented by three specimens—one labeled "Type 1, *D. frontalis* (Fab.)

Zimm.," red disk (= Carolinas), which should stand as the type, and the other two labeled "Type 2" and "Type 3," same locality. There are also two specimens, one labeled "Specimen 4, Lake Superior," and the other labeled "Specimen 5, Va." Both of these agree with the West Virginia form. In addition, there are three specimens labeled with an orange disk (= Georgia), one with light green disk (= Middle States), all of which were doubtless before Le Conte when he drew up his revised description.

The series in the Horn collection, which was evidently before Doctor Dietz when he drew up his revised description, includes but one

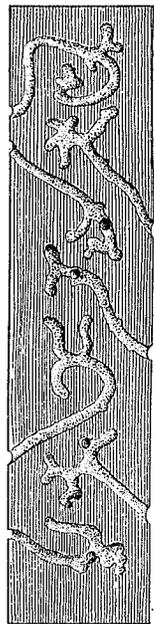


FIG. 52.—*Dendroctonus frontalis*: Termination of egg galleries. (Original.)

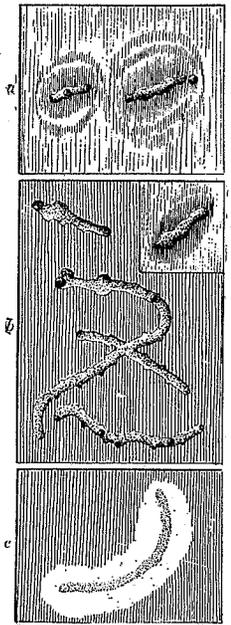


FIG. 53.—*Dendroctonus frontalis*: Beginning of egg galleries; *a*, in living bark; *b*, in dying bark; *c*, marked on surface of wood (white area represents normal appearance of wood preserved by resin). (Original.)



FIG. 54.—*Dendroctonus frontalis*: Bark showing, *a*, pitch tubes; *b*, entrance burrow; *c*, egg gallery; *d*, ventilating burrow; *e*, pupal cells; *f*, exit burrows; *g*, inner bark; *h*, outer bark. (Original.)

specimen labeled with red disk (= Carolinas). The specimens mentioned, together with two or three specimens in the United States National Museum, were probably all that were in the larger collections of the country up to 1890.

The form which in 1891 and 1892 extended northward from the normal range of the species into Virginia and West Virginia is represented in the revision series by specimens labeled "Hopk. W. Va. ♀ individual 1" and "Hopk. W. Va. ♂ individual 1." The West Virginia female differs from the typical South Carolina female in a more

rugose front, prothorax slightly narrow in front, with a few short and long hairs on sides and the punctures of anterior dorsal surface coarser toward base and fine toward anterior margin; elytral rugosities more acute; stria punctures coarser and more distinct; elytral declivity with longer and more numerous hairs. The West Virginia male differs from the typical North Carolina male type in the more shining front, with punctures more distinct, while the pronotum and elytra show the corresponding differences mentioned under the female individual 1. At one time it seemed to the writer that this

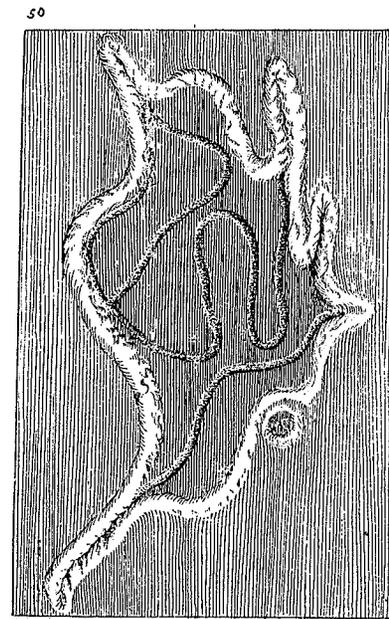


FIG. 55.—*Dendroctonus frontalis*: Old egg galleries in living tree, with surrounding callus of new wood. (Original.)

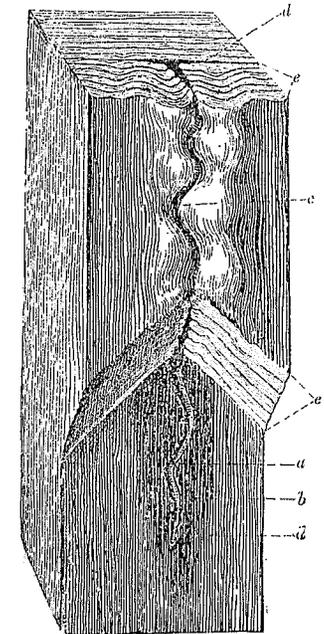


FIG. 56.—*Dendroctonus frontalis*: Egg gallery in living tree marked on surface of wood six years before block was cut from tree. *a*, Mark of gallery on original surface; *b*, resinous wood; *c*, surface scar six years later; *d*, original surface or 7-year-old annual layer of wood; *e*, six subsequent annual layers of wood formed over original wound. (Original.)

northern form was worthy of specific distinction, and the manuscript name of *D. pinicida* was proposed for it, but it was later found that some southern examples showed the same, and even greater, variations from the type. Therefore, since the species had disappeared from its northern range, it was decided that it would not be advisable to recognize it as specifically distinct.

*Pupa*.—In addition to the divisional and subdivisive characters the apices of the front and middle femora are armed with small apical spines or granules. Abdominal tergites 1 to 6 without pleural spines; 1, 2, and 3 without distinct dorsal and lateral spines; 4 to 6 with a pair of dorsal spines and one or two lateral ones; 7 and 8 with

a few dorsal granules, and 9 with medium-sized caudal spines. Pupal type labeled "Hopk. U. S. No. 2968."

*Larva*.—In addition to the divisional characters, the front has a distinct, median, smooth, shining convexity produced toward vertex; clypeus short, broad, with apex deeply emarginate; prothoracic segments very large and sternellar lobes with distinct foot calli. Apex of abdomen truncate. Larval type labeled "Hopk. W. Va. No. 5976."

The frontal convexity is more rugose in some specimens than in others.

*Galleries* (figs. 51–56).—Egg galleries sublongitudinal, winding; the eggs isolated; larval mines exposed; pupal cells in outer bark.

*Distribution* (fig. 57).—(Hopk. W. Va.) *West Virginia*: Hampshire, Monongalia, Hardy, Pendleton, Randolph, Pocahontas, Tucker, Kanawha, Raleigh, Greenbrier, and Wood counties. *Virginia*: Port

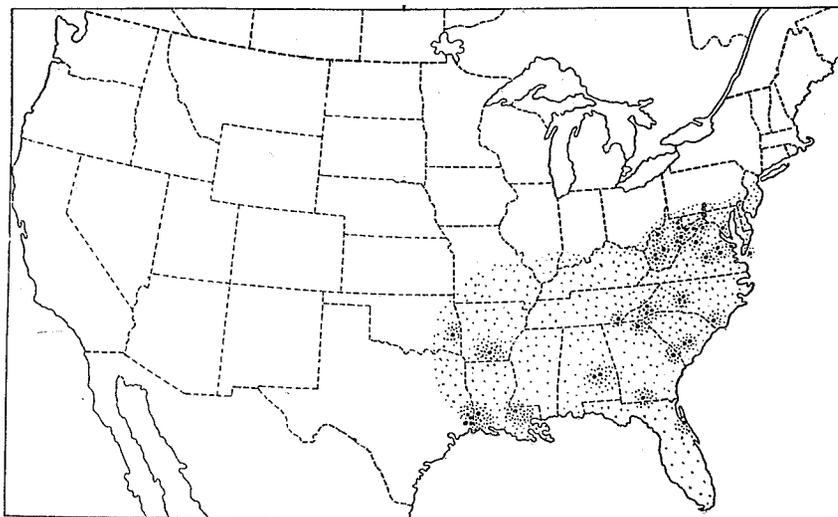


FIG. 57.—*Dendroctonus frontalis*: Distribution map. (Original.)

Republic. Work observed in southern Pennsylvania, Maryland, and Virginia (author). (Hopk. U. S.) *Alabama*: Calhoun, Montgomery. *Arkansas*: Hampton. *Georgia*: Clio, Thomasville, Demorest. *Louisiana*: Singer, Wilson. *Maryland*: Near Cumberland. *North Carolina*: Tryon, Pisgah Ridge, Fletchers, Boardman, Pink Beds, Biltmore. *South Carolina*: Chicora (Pregnalls). *Tennessee*: Ducktown. *Texas*: Call, Deweyville, Kirbyville, Beaumont. *Virginia*: Green Bay, Glen Allen, Auburn Mills, Virginia Beach. *District of Columbia*: Washington. *Additional localities represented in other collections*: (Le Conte) Lake Superior, Michigan. (There may have been some mistake in regard to the labeling of this specimen, since it is not likely the species will ever be found that far north.) (H. & S.) Haw Creek, Florida; Cobbs Island, Virginia; (A. M. N. H.) Black Mountains and Mount Graybeard, North Carolina; (Barber) "western Indian territory" [Oklahoma].

*Host trees*.—*Pinus strobus*, *P. taeda*, *P. rigida*, *P. virginiana*, *P. pungens*, *P. echinata*, *P. glabra*, *P. palustris*, *Picea rubens*, and *P. excelsa*.

*Identified specimens*.—Le Conte collection, 9; Horn, 1; U.S.N.M., H. & S., 5; D. A., 7; Barber, 2; Hopk. W. Va., 68; Hopk. U. S., more than 150, including all stages and work.

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- Bostrichus frontalis* (not of Fab.) Zimmerman, 1868, p. 149, synonymical reference. Le Conte, 1868, p. 173.
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- Dendroctonus brevicornis* Dietz, 1890, p. 32 (in part).

#### 5. *Dendroctonus arizonicus* n. sp.

(Pl. III, fig. 5.)

*Adult*.—Type of species, female: Length 3.7 mm., dark brown. Elytral declivity with long hairs confined to declivity and posterior lateral areas. Head with front convex, shining, and with distinct frontal tubercle each side of a broad median groove. Elytral striae distinctly punctured; the interspaces with subacute, moderately coarse rugosities, distinctly coarser toward the base and vertex. Pronotum with long erect hairs on the anterior half of the lateral area. Secondary sexual characters same as in *D. frontalis*.

Type labeled "Type No. 7446, U.S.N.M.," name label, "Hopk. 1/15/05, ♀, Barber & Schwarz Coll[ectors], Williams, Ar., 7.6" (= June 7).

Male type: Length, 3.3 mm. Front with prominent tubercles each side of a deep median groove. Pronotum with transverse impression and faint transverse elevation across anterior area. Elytral declivity less shining; striæ more distinctly impressed and punctured and the interspaces more convex and distinctly rugose than in the female.

Male type labeled, name label, "Hopk. Jan. 15/08, *Pinus ponderosa*, Webb, Collr., 8-22-04, Flagstaff, Ariz., ♂, Hopk. U. S. No. 5118."

*Variations*.—Length 3.5 to 3.9 mm., average about 3.6 mm.; color from light brown to black. The short hairs of the lateral area of the elytra range from obscure to distinct, and the long hairs of the elytral declivity range from short and sparse to very long and numerous. The variation in the size of the punctures of the pronotum is less marked than in other species.

*Distinctive characters*.—The coarse punctures of the pronotum, and especially the very coarse shallow rugose ones, together with the coarser rugosities of the elytra, serve to distinguish specimens of this species from *D. barberi*, and the absence of short reclining hairs on the pronotum with the more distinctly impressed elytral striæ and less evident short and long hairs on the elytra serve to distinguish it from *D. mexicanus*, which is its nearest ally. It is also distinguished from *D. frontalis* by its larger size, coarser punctures of the pronotum, and coarser rugosities of the elytra, as it is from small examples of *D. convexifrons* by the grooved front, and from small examples of *D. approximatus* by the impressed elytral striæ and the shorter, more yellow, and less numerous hairs of the declivity.

*Revisional notes*.—This species is not represented in the Le Conte collection and not in the Horn collection unless it is one specimen found under *D. frontalis* labeled "Williams, Ariz., 7.28, 152," which the writer has not seen since *D. arizonicus* has been recognized as a distinct species. If this specimen is *D. arizonicus*, it was evidently before Doctor Dietz when he prepared his revised description of *D. frontalis*.

*Pupa*.—In addition to the generic and divisional characters, the apices of the front and middle femora have each a small spine. Abdominal tergites 2 to 6 with small pleural spines and 4 to 6 with small dorsal, lateral, and pleural spines, increasing in size toward 6; 7 and 8 with a pair of dorsal granules, coarser on 7. Pupal type labeled "Hopk. U. S. No. 3129."

*Larva*.—In addition to the divisional characters, the front has a median transverse and rugose convexity produced toward apex; clypeus with apex broadly emarginate; labrum broad, with apex broadly rounded. Thoracic segments with foot calli on sternellar lobes. Larval type labeled "Hopk. U. S. No. 5156."

*Galleries*.—While the galleries of this species have not been definitely recognized from those of *D. barberi*, with which they are nearly always present, it is evident that they are quite similar in general character to those of *D. barberi*, especially in the concealed larval mines.

*Distribution* (fig. 58).—(Hopk. U. S.) *Arizona*: Williams, Flagstaff, Santa Catalina Mountains (rare).

*Host tree*.—*Pinus ponderosa* var. *scopulorum*.

*Identified specimens*.—Horn collection, 1 (♀), B. & S., 2; Hopk. U. S., more than 50 specimens, including adults, larvæ, and pupæ.

## BIBLIOGRAPHY.

*Dendroctonus arizonicus* Hopkins, 1902a, p. 3 (in part), manuscript name.

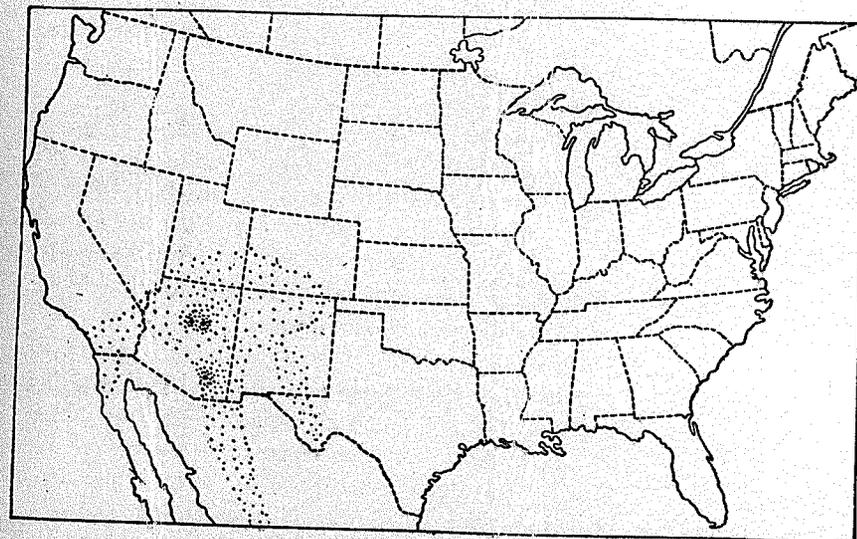


FIG. 58.—*Dendroctonus arizonicus*. Distribution map. (Original.)

6. *Dendroctonus mexicanus* Hopkins.

(Pl. III, fig. 6.)

*Adult*.—Type of species, female: Length, 4 mm.; dark brown. Elytra with long hairs on posterior half and declivity. Head with front convex, shining, with small frontal tubercles each side of the short, shallow groove; elytral striæ distinctly impressed, but not distinctly punctured; elytral rugosities distinctly coarser toward the base and vertex, and with an evident row of acute rugosities on the first interspace. Pronotum clothed with short reclining hairs on entire lateral area. Secondary sexual characters: Pronotum with transverse ridge across the anterior area; elytral declivity shining, striæ distinct, obscurely punctured; interspaces roughened with sparsely exposed granules, becoming coarser toward the vertex in lateral area.

Type labeled "Type No. 7518, U.S.N.M., individual 1," name label, "n. sp., Hopk., 4/18/02," name label, "1/15/08, A. L. Herrera, collector, ♀, Sacramento, Amecameca, Mexico."

Male type: Length, 4 mm.; front with moderately prominent frontal tubercles each side of the distinct groove. Pronotum with rather distinct transverse elevation across the entire area similar to that of the female; elytral declivity more uniformly convex; striae more impressed and deeply punctured and interspaces more convex and distinctly rugose.

Male type labeled "Type No. 7518, U.S.N.M., individual 5," remaining labels same as on female except sex label.

*Variations.*—Length from 3 to 4.5 mm.; average about 3.8 mm.; color from brown to black. The prescutal ridge is more prominent in some females than in others and is present in some males and absent in others.

*Distinctive characters.*—This species is more closely allied to *D. arizonicus* than to any of the other species of the division to which it belongs and is distinguished from it by the presence of short, reclining hairs on the pronotum, less distinctly impressed elytral striae, and more evident short pubescence of the elytra.

*Revisional notes.*—It is evident that this species was not represented in the material studied by Blandford. The size comes near that of his *D. adjunctus*, but the characters as given by him to distinguish this species from *D. parallelocolis* at once distinguish it from *D. mexicanus*.

The pupa and larva have not been seen.

*Gallery* (fig. 59).—A small section of the gallery, evidently of this species, was received with the specimens of adult from Prof. A. L. Herrera. This indicates a winding egg gallery, with the eggs isolated, the larval mines concealed in the inner bark, and the pupal cells in the outer bark.

*Distribution* (fig. 60) and *host trees.*—The specimens received at different times from Prof. A. L. Herrera and Dr. S. J. Bonansea were evidently from *Pinus teocotl*, *P. lejophilla*, and *P. ayacahuite* in Amecameca, Michoacan, and Tacubaya, Mexico.

*Identified specimens.*—Thirty-six specimens of adults and one specimen of work were identified for Professor Herrera and Doctor Bonansea, a set of which were returned to them and the remainder retained for the forest insect collection of the Bureau of Entomology.

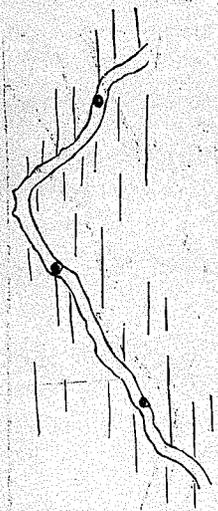


FIG. 59.—*Dendroctonus mexicanus*: Section of egg galleries. (Original.)

## BIBLIOGRAPHY.

*Dendroctonus mexicanus* Hopkins, 1906c, p. 26, original description, both sexes, host, etc.

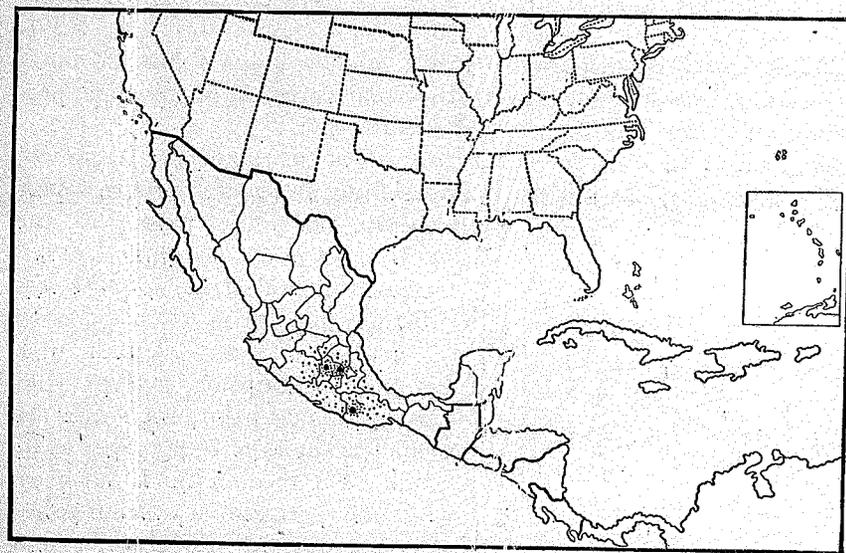


FIG. 60.—*Dendroctonus mexicanus*: Distribution map. (Original.)

7. *Dendroctonus parallelocolis* Chapuis.

(Pl. III, fig. 7.)

*Adult.*—Typical female: Length, 6.1 mm., deep black; elytral declivity with long hairs; head with front convex, shining, without distinct frontal tubercles each side of the shallow median groove; elytral striae not impressed or distinctly punctured except at vertex; elytral rugosities obtuse, rather densely placed, moderately coarse toward suture, fine and less evident toward and on the lateral area; striae obscure, especially on the lateral area. Pronotum with numerous short, reclining hairs and with very long, erect hairs on the entire lateral area, punctures distinct. Secondary sexual characters: Pronotum with transverse ridge across the anterior area; elytral declivity subconvex, shining; striae distinct, slightly impressed, punctures rather distinct; interspaces with a few granules and sparse punctures, the lateral areas more rugose and coarsely punctured.

Typical female labeled, name label, "Hopk., January 16/08, Michoacan, Mexico, A. L. Herrera, collector, ♀, Hopk. U. S. 2896b."

Typical male: Length, 6 mm. Head with front convex and with prominent frontal tubercles each side of a deep groove. Pronotum with transverse impression across anterior area; elytral declivity

subconvex; striæ distinct, slightly impressed, and the interspaces more distinctly rugose than in female.

Typical male labeled, name label, "Hopk. 1/16/08, type of drawing, *Pinus*, Michoacan, Mexico, A. L. Herrera, collector, ♂, Hopk. U. S. 2896a."

*Variations*.—Length from 5 to 6.1 mm., average about 5.5 mm.; color, dark brown to black, with the usual variation in epistoma, pronotal punctures, pubescence, and median line.

*Distinctive characters*.—This species is distinguished from *D. approximatus* by the noticeably less shining and more pubescent pronotum, the deeper punctures, the noticeably and constantly less impressed elytral striæ, and the less distinct punctures.

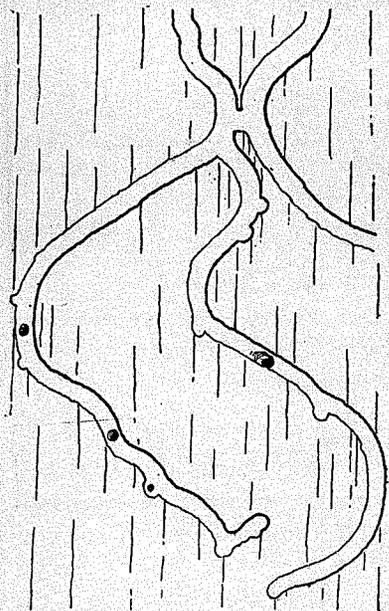


FIG. 61.—*Dendroctonus parallelocollis*: Section of egg gallery. (Original.)

In the writer's reference to this species (1905a, p. 81) it was considered to be the same as *D. approximatus* Dietz, but I am now convinced that the two are specifically distinct.

The pupæ and larvæ have not been observed.

*Galleries* (fig. 61).—A short section of the egg gallery, from which an adult was taken, indicates that it is quite similar, in its winding character and the absence of exposed larval mines, to that of *D. approximatus*.

*Distribution* (fig. 62).—Recorded from Mexico by Chapuis (1869) and Blandford (1897). Specimens were received with *D. mexicanus* from Prof. A. L. Herrera, labeled Mexico and Michoacan, Mexico, with his statement that it destroys the forests of Ionacatapec, Morelos, and many regions of Mexico.

*Revisional notes*.—Agrees with original description, except that the specimens before the writer are smaller, the type being given as 6½ mm. The median line is flat in all but one specimen, in which it is impressed toward the anterior and posterior margin. In Blandford's revision the length of the type is given as 6.3 mm. Blandford states that it differs from *D. approximatus* Dietz by its smaller size, more elongate shape, more shining and strongly punctured prothorax, and indistinct elytral striæ. The last difference holds, but the others do not.

In the writer's reference to this species (1905a, p. 81) it was

*Host trees*.—According to evidence from correspondence with Professor Herrera, it would appear that this species, like *D. mexicanus*, attacks *Pinus teocott* (?), *P. lejophylla*, and *P. ayacahuite*, although there is no definite statement to that effect. It is quite evident, however, that this species is associated with *D. mexicanus* in the same manner as *D. approximatus* in its association with *D. arizonicus* and *D. barberi*.

*Identified specimens*.—Ten specimens of adults and one specimen of work identified for Prof. A. L. Herrera.

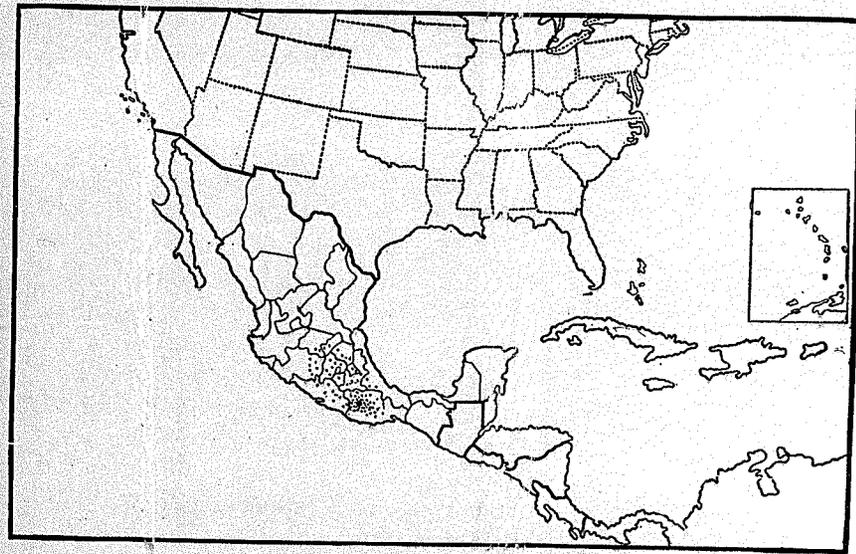


FIG. 62.—*Dendroctonus parallelocollis*: Distribution map. (Original.)

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*Dendroctonus parallelocollis* Chapuis, 1869, p. 36, original description. Chapuis, 1873, p. 244, reprint. Blandford, 1897, p. 147, synopsis, revision, distribution, bibliography. Hopkins, 1906c, p. 81, systematic notes.

#### 8. *Dendroctonus approximatus* Dietz.

(Pl. IV, fig. 8.)

*Adult*.—Typical female: Length, 6.5 mm., reddish brown; elytral declivity with long hairs; head with front convex, shining, and with obscure frontal tubercles each side of short, median groove; elytral striæ not impressed or distinctly punctured; elytral rugosities rather coarse, sparse; striæ on lateral area rather distinct; pronotum with long hairs on anterior two-thirds of lateral area, but not on posterior section. Secondary sexual characters: Pronotum with transverse ridge across the anterior area; elytral declivity subconvex, shining;

striae very distinct, impressed, and distinctly punctured; interspaces sparsely tuberculate, and with a few fine punctures; lateral area shining, with a few subacute tubercles, and rather coarse, distinct punctures.

Typical female labeled, name label, "Hopk. 1/16/08, ♀, individual c, Barber & Schwarz, Coll[ectors], Flagstaff, Ar. 2.7" (= July 2).

Type of species, ♀, in Horn collection, A.E.S., Philadelphia, labeled "Type *D. approximatus* n. sp., Col[orado]."

Male type: Length, 5.7 mm. Head with front convex, shining, a prominent frontal tubercle each side of a deep groove. Pronotum with broad impression across the anterior area; elytral declivity same as female, except that the interspaces are more densely rugose.

Male type labeled, name label, "Hopk. 1/16/08, ♂ type of revision, type of drawing, Williams, Ar., 7.6" (= June 7) "♂, Barber & Schwarz, Coll[ectors]."

*Variations*.—The length varies from 4 to 7.4 mm., the average about 6 mm. The color ranges from reddish-brown to black. The epistomal, frontal, pronotal, and elytral sculpture and vestiture vary as usual. The greatest variation is in the strial and interspacial punctures of the declivity.

*Distinctive characters*.—The characters which distinguish this species from *D. parallellocollis*, its nearest ally, are the noticeably more shining and less pubescent pronotum, with the punctures finer and more shallow, the elytral striae constantly more impressed, and the punctures distinct.

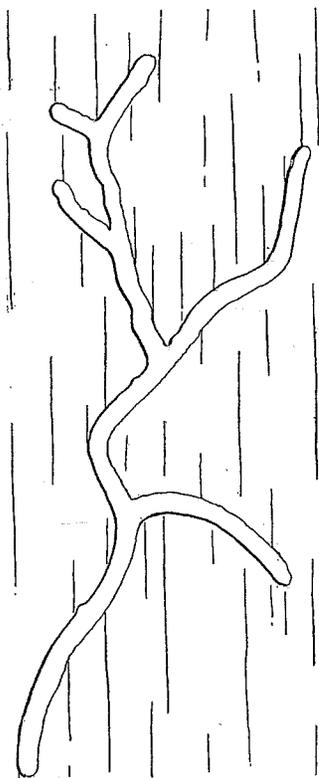


FIG. 63.—*Dendroctonus approximatus*: Single egg gallery. (Original.)

*Revisional notes*.—The original description (Dietz, 1890, p. 31), was based on "four specimens, two males and two females, from New Mexico and Colorado in Doctor Horn's collection." The specimen labeled type in the Horn collection is a female from Colorado, and agrees with the description, but one specimen labeled "N. M." is a female of *D. convexifrons* Hopk., and one other specimen with the type, but without locality label, is quite a different thing from either of the other two. The specimen has not been examined since the more distinctive characters of *D. monticolæ* Hopk. and *D. ponderosæ* Hopk. have been recognized, but it evidently belongs to one of these species. The fourth specimen mentioned by Dietz was not in the

collection when examined by the writer on January 12, 1900. The reference in the original description to the front of the head "coarsely granulated, channeled" applies to the type, and at once distinguishes it from the other two specimens which are without a median frontal channel or groove. The "strong transverse impression about one-fourth from the anterior margin" of the prothorax is associated with the more distinct transverse elevation which the author failed to mention. In the writer's remarks (Hopkins, 1905, p. 81) under *D. parallellocollis* it is stated that *D. parallellocollis* Chap. and *D. approximatus* Dietz are evidently the same, but further comparative studies have convinced him that they are specifically distinct.

*Pupa*.—In addition to the generic, divisional, and subdivisional characters, the apex of the front and middle femora have each a minute subapical spine; abdominal tergites 1 to 6 with small pleural spines, 1 without distinct dorsal and lateral spines; 2 to 6 with distinct dorsal and lateral spines, increasing in length and prominence to and including tergite 6; 7 and 8 smooth; 9 with long pleural spine. Pupal type labeled "Hopk. U. S. No. 5777."

*Larva*.—In addition to generic and divisional characters, the front has a broad, but not prominent, median elevation; clypeus short, broad, with apex truncate; prothoracic segments with prominent

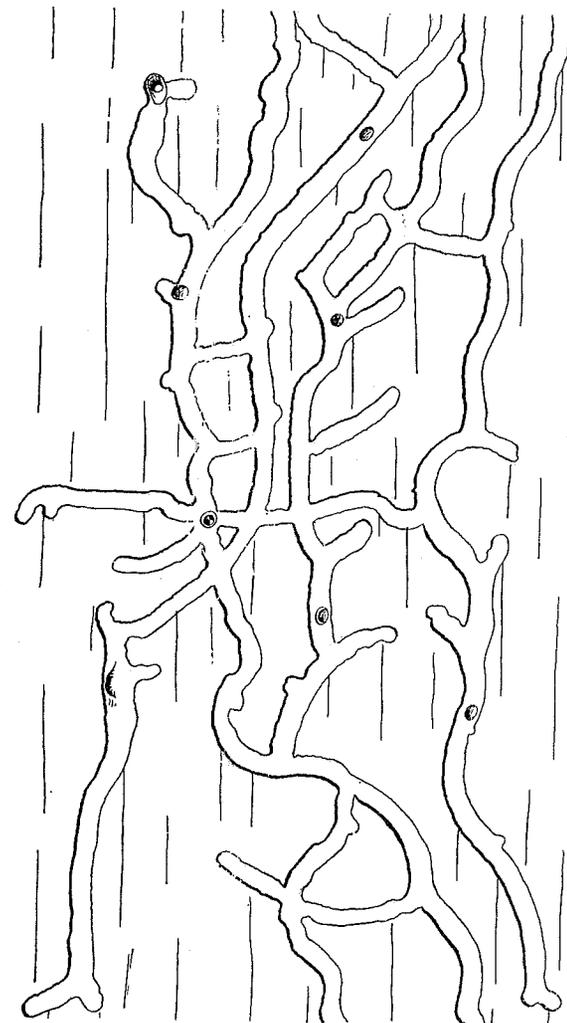


FIG. 64.—*Dendroctonus approximatus*: Egg galleries. (Original.)

sternellar lobes, each with a distinct foot callus. Larval type labeled "Hopk. U. S. No. 5024."

*Galleries* (figs. 63, 64).—Egg galleries sublongitudinal, branched, slightly winding; eggs isolated; larval mines concealed; pupal cells in outer bark.

*Distribution* (fig. 65).—(Hopk. U. S.) *Colorado*: Brookville, Glen Haven, Las Animas County, La Veta, Monte Vista, and Palmer Lake. *Utah*: Escalante, Kamas, Panguitch. *New Mexico*: Capitan Mountains, Cloudcroft, Lincoln National Forest, Santa Fe. *Arizona*: Black Mesa Forest Reserve, Chiricahua Mountains, Flagstaff, Paradise, Rincon Mountains, Santa Catalina Mountains, Show Low, Tucson. *Additional locality from correspondence*: Glenhaven, Colo.

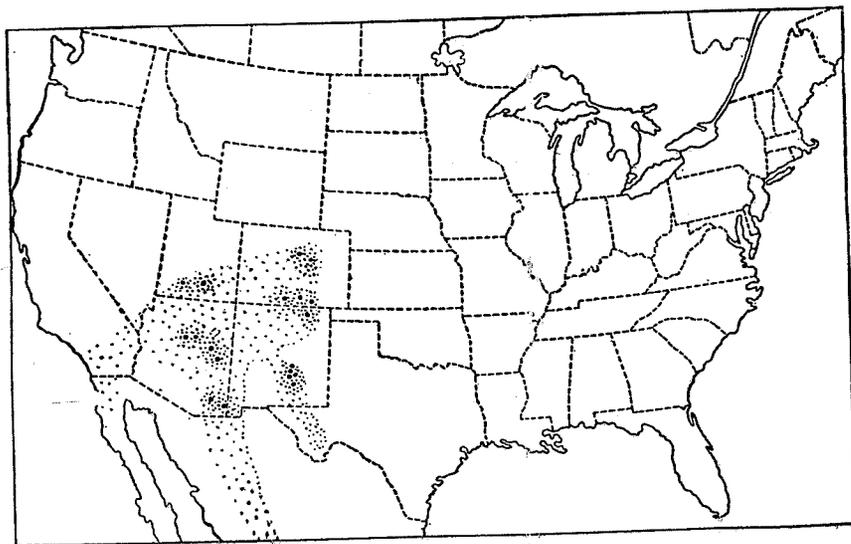


FIG. 65.—*Dendroctonus approximatus*: Distribution map. (Original.)

*Host trees*.—*Pinus ponderosa scopulorum* (common), *P. arizonica* (rare), and *P. chihuahuana* (rare).

*Identified specimens*.—Horn, A. E. S., 1 specimen, the type; U.S.N.M., 31; Hopk. U. S., more than 200 specimens, including all stages and work.

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*Dendroctonus approximatus* Dietz, 1890, p. 31, fig. 5, antenna and epistoma; original description (applies to type only). Blandford, 1897, p. 147, reference to characters. Hopkins, 1899a, p. 392, fig. LVIII, reference. Schwarz, 1902, p. 32 (in part), destructive to pine at Flagstaff, Ariz. (see also *convexifrons*). Wickham, 1902, p. 310 (in part), list, Dietz quoted. Hopkins, 1903a, p. 60, reference to habits, etc. Hopkins, 1903b, p. 281, mention. Hopkins, 1904, p. 44, habits, distribution, hosts, etc. Hopkins, 1905, p. 11, some distinctive characters. Hopkins, 1906c, p. 81, referred to *D. parallelocollis*.

*Dendroctonus (parallelocollis) var. approximatus* (Dietz) Fall, 1907, p. 218, list, localities.

#### SUBDIVISION B.

(Species numbered 9 to 11, inclusive.)

The distinctive characters common to the species of the second subdivision are as follows:

*Adult*.—Body somewhat stout, prothorax with sides distinctly narrowed and constricted toward the head; elytral declivity with second stria distinctly curved, second interspace broader toward middle, narrowed toward apex.

*Sexes*.—Female: Elytral declivity with interspaces smoother and more shining, mandibles less stout. Male: The reverse.

*Pupa*.—Elytral pads roughened with granules, vertex of head deeply grooved and with two prominent forward curved frontal spines toward the vertex; abdominal tergites 2 to 6 with long and prominent pleural spines.

*Larva*.—Front with prominent transverse and rugose elevation, more prominent toward the sutures.

*Galleries*.—Pupal cells in inner bark, eggs in approximate groups, egg galleries slightly winding to straight, larval mines always exposed in inner bark.

#### 9. *Dendroctonus monticolæ* Hopkins.

(Pl. IV, fig. 9.)

*Adult*.—Type of species, female: Length 5.6 mm., light brown; elytral declivity with a few long hairs; head with front convex, without median elevation or groove, but with faint posterior impression; elytral rugosities coarse, rather dense, coarser on dorsal area; striae not distinctly impressed, except toward suture, punctures small. Pronotum with the anterior area transversely impressed, but with moderately long hairs on the lateral area, slightly longer on the anterior section. Secondary sexual characters: Elytral declivity convex, subopaque; striae distinct, and impressed, with fine obscure punctures; interspaces with rather coarse granules, in approximate rows; lateral area with obscure punctures and subacute rugosities.

Type labeled "No 7447 U.S.N.M.," name label, "Hopk. 1/16/08, *Pinus monticola*, Hopkins, collector, 5/27/99, Kootenai, Idaho, ♀, Hopk. U. S. 205."

Male type: Length 4.9 mm. Head with front less distinctly punctured and more rugose than female; elytral declivity with striae more distinctly punctured, interspaces more opaque, and rugosities slightly coarser, the mandibles stouter than in female.

Male type labeled same as female except sex label.

*Variations*.—The length varies from 3.7 to 6.4 mm., averaging about 5.5 mm. The color ranges from light brown to black; the sculpture and vestiture of the epistoma, front, pronotum, and elytra vary as usual, but the character of the striae punctures is fairly constant.

The greatest variation is in size and in the presence or absence of dorsal line of the pronotum.

*Distinctive characters.*—The characters which distinguish this species from the next following, to which it is more closely allied, are the average smaller size and prevailing moderately impressed elytral striae with distinct but moderately coarse punctures. While the striae vary in size in different individuals, they are never so coarse as in the average *D. ponderosæ*. It is also distinguished from *D. jeffreyi* by the much smaller average length of body and the prevailing coarser punctures of the pronotum.

*Revisional notes.*—A brief description (Hopkins, 1905, p. 11) was published under the name *D. monticola*, but the name should read *D. monticolæ*, which, as the manuscript name indicates, was originally intended. The species is represented by three specimens from California in the Le Conte collection, with the type series, under *D. similis*, bearing specimen numbers 4, 12, and 13, and therefore may have been included in the revision by Le Conte (1876, p. 385), although the locality (California) is not given in that correction. There is also one specimen in the Horn collection, labeled "Cal.," under *D. similis*. It is probable that the one under *similis* was before Dietz when he prepared his revision (1890, pp. 30–31) under the name *similis*. These specimens are evidently the only ones which may have been involved in Le Conte's or Dietz's revisions on the literature previous to Hopkins, 1899b, pp. 14 and 26.

*Pupa.*—In addition to the generic, divisional, and subdivisional characters, the apex of the front and middle femora is armed with two small apical spines; abdominal tergites 2 to 6 with long and prominent pleural spines, 1 is without distinct dorsal and lateral spines, but 2 to 6 have distinct dorsal and lateral ones, 2, 3, and 6 with a pair, and 4 and 5 with three lateral spines each side of the dorsal ones; 7 has two dorsal spines, while 8 is smooth and the pleural spines of 9 are long and prominent. Pupal type labeled "Hopk. U. S. No. 196."

There is the usual variation in the arrangement and number of minor spines, and one specimen from Yosemite National Park is quite different in the widely separated frontal spines, with the dorsal ones of the abdominal tergites coarser and tergite 7 with a pleural spine. It is possible that this may be a pupa of an unrecognized species. The characters of the pupa of *D. monticolæ*, which serve to distinguish it from that of *D. ponderosæ*, are the less coarse spines of the abdominal segments, the less densely granulated elytral pads, and the presence of two apical spines on the front and middle femora.

*Larva.*—In addition to the generic and divisional characters, the front has the posterior angle subacute and a moderately stout, rugose elevation situated in the middle, becoming slightly thickened and elevated toward the suture. Clypeus shining, with faint median

groove and usual elevation; apex broadly emarginate, labrum with apex broadly rounded, and the sternellar lobes of the thoracic segments with distinct foot calli. Larval type labeled "Hopk. U. S. No. 196."

There is some variation in the frontal elevation, but generally it is situated slightly anterior to the middle or in the middle, while the posterior angle of the front is distinctly subacute. These serve as

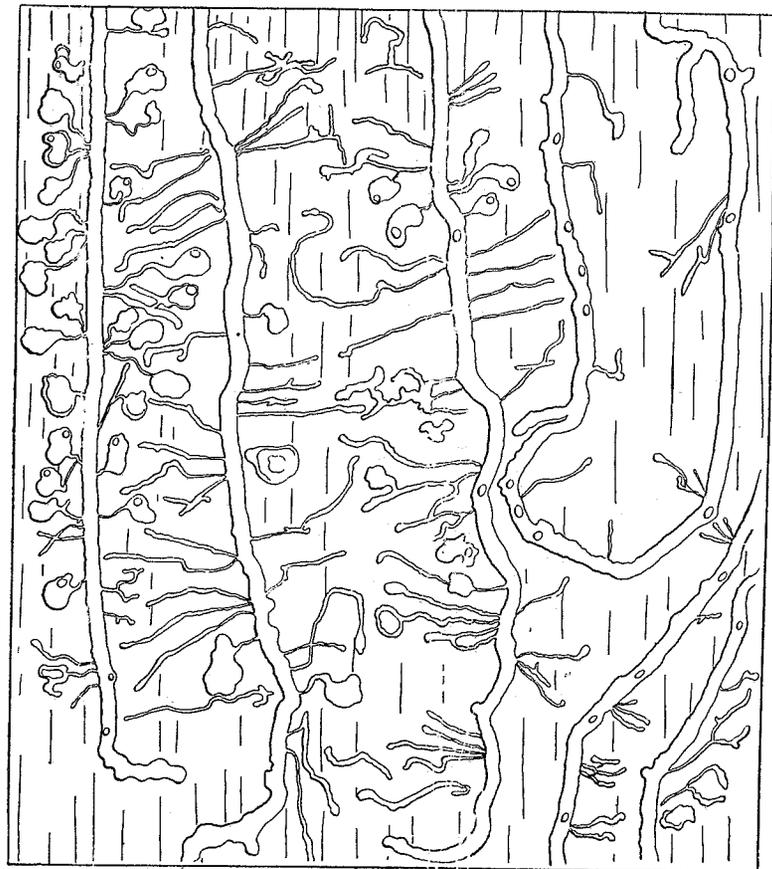


FIG. 66.—*Dendroctonus monticolæ*: Egg galleries and larval mines in bark. (Original.)

the most distinctive characters to separate the larva of this species from that of *D. ponderosæ*.

*Galleries* (figs. 66, 67).—The egg galleries are longitudinal, distinctly to slightly winding or straight, usually grooved on the surface of the wood and deeply grooved in the bark, the larval mines and pupal cells exposed in the inner bark; the eggs are placed in approximate groups, and the larval mines are short and broad. The egg galleries differ from those of *D. ponderosæ* in smaller size, more winding form, and are often of a much greater length.

*Distribution* (fig. 68).—(Hopk. U. S.) *California*: Alder Creek, Chester, Fulda, Lake Tenaya, Mariposa Grove, Millwood, Siskiyou County, Soda Springs, Summerdale, Tioga Road, Wawona. *Idaho*: Boise County, Cedar Mountain, Centerville, Coeur d'Alene National

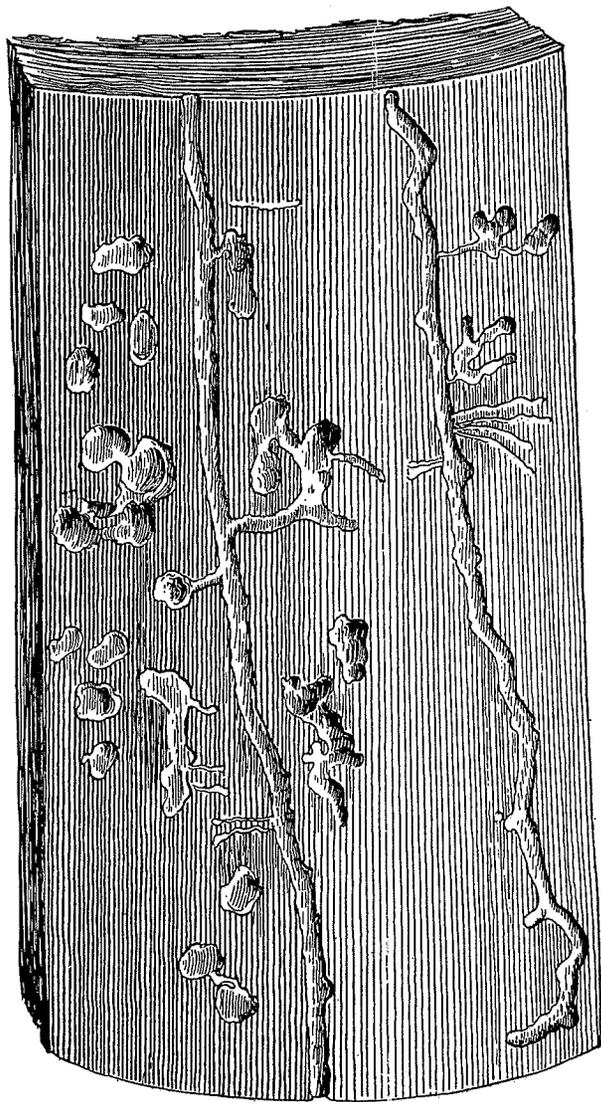


FIG. 67.—*Dendroctonus monticolæ*: Egg galleries and larval mines grooved in surface of wood. (Original.)

Forest, Collins, Helena, Kootenai, Moscow Mountains, Sand Point, Smith's Ferry, Weiser. *Montana*: Big Fork, Columbia Falls, Iron Mountain, Lolo, Lewis and Clark National Forest, Missoula, Saltese. *Oregon*: Ashland, Grants Pass, Joseph, Pokegama, Wallowa. *Washington*: Longmires Springs, Mount Rainier National Forest, Palschie,

Washington National Forest. *Wyoming*: North Fork Shoshon River, Wapiti. *Additional localities from other collections*: (A. M. N. H.) Millwood, Cal.; (U.S.N.M.) Columbia Falls, Mont.

*Host trees*.—*Pinus lambertiana*, *P. monticola*, *P. murrayana* and *P. ponderosa* (common); *Picea engelmannii* (rare).

*Identified specimens*.—Le Conte, M. C. Z., 3; Horn, A. E. S., 1 A. M. N. H., Webb collection, 1; Henry Edwards collection, 1 U.S.N.M., 2; D. A., 11; Webb collection, 14; Hopk. U. S., over 500 including different stages and work.

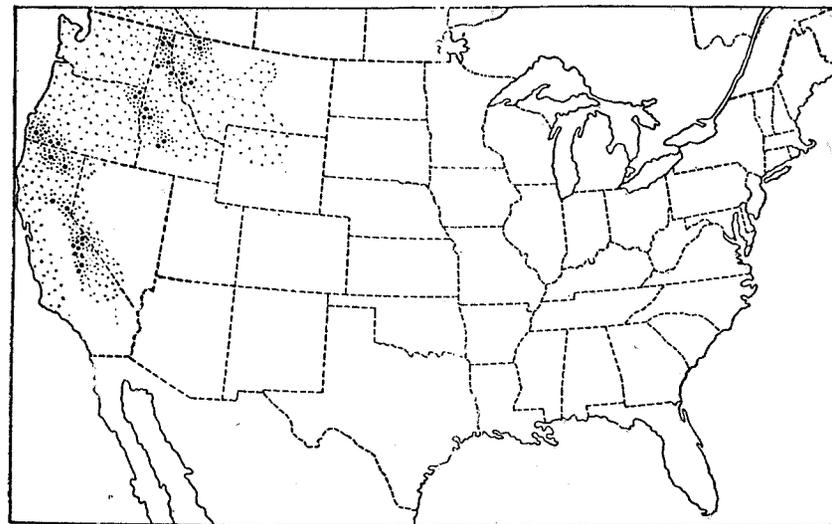


FIG. 68.—*Dendroctonus monticolæ*: Distribution map. (Original.)

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*Dendroctonus* n. sp. Hopkins, 1899b, pp. 14, 26, first record of habits and hosts.  
*Dendroctonus monticolæ* Hopkins, 1901b, p. 67, referred to as new species but no described, habits, galleries. Hopkins, 1902c, p. 21, notes. Hopkins, 1905 p. 11, first description, distribution, characters, very brief. Webb, 1906, p. 22 mentioned.  
*Dendroctonus monticolæ* Hopkins, 1902a, p. 3, manuscript name.  
*Dendroctonus* n. sp. (mountain pine *Dendroctonus*). Hopkins, 1904, pp. 19, 42, 45 habits, hosts, distribution, etc.  
*Mountain pine beetle*. Hopkins, 1908, p. 162.

#### 10. *Dendroctonus ponderosæ* Hopkins.

(Pl. IV, fig 10.)

*Adult*.—Type of species, female: Length, 6 mm., black; elytra declivity with a few long hairs. Head with front convex, without median elevation or groove, but with faint posterior impression elytral rugosities moderately coarse and moderately dense, becoming

much finer on the lateral area and coarser toward and on the vertex. Pronotum with moderately long, erect hairs on the lateral area, considerably longer toward the anterior section; punctures of elytral striæ distinct and coarse. Secondary sexual characters same as in preceding species.

Type labeled "Type No. 7448 U.S.N.M.," name label, "Hopk. 1/16/08, *Pinus ponderosa*, Spearfish, S. D., 7/1/00, A. D. Hopkins, collector, ♀, Hopk. U. S. 434."

Male type: Length 5.5 mm. Characters same as in female, except pronotum with very dense, subrugose punctures toward the anterior margin, the elytral rugosities finer and less dense; elytral declivity with coarser interspacial granules, and the stria punctures slightly more distinct.

Male type labeled same as female, except sex label.

*Variations.*—The length varies from 4.5 to 7 mm., with the average about 6 mm. The color ranges from brown (in young specimens) to black in matured. The sculpture and vestiture of the epistoma, front, pronotum, and elytra vary as usual, and there is a quite noticeable variation from a somewhat slender form to a shorter and stouter one. The greatest variation is in length and in the size and density of the punctures of the pronotum and of the striæ of the elytra.

*Distinctive characters.*—The characters which distinguish this species from the one following are its average smaller size, less shining pronotum, with coarser and deeper punctures, and from the preceding by its average larger size and somewhat stouter form, with the elytral striæ more distinctly impressed and the punctures distinctly coarser. There is a considerable range of variation in these characters, but the specimens with less distinctly impressed striæ and finer punctures which might be mistaken for *D. monticola* are exceptional, and should cause no confusion as long as the range of distribution of the two species is so distinct.

*Revisional notes.*—In March, 1902, the writer (Hopkins, 1902a, p. 3) published the manuscript name, *D. ponderosæ*, without description of any kind, and in April of the same year (Hopkins, 1902b, p. 10) he gave a brief description under *D. ponderosa*, but, as indicated by the manuscript name, it was intended that the name should relate to the host tree, *Pinus ponderosa*, therefore the name *D. ponderosæ*, under which it is here fully described, should stand. The species is represented in the Le Conte collection by one immature example, which, in 1900, was in the *D. rufipennis* series, labeled "Specimen 8, Col." In March, 1907, this specimen was again examined by the writer, and identified as *D. ponderosæ*. It is evident that it was in Le Conte's collection when he prepared his latest revision (1876), but there is

evidence that the characters and locality were not involved in the revised description under *D. rufipennis*. It is probably represented in the Horn collection (A. E. S.) by one specimen, without locality label, found by the writer in 1900 as the third specimen in the type series, under *D. approximatus*. Two other specimens, labeled "Col.," were found in the Horn collection and one specimen in the general Academy of Natural Sciences collection under *D. rufipennis*. The two in the Horn collection were evidently before Dietz when he prepared his revision under *D. rufipennis* and included in the Colorado locality if not in the revised description. The writer (1902, p. 10) refers in a footnote to wrong identifications under *D. rufipennis* and *D. terebrans*. This probably includes all of the published references in which this species has been in any manner involved in revisions or systematic notes.

*Pupa.*—In addition to the generic, divisional, and subdivisional characters, the front and middle femora are armed each with one small apical spine. Abdominal tergites 2 to 6, with long and prominent pleural spines; 1 is without distinct dorsal and lateral spines, but 2 to 6 have distinct dorsal and lateral ones, and all of them have a pair of dorsal, and 2, 3, and 6 have a pair, and 4 and 5 have three lateral spines each side of the dorsal ones; 7 has two dorsal spines, while 8 is smooth, and the pleural spines of 9 are long and prominent. Pupal type labeled "Hopk. U. S. No. 623."

In a number of individuals, the usual variation in the arrangement and number of minor spines is found, and between the younger and older examples there is a wide range of variation.

The characters which seem to distinguish the pupa of this species from that of *D. monticolæ* are the coarser spines of the abdominal tergites, the more densely granulate elytral pads, and the presence of but one apical spine on the front and middle femora.

*Larva.*—In addition to the generic and divisional characters, the front has the posterior angle subobtuse, and a stout prominent rugose transverse elevation situated slightly behind the middle and elevated and broad toward the sutures; clypeus with the base shining and bearing a faint median elevation, and the apex broadly emarginate; labrum less than half as long as broad, with the apex truncate; sternellar lobes of the thoracic segments with indistinct foot calli. Larval type labeled "Hopk. U. S. No. 755."

There is some variation in the frontal elevation, but generally it is situated behind the middle, and the posterior angle of the front is more obtuse than in the preceding, which latter serves as the most distinctive character separating the larva of this species from that of *D. monticolæ*.

*Galleries* (figs. 69, 70).—The egg galleries are longitudinal, and usually nearly straight. They are usually grooved on the surface of the wood and deeply grooved in the inner bark, with the larval mines and pupal cells exposed. The eggs are placed in approximate groups,



FIG. 69.—*Dendroctonus ponderosae*: Egg galleries and larval mines. (Original.)

and the larval mines are short. The egg galleries differ from those of *D. monticolæ* in the larger diameter and straighter, shorter form.

*Distribution* (fig. 71).—(Hopk. U. S.) *Arizona*: Chiricahua National Forest, Flagstaff, Fredonia, San Francisco Mountains. *Colorado*: Bailey, Brookvale, Cascade, Cat Mountain, Cochetopa, Colo-

rado Springs, Fort Garland, Glenwood Springs, Gunnison National Forest, Green Mountain Falls, Hahns Peak, Husted, Indian Creek, Larkspur, La Veta, Manitou, Medicine Bow National Forest, Meeker, Monte Vista, Ouray National Forest, Palmer Lake, Pikes Peak, Pine, Poncha Springs, San Isabel National Forest, San Juan National Forest, Sequache, Uncompahgre National Forest, White River National Forest. *New Mexico*:

Gila National Forest, Vermejo. *South Dakota*: Custer, Elmore, Hill City, Lead, Nemo, Piedmont, Sylvan Lake.

*Utah*: Escalante, Kamas, Kanab, La Salle National Forest, Panguitch, Provo. *Wyoming*: Downton, Encampment, Keystone.

*Additional locality from other collectors*: (Brown) Las Animas County, Colo. *Localities reported by correspondents*: Eagle, Florissant, Idaho Springs, Kennedy Station, La Veta, Montrose, Pagosa Springs, Porter, San Juan, Ute Pass, and West Cliff, Colo.

*Host trees*.—*Pinus ponderosa scopulorum*, *P. flexilis*, *P. murrayana*, *P. strobiformis*, and *Picea engelmanni*.

*Economic relation to forests*.—This species is exceedingly destructive to the pine forests of

the central and southern Rocky Mountain region, having caused a loss of forest resources worth many millions of dollars. The rock pine, or bull pine (*Pinus ponderosa* var. *scopulorum*), is its favorite host tree, but it attacks and kills the other pines and infests the spruce, though apparently not destructive to the latter.

*Identified specimens*.—Le Conte (M. C. Z.), 1 specimen; Horn (A. E. S.), 2 specimens; A. N. S., 2 specimens; U.S.N.M., 1 specimen;

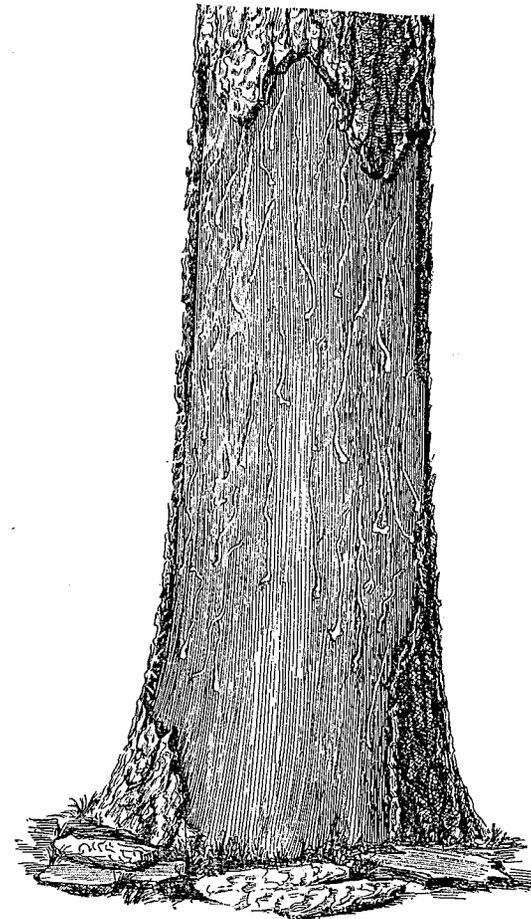


FIG. 70.—*Dendroctonus ponderosae*: Tree with bark removed, showing egg galleries grooved and marked on surface of wood. (Original.)

D. A., 14 specimens; Gillette, 2 specimens; Hopk. U. S., more than 10,000 specimens, including all stages and work.

## BIBLIOGRAPHY AND SYNONYMY.

- Dendroctonus similis* (not of Le Conte, 1860) Le Conte, 1876, p. 385 (in part) (in collection 1890).
- Dendroctonus approximatus* Dietz, 1890, p. 31 (in part?) (specimen with type series).
- Dendroctonus ponderosae* Hopkins, 1902a, p. 3, manuscript name only. Hopkins, 1903b, pp. 275, 282, p. xxix, figs. 28, 32, stages and work figured, and full account of habits, life history, methods of control, etc. Hopkins, 1904, pp. 41, 43, 44, Pl. I, fig. 1, Pls. III, VIII, IX, XII, fig. 2, stages and work illustrated, habits, host, distribution, etc. Hopkins, 1905, pp. 1-24, full account of history, habits, life history, work, methods of control, etc., Pls. I, II, figs. 1-6, stages and work. Hopkins, 1906a, p. 4, old work. Hopkins, 1906b, p. 147, Pls. IV, V, figs. 1-5, anatomy of larval head. Fall, 1907, p. 218, list, locality. Hopkins, 1908, p. 162, depredations.
- Dendroctonus ponderosa* Hopkins, 1902b, p. 10, brief original description, adult, etc., galleries and work illustrated, fig. 1, Pls. I, III, IV, VII, full account of habits, methods of control, etc. Hopkins, 1902c, p. 21, habits. Hopkins, 1903a, p. 59, habits, etc.

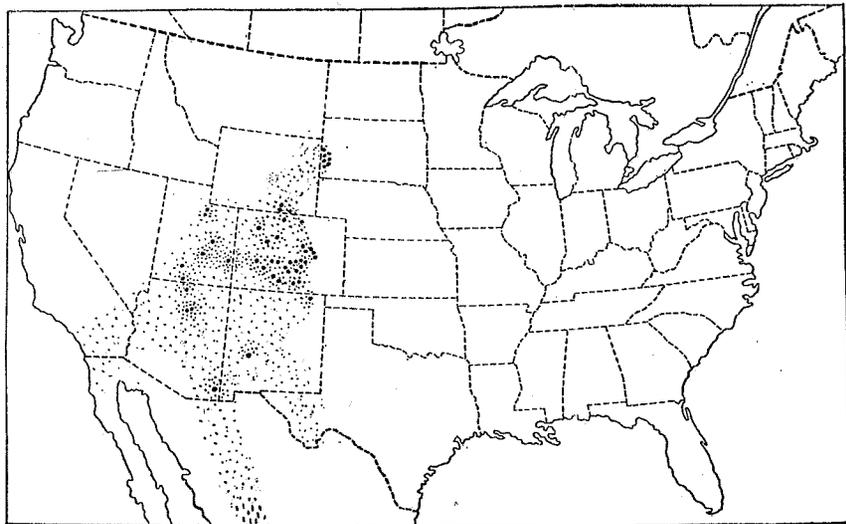


FIG. 71.—*Dendroctonus ponderosae*: Distribution map. (Original.)

11. *Dendroctonus jeffreyi* n. sp.

(Pl. IV, fig. 11.)

*Adult*.—Type of species, female: Length 7.5 mm., black; elytral declivity with a few long hairs. Head with front convex, with slight anterior and posterior impressions, without frontal elevations; elytral rugosities moderately coarse and dense, becoming much finer on lateral area and coarser toward the vertex. Pronotum shining, sides

distinctly constricted toward the head, with moderately long, erect hairs on the lateral area, longer and denser on the anterior surface; punctures of elytral striæ distinct and coarse, the striæ more distinctly impressed on the dorsal area. Secondary sexual characters same as in preceding species.

Type labeled "Type No. 7449 U.S.N.M.," name label, "Hopk. 1/22/08, *Pinus jeffreyi*, Little Yosemite, Cal., H. E. Burke, collector, ♀, Hopk. U. S. 4394a."

Male type: Length 7 mm., same characters as female, except elytral declivity is more opaque and with distinctly coarser interspatial rugosities.

Male type labeled same as female, except sex label.

*Variations*.—The length varies from 6 to 8 mm., with the average about 7 mm., and the color from brown in young specimens to deep black when matured. The sculpture and vestiture of the epistoma, front, pronotum, and elytra vary as usual. There is apparently less variation in size and in other characters than is found among the individuals of the other species.

*Distinctive characters*.—This species is at once distinguished from either of the two preceding by its average larger size and shining pronotum, with its fine and shallow punctures.

*Note*.—This species is not represented in any of the collections examined by the writer, and nothing has heretofore been published about it.

*Pupa*.—In addition to the generic and divisional characters, the apices of the front and middle femora are armed with two distinct spines; abdominal tergites 2 to 6 with long and prominent pleural spines; 1 is apparently without dorsal spines, 2 and 6 are evidently with dorsal and lateral spines, but in the single poor specimen the relative size and number can not be made out; they appear, however, to be less prominent than in either of the preceding species; 7 has two small dorsal, three distinct lateral spines, and a small pleural one; 8 is smooth, and 9 is with prominent pleural spines, as usual. Pupal type labeled "Hopk. U. S. No. 4412a."

The above description is based on a single specimen, which is damaged, therefore is subject to revision when more specimens are examined. It seems to be quite different from the unique pupa mentioned under *D. monticola*.

*Larva*.—In addition to the generic, divisional, and subdivisional characters, the front has the posterior angle subacute, and a narrow transverse elevation situated in the middle and not broadened or more elevated toward the sutures; clypeus shining, with median groove toward the base and with the apex broadly emarginate; labrum with apex broadly truncate; sternellar lobes of the thoracic segments

with obscure foot scars. Larval type labeled "Hopk. U. S. No. 6204b."

There is very little variation in the four specimens before the writer, and the narrow smoother frontal elevation, not elevated and broadened toward the suture, is the most distinctive character separating the larva of this species from those of the two preceding species.

*Galleries.*—The egg galleries are longitudinal, nearly straight, grooved on surface of the wood, and deeply grooved in the inner bark, with the larval mines and pupal cells exposed. The eggs are placed singly and in approximate groups. The egg galleries and larval mines of this species differ from those of the two preceding in

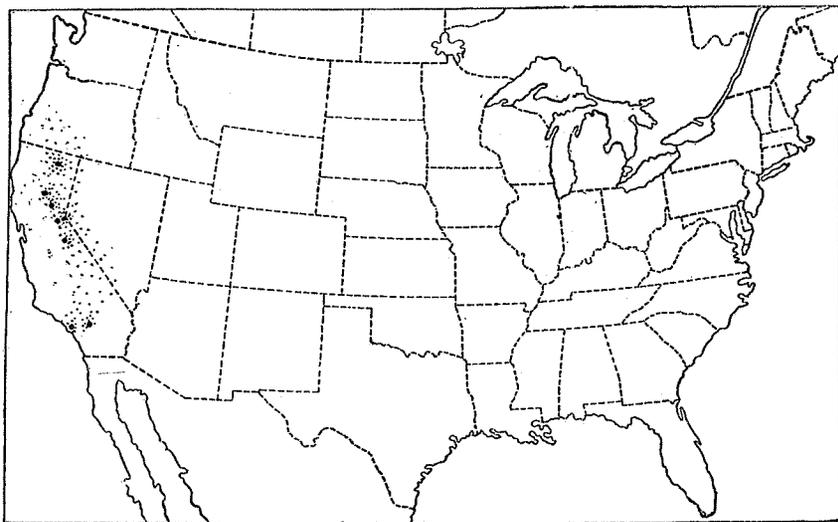


FIG. 72.—*Dendroctonus jeffreyi*: Distribution map. (Original.)

being much coarser; otherwise they appear to be more like those of *monticolæ*.

*Distribution* (fig. 72).—(Hopk. U. S.) *California*: Chester, Little Yosemite, Nevada City, Pinogrande, Sterling, Tallac, Yosemite (Yosemite National Park), and Seven Oaks (San Bernardino National Forest).

*Host trees.*—*Pinus jeffreyi*, *P. ponderosa*, and *P. lambertiana*.

*Identified specimens.*—Hopk. U. S., over 160 specimens, including adults, pupæ, and larvæ.

#### DIVISION II.

The distinctive characters common to the species of the second division are:

*Adults.*—Prothorax stout, usually narrower than elytra, distinctly narrowed or constricted toward head; elytra with anterior dorsal

half bearing long hairs, except in *D. terebrans* and badly rubbed specimens.

*Pupa.*—Vertex of head faintly impressed, flat or convex, and with two small widely separated frontal granules toward vertex.

*Larva.*—Abdominal tergites 8 and 9 with dorsal plates except in *simplex* and *pseudotsugæ*, and 8 without plate in *micans*.

*Galleries.*—Egg galleries longitudinal, straight to slightly winding; eggs in groups or masses; larval mines and pupal cells exposed in inner bark.

#### SUBDIVISION C.

(Species Nos. 12 to 21, inclusive.)

The distinctive characters common to the species of this third subdivision are:

*Adults.*—Front usually with posterior impression, pronotum with large and small punctures intermixed. Pronotum with long hairs on dorsal and lateral areas.

*Sexes.*—Female: Interspaces of elytra declivity more roughened and the striæ more distinctly impressed. Male: The reverse.

*Pupa.*—Vertex of head flattened or faintly impressed; apices of front and middle femora smooth; abdominal tergites with moderately prominent pleural and dorsal spines.

*Larva.*—Abdominal tergites 8 and 9 without dorsal plate in *simplex* and *pseudotsugæ* and with unarmed dorsal plate in the remaining species.

*Galleries.*—Egg galleries slightly winding to straight; eggs in groups, but larval mines separated from the beginning, or beyond the middle, except in *D. micans*.

#### 12. *Dendroctonus simplex* Le Conte.

(Pl. V, fig. 12.)

*Adult.*—Typical female: Length, 3.9 mm., dark reddish-brown. Head with front distinctly convex, with faint posterior impression. Pronotum with distinctly coarse and fine punctures intermixed; elytral declivity with striæ deeply impressed; epistomal process narrow, flat, the sides nearly parallel, apex not extending beyond the anterior frontal margin; elytral rugosities moderately coarse, becoming finer on the lateral areas, sparse, coarser, and more acute on the dorsal area and vertex; striæ toward suture impressed, not impressed on lateral area; stria punctures coarse and distinct. Pronotum with moderately long reclining hairs on lateral area. Secondary sexual characters: Elytral declivity with interspaces more rugose and the striæ more distinctly impressed.

Typical female labeled, name label, "Hopk. 1/22/08, H. S. 41, ♀, Grand Ledge, Mich., 21.4" (= April 21).

Typical male: Length, 3.8 mm.; elytra more shining, less rugose; declivity shining, interspaces convex and smooth, with fine, distinct

punctures and with striæ distinctly impressed and finely punctured; otherwise as in female.

Typical male labeled, name label, "Hopk. 1/22/08, H. S. 40, ♂, Grand Ledge, Mich., 20.5" (= May 20).

*Variations.*—The length varies from 3.5 to 5 mm., with the average about 4.7 mm. The color varies from reddish to reddish-brown, with the head and thoracic segments ranging from light to dark brown, and nearly black. The epistomal characters are more constant in this and the next species, otherwise the usual variation in the sculpture and vestiture of the head, pronotum, and elytra prevails. The greatest variation, other than size, is found in the punctures of the pronotum and in the strial punctures and interspacial rugosities of the elytra.

*Distinctive characters.*—The characters which distinguish this species from the following, to which it is more closely allied, are the much smaller average size of the individual and the coarser and deeper punctures of the pronotum.

*Revisional notes.*—The original description was based on two male specimens labeled "Canada," which have been examined by the writer and found to agree with the common species which lives in the eastern larch. The comparison in the description with *D. obesus* must refer to *D. pseudotsugæ* Hopk., representatives of which were then confused with the true *D. obesus* (Mann.). The smooth intervals on the declivity referred to is a male character. The reference to a much deeper sutural stria relates to what is now recognized as stria 1. The revision relates to the type specimens. With our present knowledge of the specific characters, those given in Le Conte's tables are only partially applicable. It is evident that no other species were confused with this one in Le Conte's description and revision, but it was involved in the revision under *D. obesus* (1868) and *D. similis* (1873). In 1900 it was in Le Conte's collection under *D. rufipennis*, labeled "Lake Superior" and "Tex.," and under *D. similis*, labeled "Lake Superior" and "Can." In Dietz's revision, the specimens from Colorado and California were evidently *D. pseudotsugæ*, but did not involve any confusion in the description, except in the length, 6.2 mm., which was evidently based on a specimen of *D. pseudotsugæ*.

The species was found to be represented in the Horn collection by one specimen, under *simplex*, labeled "Can.," and two specimens under *D. similis*, labeled "Can."

*Pupa.*—In addition to the generic, divisional, and subdivisional characters, the apex of the front and middle femora has a minute subapical granule. Abdominal tergite 1 with very small and 2 to 6 with stout, prominent pleural spines, 1 without dorsal or lateral, 2 without dorsal, 3 to 6 with prominent dorsal spines, becoming larger toward 6, 2 to 6 with two lateral spines each side, becoming more

prominent toward the latter, 7 with two minute dorsal hairs, 8 smooth, 9 with prominent widely separated spines. Pupal type, labeled "Hopk. U. S. No. 6444b."

The usual variation in arrangement and number of minor spines prevails, but the pupa of this species is easily distinguishable from that of the following by its smaller size and the more prominent dorsal, lateral, and pleural spines.

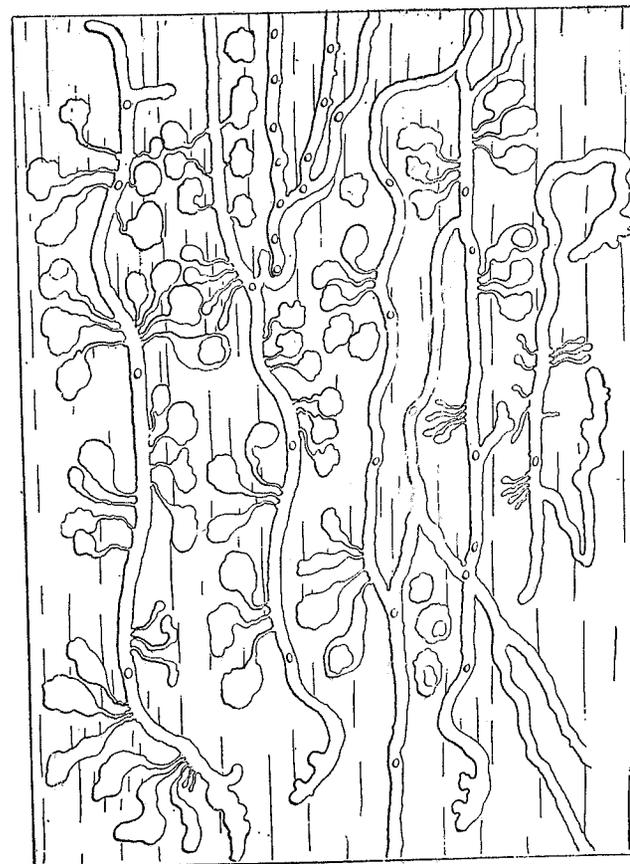


FIG. 73.—*Dendroctonus simplex*: Egg galleries and larval mines. (Original.)

*Larva.*—In addition to the generic and divisional characters, the front is convex, opaque, with the posterior angle obtuse, and the middle with an indistinct transverse elevation, and transversely rugose. The clypeus is prominent, shining, with a distinct median impressed line and the apex broadly emarginate; the labium is short, with the apex broadly rounded. The sternellar lobes of the thoracic segments are prominent and with distinct foot calli. Larval type labeled "Hopk. U. S. No. 6444b."

*Galleries* (fig. 73).—Egg galleries longitudinal, slightly winding, and sometimes branched and grooved on the surface of the wood, as

well as deeply grooved in the inner bark; larval mines and pupal cells exposed in the inner bark. Eggs are placed in groups of three to five or more, and the larval mines, which are short, are separated from the start. The galleries differ from those of the next species by their smaller size, more elongate and winding form of the egg galleries, and the much shorter larval galleries arranged in much smaller groups.

*Distribution* (fig. 74).—(Hopk. U. S.) *Maine*: Cupsuptic. *Michigan*: Grand Island, Munising, Mackinac Island, Seney. (Hopk. W. Va.) *West Virginia*: Cranesville. *Additional localities from other collections*: (U.S.N.M.) Ungava Bay, Canada; Agricultural College, Mich. (H. & S.) Marquette, Grand Ledge, and Port Huron, Mich.

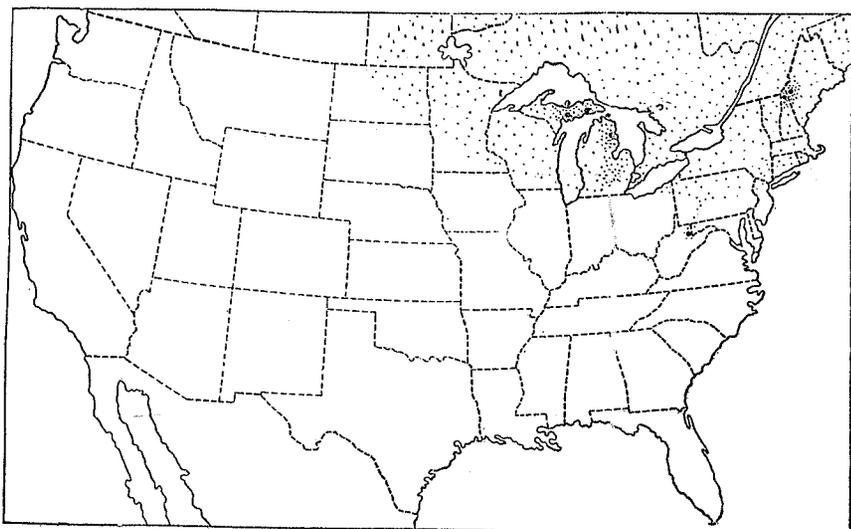


FIG. 74.—*Dendroctonus simplex*: Distribution map. (Original.)

(D. A.) West Stewartstown, N. H. One specimen in the Le Conte collection under *D. obesus*, labeled "Texas" (must be an erroneous locality, resulting from some mistake).

*Host tree*.—*Larix laricina*.

*Identified specimens*.—Le Conte, 10 specimens (2 under *D. simplex*, 3 under *D. rufipennis*, and 5 under *D. similis*); Horn, 3 specimens (2 under *simplex*, 2 under *similis*); U.S.N.M., 6; H. & S., 10; D.A., 5 specimens; Hopk., W. Va., 157, and Hopk. U. S., over 150 specimens.

#### BIBLIOGRAPHY AND SYNONYMY.

*Dendroctonus simplex*. Le Conte, 1868, p. 173, original description, synopsis, localities. Le Conte, 1876, p. 385, revision, synopsis, bibliography, localities. Packard, 1887, p. 177 (Le Conte quoted). Schwarz, 1888, p. 175, synonymy, habits in larch. Packard, 1887, p. 177, Le Conte quoted. Packard, 1890, p. 722

(*ibid.*) Dietz, 1890, p. 31 (in part), Michigan and Lake Superior, fig. 4, antenna and epistoma. Harrington, 1891, p. 27, habits and host. Hopkins, 1898a, p. 69, distinct from *rufipennis* (*piccaperda*). Hopkins, 1898b, in larch in W. Va. Hopkins, 1899a, p. 392, etc., fig. lviii, adult, revisional notes, etc., host, distribution. Hopkins, 1899c, p. 343, good species, habit, host, etc. Felt, 1906, p. 752 (in part), bibliography.

*Dendroctonus similis* (not of Le Conte, 1860) Le Conte, 1876, p. 385 (in part), revision, synonymy, bibliography, localities. Dietz, 1890, p. 31, Canada.

*Dendroctonus rufipennis* (not of Kirby) Le Conte, 1876, p. 385 (in part) (in collection 1906-1907, under *rufipennis*).

*Dendroctonus* sp. Harrington, 1884, p. 218. Packard, 1890, p. 903.

#### 13. *Dendroctonus pseudotsugæ* Hopkins.

(Pl. V, fig. 13.)

*Adult*.—Type of species: Length 5.75 mm.; reddish brown, with the prothorax darker. Head with front convex, with faint median and posterior impression; elytral declivity with striae deeply impressed; epistomal process narrow, slight, with sides nearly parallel, the apex scarcely projecting beyond the anterior margin. Pronotum with punctures fine, and moderately regular in size; elytral rugosities moderately coarse, finer on lateral area, coarse and more acute on dorsal area and vertex; striae of dorsal area distinctly impressed, not impressed on lateral area; punctures coarse and distinct. Pronotum with moderately long hairs on the lateral area. Secondary sexual characters: Elytral declivity convex, with interspaces rugose and the striae distinctly impressed and punctured.

Type labeled "Type No. 7450 U.S.N.M.," name label, "Hopk. 1/22/08, *Pseudotsuga taxifolia*, Hopkins, collector, Grants Pass, Or., ♀, Hopk. U. S. 39."

Male type: Length 5.75 mm.; elytral declivity with interspaces strongly convex and smooth, shining, sparsely punctured; striae deeply impressed, punctures obscure, otherwise as in female.

Male type labeled "♂ type," name label, "Hopk. 1/22/08," otherwise same as female.

*Variations*.—The length varies from 4 to 7 mm., with the average about 6 mm. The color ranges from light reddish to nearly black. The usual variation in sculpture, vestiture, etc., prevails. The greatest variation is in the size and color, and in the size of the punctures of the pronotum. The epistomal process varies considerably, so that in some specimens it extends beyond the epistomal margin, while in others it does not.

*Distinctive characters*.—This species and the one preceding are at once distinguished from all of the other species of the genus by the characters of the epistoma and from each other by the sculpture of the pronotum and the difference in average size of representative individuals. *D. pseudotsugæ* is distinguished especially by the shining and finely punctured pronotum.

*Revisional notes.*—This species has been an element of much confusion in descriptions, revisions, and identifications, under the names *D. similis*, *D. obesus*, *D. rufipennis*, etc. It is represented in the type series in Le Conte's collection under *D. similis*, but the specimen which bears the name label, and therefore the type of *D. similis*, is a true *D. obesus* (Mann.). Le Conte (1868, p. 173) referred *D. similis* to *obesus* on account of the intervals of the elytra being "rough for their whole extent," which is the case in the type of *D. similis*, and in all females of *D. obesus*. Later he evidently com-

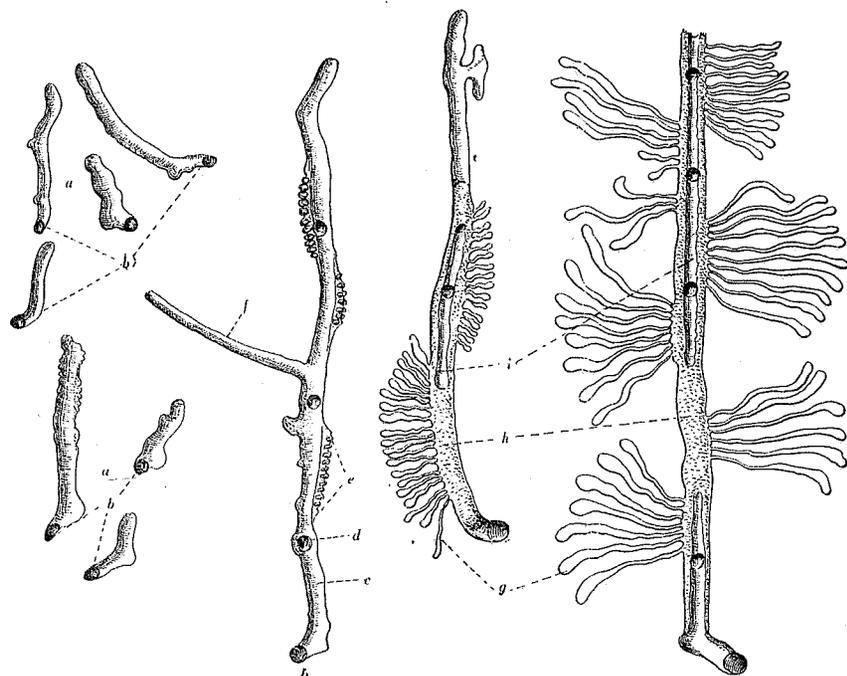


FIG. 75.—*Dendroctonus pseudotsugae*: Egg galleries and larval mines. *a*, Beginning or basal sections of egg galleries in bark; *b*, entrance; *c*, egg gallery; *d*, ventilating hole; *e*, egg nest; *f*, abnormal branch; *g*, larval mines; *h*, egg gallery packed with borings; *i*, subsequent passage or inner gallery through borings. (Original.)

pared the type of *D. similis* with a single male specimen of *D. obesus* in his collection, which, according to Mr. Henshaw, is from the Mannerheim collection, and finding that this differed from his *D. similis* in the smooth elytral declivity he restored *D. similis* (Le Conte, 1876, p. 385) and called attention to the roughened interspaces of the declivity as a distinctive character; all of which makes it quite clear that he considered the specimen bearing the name label as the type of his *D. similis* and that therefore this name must fall as a synonym of *D. obesus* Mann. Thus the other specimens of the type series are left to represent a distinct species as here described. In 1900 it was

represented in the Le Conte collection by two specimens labeled "Or." and three specimens labeled "Van." under *D. similis*, and one specimen labeled "Garland Pass, Col.," under *D. rufipennis*. In 1900 it was represented in the Horn collection by one specimen labeled "Col." and one specimen labeled "Cal.," and in the A. E. S. collection by three specimens from Oregon under *D. similis* and two specimens labeled "Col." under *D. rufipennis*. Dietz's revision under *D. similis* (1890, pp. 30-31) includes the characters of *D. pseudotsugae*, as represented by the Oregon, Colorado, and California speci-

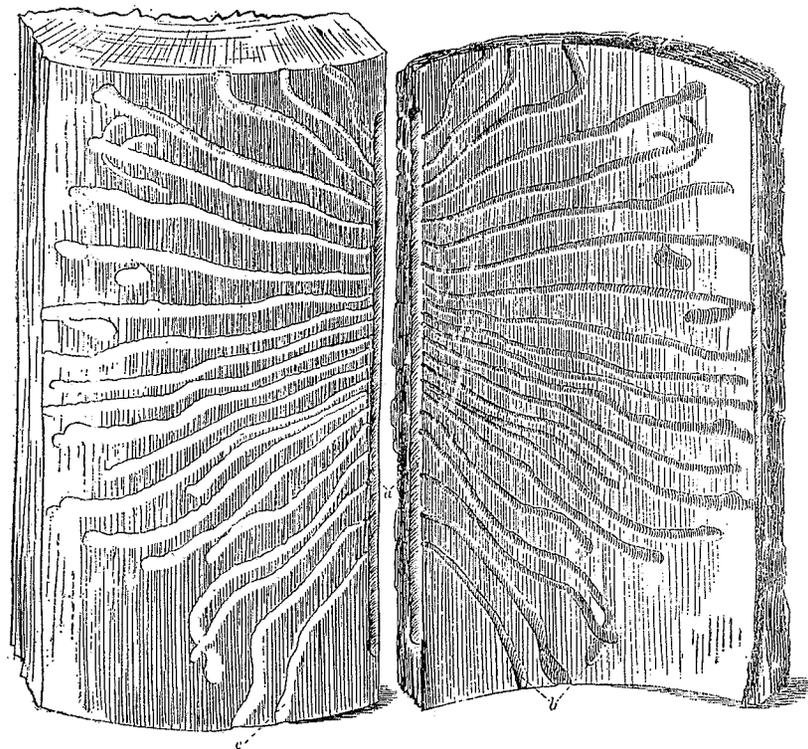


FIG. 76.—*Dendroctonus pseudotsugae*: Egg gallery and larval mines. *a*, Egg gallery in bark and grooved in surface of wood; *b*, larval mines in bark; *c*, larval mines marked and slightly grooved on surface of wood. (Original.)

mens, while the specimens from Canada represented *D. simplex*, and one from California referred to in the note is *D. monticolæ*.

*Pupa.*—In addition to the generic, divisional, and subdivisional characters, the apices of the front and middle femora are smooth; abdominal tergite 1 is without a pleural spine, 2 with small, and 3 to 6 with rather stout ones; 1 and 2 are without dorsal and lateral spines, while 3 to 6 have a pair of dorsal and a pair of lateral ones each side; 7 and 8 are smooth, and 9 has the usual prominent pleural spines. Pupal type labeled "Hopk. U. S. No. 2298."

The usual variation in number and arrangement of minor spines prevails in other specimens, but they are easily distinguished from those of *D. simplex* by their larger size and less prominent dorsal, lateral, and pleural spines.

*Larva*.—In addition to the generic and divisional characters, the front is opaque, except toward the apex, where it is more shining, and the apex is subacute; the middle has a transversely rugose

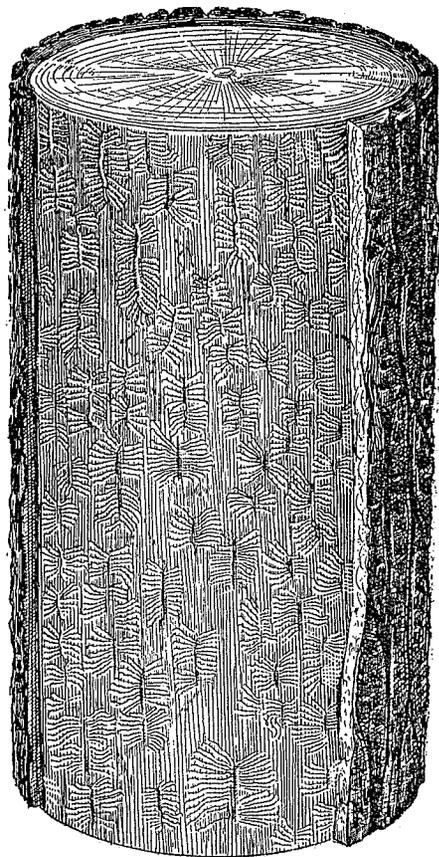


FIG. 77.—*Dendroctonus pseudotsugae*: Section of log with bark removed, showing brood galleries marked and grooved on surface of wood. (Original.)

differ from those of the one preceding by their larger size and shorter form of the egg gallery and the much larger larval mines, which are arranged in larger groups.

*Distribution* (fig. 78).—(Hopk. U. S.) *Arizona*: Chiricahua National Forest, Flagstaff, San Francisco Mountains, Santa Catalina National Forest. *California*: Fieldbrook, Guerneville, McCloud, San Mateo County (Big Basin). *Colorado*: Colorado Springs, Fort Garland, Gunnison National Forest, Indian Creek, Leavenworth Valley, Moffat,

elevation, slightly more elevated and broader toward the suture. The clypeus is prominent, shining, and with an impressed line from the middle to the anterior margin, which is broadly emarginate; labium short, with the apex broadly rounded; the sternellar lobes are moderately prominent, with indistinct foot calli. Larval type labeled "Hopk. U. S. No. 2289."

*Galleries* (figs. 75-77).—

The egg gallery is longitudinal, short, but slightly winding, sometimes branched, slightly grooving the surface of the wood, and deeply grooved in the inner bark. The larval mines and pupal cells are exposed in the inner bark, and the eggs are rather closely placed in groups of three to ten or more, but the larval mines are separated from the start and are usually extended for some distance from the egg gallery.

The galleries of this species

Ouray, Palmer Lake, San Isabel National Forest, San Juan National Forest, Saguache. *Idaho*: Beaver Canyon, Centerville, Bailey, Henrys Lake National Forest, Kooskia, Kootenai, Pioneer ville, Priest River, Sand Point, Smiths Ferry, Stites. *Montana*: Belton, Bozeman, Middle Creek (Gallatin County), Ovando. *New Mexico*: Capitan, Clouderoft, Sacramento National Forest, Santa Fe, Vermejo. *Oregon*: Corvallis, Detroit, Grants Pass, Newport, Slate Creek, St. Helena. *Utah*: Panguitch. *Washington*: Ashford, Buckeye, Des Moines, Dole, Gray's Harbor City, Hoquiam, Junction, Kent, Keyport, Meredith, New London, North Bend, Orting, Palschie, Port Angeles, Port Williams, Pullman, Puyallup, Rock

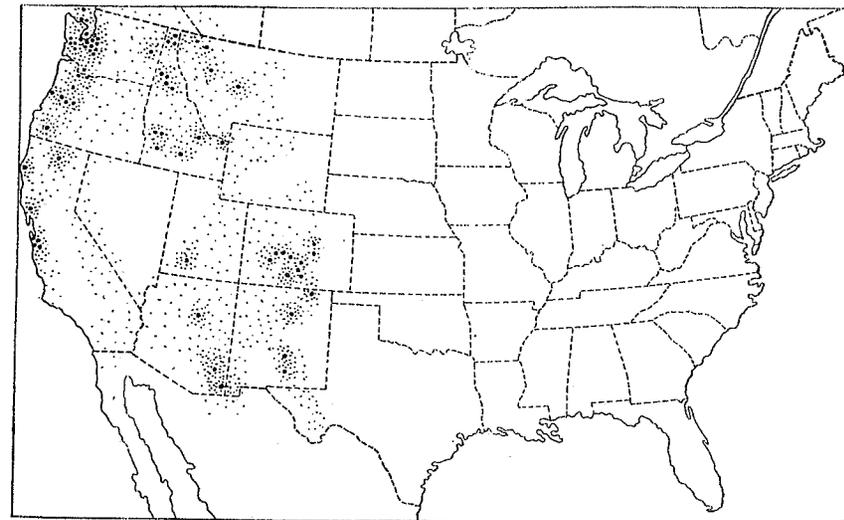


FIG. 78.—*Dendroctonus pseudotsuga*: Distribution map. (Original.)

Creek, Satsop. *Additional localities from other collections*: (Le Conte) Vancouver, B. C. (U.S.N.M.) Easton, Wash. (H. & S.) Hood River, Oreg; Beaver Canyon, Idaho. (D. A.) Mount Angel, Oreg. (Soltau) Seattle, Wash. (Wickham) Leavenworth Valley and Kalispell, Mont.

*Host trees*.—*Pseudotsuga taxifolia*, *P. macrocarpa*, and *Larix occidentalis*.

*Identified specimens*.—Le Conte, 6 specimens (1 under *rufipennis*, 5 under *D. similis*); Horn, 2; A. E. S., 5; Dietz, 2; U.S.N.M., 7; H. & S., 2; Soltau, 3; Webb, 21; Wickham, 2; Laurent, 1; D. A., 5; Hamilton, 1; Hopk. U. S., over 700 specimens, including all stages and work.

## BIBLIOGRAPHY AND SYNONYMY.

- Dendroctonus similis* (not of Le Conte, 1860) Le Conte, 1876, p. 385 (in part), revision, synonymy, bibliography, localities. Le Conte, 1878, p. 469, listed, Leavenworth Valley, Colo. Packard, 1887, p. 177, Le Conte quoted. Packard, 1890, p. 722, Le Conte quoted. Dietz, 1890, pp. 30-31, from Oregon, California, Colorado, fig. 3, antenna, epistoma. Hopkins, 1899a, p. 392, fig. lviii, adult. Hopkins, 1899b, pp. 10, 11-15, 21, 22, 26, first records, habits, hosts, etc. Wickham, 1902, p. 310, list and localities. Hopkins, 1903a, p. 61, synonymy. Fall, 1907, p. 218, in list, locality.
- Dendroctonus rufipennis* (not of Kirby) Le Conte, 1876, p. 385 (in part) (in collection 1900-1907, under *rufipennis*). Le Conte, 1878, p. 469 (in part). Packard, 1887, pp. 177, 243 (in part?). Hopkins, 1899b, p. 15, localities, note. Hopkins, 1904, p. 19, reference.
- Dendroctonus simplex* (not of Le Conte) Dietz, 1890, p. 31 (in part), Colorado, California. Wickham, 1902, p. 310 (on Dietz's authority).
- Dendroctonus pseudotsugæ* Hopkins, 1901b, p. 67, brief description of adult, galleries, habits, distribution, etc. Hopkins, 1903a, p. 60, habits, comparison with *D. similis*, which=*D. obesus*. Hopkins, 1905, pp. 10, 11, brief description, habits, etc. Hopkins, 1906a, p. 4, old work.
- Dendroctonus* n. sp. (Douglas spruce beetle.) Hopkins, 1904, pp. 19, 45.

14. *Dendroctonus piceaperda* Hopkins.

(Pl. V, fig. 14.)

*Adult*.—Type of species, female: Length, 5.75 mm.; elytra red, thorax, head, and abdomen black; head with front convex and with faint median and posterior impression and anterior elevated line. Elytral declivity with striæ not deeply impressed; epistomal process broad, concave, with the lateral section oblique; punctures of pronotum distinctly irregular; posterior half of proepisternal area not punctured; elytral striæ distinctly impressed in dorsal and lateral areas, with punctures rather coarse and distinct; interspaces slightly convex; rugosities acute, rather closely placed, irregular. Secondary sexual characters: Declivity convex; striæ very faintly impressed, with fine indistinct punctures; interspaces nearly flat, shining, with approximate row of fine granules.

Type labeled "Type No. 7451 U.S.N.M.," name label, "Hopk. 4/23/02, compared with Kirby type *rufipennis*, does not agree, *Picea canadensis*, Hopkins, collector, Camp Caribou, Me., ♀ type, Hopk. U. S. 326."

Male type: Length, 5.6 mm.; elytra dark reddish-brown; thorax and head darker; elytral declivity convex; striæ not impressed; punctures obscure; interspaces flat, shining, and finely punctured, with very small granules toward vertex.

Type labeled, "♂ type, type of drawing," name label, "Hopk. 1/22/08, *Picea canadensis*, Hopkins, collector Camp Caribou, Me., ♂ type, Hopk. U. S. 326."

*Variations*.—The length varies from 4.7 to 6 mm., with the average about 5.5 mm. The color ranges from uniform light red to black, to the head, thorax, and abdominal sternites dark to black, with the ely-

tra lighter or red. The sculpture and vestiture of the epistoma, front, pronotum, and elytra vary as usual. The greatest variation is in size and color.

*Distinctive characters*.—The characters which distinguish this species from the next are its smaller average size, slightly less elongate form, less shining elytra, with the striæ more distinctly impressed on the sides and the interspaces slightly more convex and more acutely rugose. The difference is not so perceptible in comparing single individuals as when many individuals of both species are compared. It differs from *D. borealis* by the noticeably more elongate and narrower pronotum, and from species 17 to 21 it is distinguished by the distinctly impressed lateral striæ of the elytra, except *D. punctatus* Lec., which is at once recognized by the coarse punctures of the declivital striæ. It is at once distinguished from *D. rufipennis* (Kirby) by its smaller size and coarsely punctured and impressed lateral striæ.

*Revisional notes*.—Probably no species of the genus has been involved in so much confusion as this. It has been extensively discussed under *D. rufipennis*, and confused in collections with several other species under this name. There are three specimens in the Le Conte collection labeled "Anticosti," which were evidently the ones referred to in his revision (1876, p. 385). There are also two specimens without locality labels, which may have been the ones from Colorado, while the one from Alaska is here referred to *D. borealis*. The smoother and more shining declivity referred to by Le Conte as a distinguishing character relates to the males only. It is represented in the Horn collection by two specimens labeled "Canada," under *D. rufipennis*, which were therefore evidently included in Dietz's revision. It is also very probable that the specimens from New Brunswick belonged to this species.

It is very evident that the barkbeetle referred to under *D. rufipennis* by Peck, Packard, Hough, and other authors as depredating on the spruce of New Brunswick, Canada, New England, New York, and Pennsylvania was *D. piceaperda*.

*Pupa*.—In addition to the generic, divisional, and subdivisional characters, the apices of the front and middle femora are smooth; abdominal tergites 2 to 6 with very small pleural spines; 1 without distinct dorsal or lateral spines; 2 to 3 without dorsal, but with two small lateral spines each side; 4 to 6 with a pair of very small dorsal and three or four small lateral spines each side; 7 and 8 smooth; 9 with usual pleural spines. Pupal type labeled "Hopk. U. S. 377."

The usual variation in minor details prevails. It is distinguished from the pupa of *D. engelmanni* by the less impressed vertex of the head and the generally smaller spines and the absence of dorsal spines on the third abdominal tergite.

*Larva*.—In addition to the generic, divisional, and subdivisional characters, the front has a slight transverse, rugose elevation situ-

ated slightly in front of the middle, the anterior surface, including the elevation, opaque. The area behind the elevation is impressed and shining; clypeus short, broad, with median groove and its apex subacutely emarginate (in dried specimens); labrum prominent, its anterior margin subtruncate; mandibles opaque, with slight dorsal impression or elevation; sternellar lobes of thoracic segments moderately

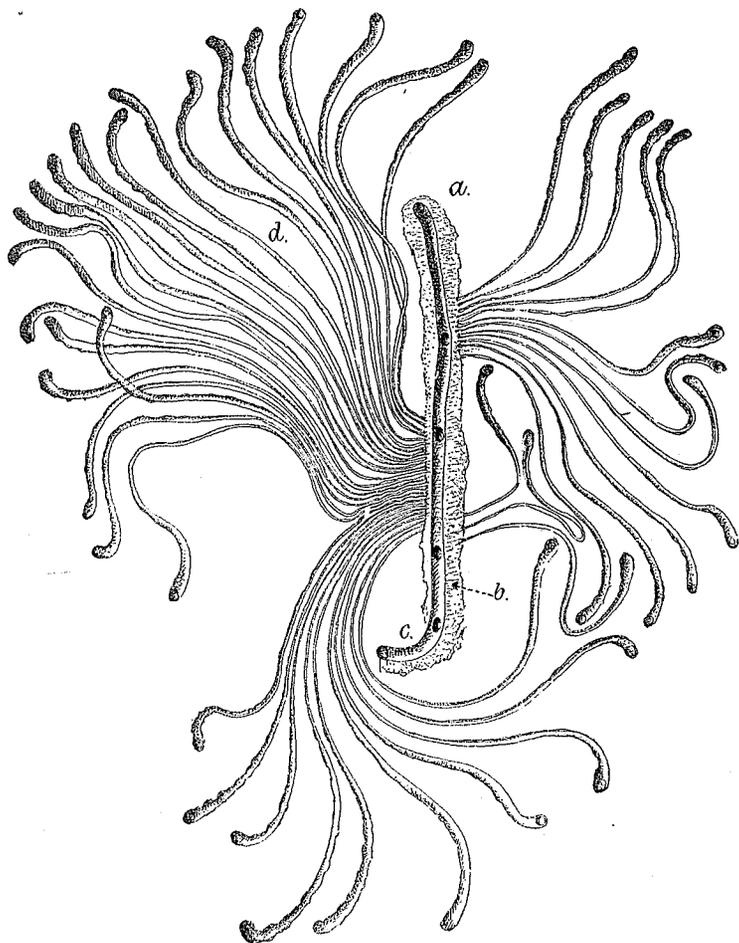


FIG. 79.—*Dendroctonus piceaperda*: Egg gallery and larval mines. *a*, Egg gallery; *b*, boring dust packed in gallery; *c*, entrance and subsequent or inner gallery; *d*, larval mines. (Author's illustration.)

prominent and with distinct foot calli. Larval type labeled "Hopk. U. S. No. 318."

The most distinctive characters are the opaque mandibles with moderate impression and elevation, and the distinctly elevated anterior margin of the epicranium.

*Galleries* (fig. 79).—The egg galleries are short, broad, longitudinal, grooving the surface of the wood and deeply grooved in the inner

bark, the larval mines exposed and the pupal cells partially to entirely exposed. The eggs are closely placed in large groups, and the larval mines are at first contiguous or nearly so, near the egg gallery, but soon become separated and when completed are often as long as the egg gallery or longer. The egg galleries differ from those of all of the species of subdivisions A and B in being very much broader than the diameter of the beetle's body. This broad groove is packed with borings, through which a central gallery is excavated by the parent beetle after the eggs have been deposited.

*Distribution* (fig. 80).—(Hopk. U. S.) *Maine*: Beaver Pond, Camp Caribou, Cupsuptic, Meadows. *Michigan*: Grand Island, Munising. *New Hampshire*: Waterville. *Additional localities from specimens*

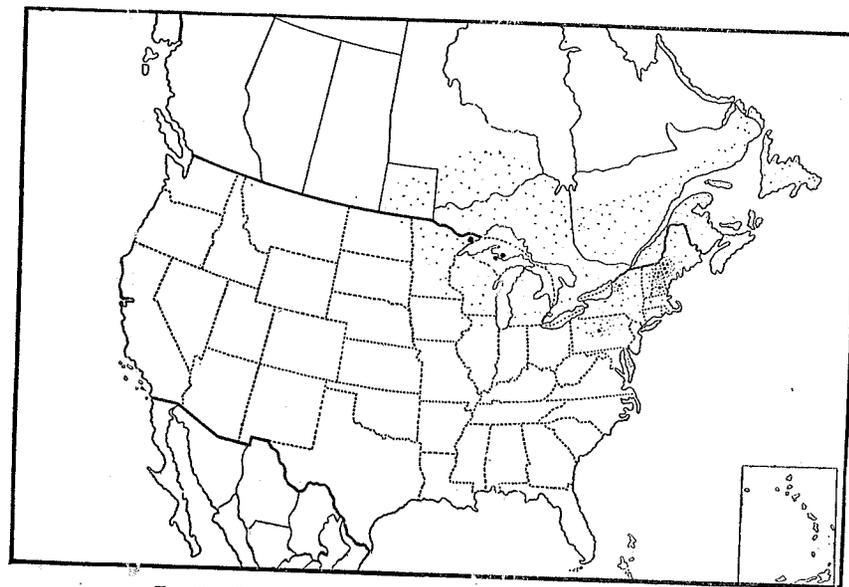


FIG. 80.—*Dendroctonus piceaperda*: Distribution map. (Original.)

*identified in other collections*: (Le Conte) Anticosti, Canada. (Horn) Canada. (U.S.N.M., H. & S.) Isle Royale, Mich. (D. A.) Colebrook and West Stewartstown, N. H. (Wenzel) Ricketts, Pa.

It is evident that this species follows the distribution of the spruce from the higher mountains of central Pennsylvania northward and eastward into New York, New Hampshire, Maine, New Brunswick, and Canada, and westward to the Lake Superior region.

*Host trees*.—*Picea rubens*, *P. canadensis*, and *P. mariana*.

*Identified specimens*.—Le Conte, 3 specimens from Anticosti, 2 without label, under *D. rufipennis*, 1 labeled "N. Y." under *D. punctatus* (Mar. 11, '07), 2 specimens without locality labels doubtfully referred to this species; Horn, 2 specimens labeled "Can.," under *D. rufipennis*; U.S.N.M., H. & S., 1 specimen labeled "Isle Royale;" Weed and

Fiske, 12 specimens; Hopk. U. S., over 300 specimens, including all stages and work.

## BIBLIOGRAPHY AND SYNONYMY.

*Hylurgus rufipennis* (not of Kirby) Peck, 1876, pp. 283, 301, destruction of spruce in New York (evidently the work of *D. piceaperda* Hopk.). Peck, 1879, pp. 32-38, ravages in spruce in northern wilderness (same as 1876?). Packard, 1890, pp. 814-815 (quotes Peck, *ibid.*). Hough, 1882, pp. 259-263, insect ravages in spruce forests of Maine.

*Dendroctonus rufipennis* (not of Kirby) Le Conte, 1876, p. 385, revision, synopsis, localities. Lintner, 1885, p. 54, destruction of spruce in New York. Fletcher, 1887, pp. 39-40, habits. Dietz, 1890, p. 30 (in part), Canada and New Brunswick. Packard, 1887, pp. 177-243 (in part). Packard, 1890, p. 722 (in part), quotes Le Conte. Harvey, 1898, p. 176, depredations on spruce in Maine; p. 98, host, distribution, etc. Hopkins, 1898a, p. 69, distinct from *simplex*. Weed and Fiske, 1898, pp. 67-69, report on investigations. Chittenden, 1898, p. 96, doubt as to Kirby's species. Smith, 1899, p. 364, Lakewood, N. J. Hopkins, 1899a, pp. 349-393 (in part), reference. Hopkins, 1899c, p. 343 (in part?), reference. Chittenden, 1899, p. 56 (in part?), reference. Johnson, 1901, p. 92, habits in Pa. Hopkins, 1905, p. 6, reference to wrong determination. Felt, 1906, p. 753 (in small part), bibliography.

*Polygraphus rufipennis* (not of Kirby) Packard, 1890, p. 721, [fig. 251=*Polygraphus rufipennis* (Kirby)], Le Conte quoted (includes several species).

*Xyloterus bivittatus* (not of Kirby) Packard, 1890, p. 823, fig. 276 (in part), adult?; Pl. XXIV, fig. 1, larva?, 1 a, pupa?, destruction of spruce.

*Barkbeetles.* Packard, 1890, pp. 811-824 (in part), destruction of spruce, New Brunswick to New York.

*Dendroctonus (Polygraphus) rufipennis* (not of Kirby) Cary, 1900, pp. 52-54, depredations on spruce, methods of control.

*Dendroctonus piceaperda* Hopkins, 1901a, p. 16, Pl. II, larvæ, pupæ, adult, etc., original description, different stages and galleries, with full account of habits, host, natural enemies, methods of control, etc. (see also index and Pls. I-V, XIV, XV). Hopkins, 1902b, p. 21, mention. Hopkins, 1902a, p. 3. Hopkins, 1902c, p. 22, habits, etc. Hopkins, 1903b, pp. 266, 270, 281, Pl. XXVII, figs. 23-25, stages and work figured, revised account of habits, life history, methods of control, etc. Hopkins, 1904, p. 26, Pl. I, fig. 3, Pls. V, XII, fig. 1, Pls. XIII, XIV, XV, stages and work (reprints), habits, hosts, distribution, etc. Hopkins, 1905, pp. 10, 11, distinctive characters, brief. Felt, 1905, pp. 6, 7, habits and work. Felt, 1906, pp. 379-385, fig. 85 b, history, habits, etc. Hopkins, 1908, pp. 160-161, depredations.

15. *Dendroctonus engelmanni* n. sp.

*Adult.*—Type of species, female: Length 6.2 mm., black. Head with front convex, faint median and posterior impression and faint anterior line. Elytral declivity with striæ not deeply impressed; punctures of pronotum distinctly irregular; posterior half of proepisternal area not punctured; punctures of prothorax and elytra rather coarse; striæ moderately impressed; interspaces moderately convex, and scarcely rugose, except on dorsal area. Secondary sexual characters: Declivity convex; striæ rather distinctly but not deeply impressed; punctures distinct; interspaces with rows of granules.

Type labeled "Type No. 7452 U.S.N.M.," name label, "Hopk. 1/22/08, *Picea engelmanni*, Capitan, N. M., W. F. Fiske, collector, ♀, Hopk. U. S. 3958."

Male type: Length 5.5 mm. Front without anterior line. Elytra with striæ less distinctly impressed and interspaces less convex than in female; declivity convex, with striæ and stria punctures obscure; interspaces flat, shining, finely but distinctly punctured and without granules except on vertex.

Type labeled, "♂ type," name label, "Hopk. 1/22/08, *Picea engelmanni*, Capitan, N. M., W. F. Fiske, collector, ♂, Hopk. U. S. 3958."

*Variations.*—The length varies from 5 to 7 mm., with the average at about 6.5 mm. The color ranges from uniform light to dark red and black, to black head, thorax, and abdomen, and red elytra. The sculpture and vestiture of the epistoma vary as usual, with the greatest variation in size, color, and punctures.

*Distinctive characters.*—The characters which serve to distinguish this species from the one preceding are the larger average size, slightly more elongate form, more shining elytra, with the lateral striæ somewhat less impressed, the punctures usually coarser, and the interspaces less acutely rugose. It is more closely allied to *D. obesus*, from which it is distinguished by the commonly darker prothorax, and more distinctly impressed lateral striæ of the elytra, with coarser punctures.

*Revisional notes.*—This species, like the preceding, has been involved in the confusion in revisions and collections under *D. rufipennis*. The species under this name was represented in the Le Conte collection by two specimens labeled "Alta, Ut." and "Colo.," by two in Horn's collection labeled "H. B.," and "Alta, Ut.," and by one specimen from Doctor Dietz, labeled "Ut." These were doubtless involved in Le Conte's and Dietz's revisions.

*Pupa.*—In addition to the generic, divisional, and subdivisional characters, the apices of the front and middle femora are smooth; abdominal tergites 2 to 6 with small pleural spines; 1 and 2 without dorsal but with lateral spines, and 3 to 6 with dorsal and lateral spines; 7 and 8 smooth; 9 with pleural spines, as usual. Pupal type labeled "Webb No. 2."

The usual variation in minor details prevails, but the pupa of this species is distinguished from that of the preceding one by the more distinctly impressed vertex of the head, the generally coarser spines, and the presence of dorsal spines on the third abdominal tergite.

*Larva.*—In addition to the generic, divisional, and subdivisional characters, the front has a transverse rugose elevation situated near the middle; the anterior surface, including the elevation, is opaque; the area behind the elevation is impressed and shining, clypeus

broad, with median dorsal groove and the apex subacutely emarginate; labrum prominent, its anterior margin truncate; mandibles opaque toward base, more shining toward apex, with a distinct dorsal impression and oblique ridge near the middle; sternellar lobes of the thoracic segments moderately prominent and with distinct foot calli.

Larval type labeled "Webb No. 2."

The most distinctive characters separating the larva of this species from that of the preceding one are the more shining mandibles, with much deeper dorsal impression and more prominent oblique ridge and the much less distinctly elevated anterior margin of the epicranium.

*Galleries* (fig. 81).—The galleries of this species are very much the same as those of the preceding one, except that the larval mines are more distinctly contiguous for a greater distance from the egg galleries.

*Distribution* (fig. 82).—(Hopk. U. S.) *Arizona*: Chiricahua Mountains. *Colorado*: Clyde, Boulder, Craig, Fort Collins, Glenwood Springs, Gunnison, Hahn's Peak, Holy Cross National Forest, Meeker, Ouray National Forest, San Isabel National Forest, Steamboat Springs, White River National Forest. *New Mexico*: Capitan Mountains, Sierra Blanca Mountains, Sacramento National Forest. *South Dakota*: Spearfish Canyon, Black Hills.

*Utah*: Ephraim. *Wyoming*: En-

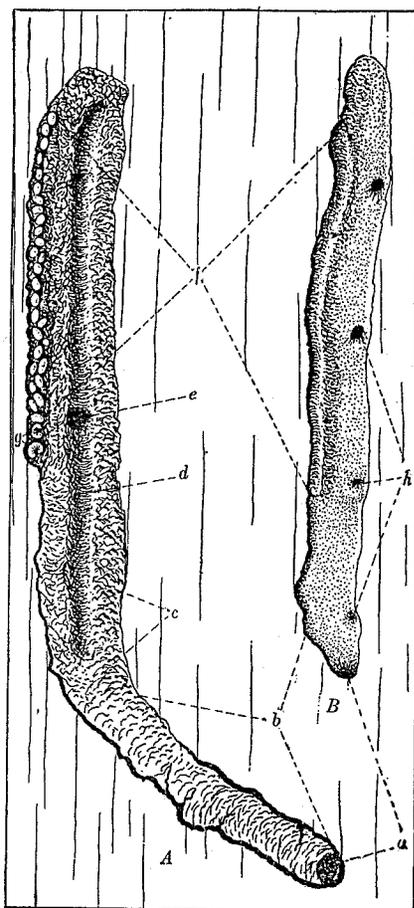


FIG. 81.—*Dendroctonus engelmanni*: Egg gallery in living bark. A, Normal; B, boring dust removed; a, entrance; b, basal section; c, boring dust packed in gallery; d, subsequent or inner gallery; e, ventilating burrow; f, egg nest, with and without eggs; g, freshly hatched larva; h, pits in roof of gallery. (Original.)

campment. *Additional localities from specimens in other collections*: (Horn) "H. B." (Northwest Territory, probably in Mackenzie River region) and Alta, Utah. (Wickham) Argentine, Leadville, and Silver Plume, Colo. (Cockerell) Las Vegas, N. Mex. (H. & S.) Calgary, Alberta; Glacier, British Columbia. (Webb) Collins, Idaho.

*Host trees*.—*Picea engelmanni* and *P. canadensis*.

*Identified specimens*.—Le Conte collection, 2 specimens; Horn, 2; Dietz, 1 (Utah); U.S.N.M. (H. & S.), 4; Wickham, 4; Cockerell, 7; Webb, 25; Hopk. U. S., more than 200 specimens, including all stages and work.

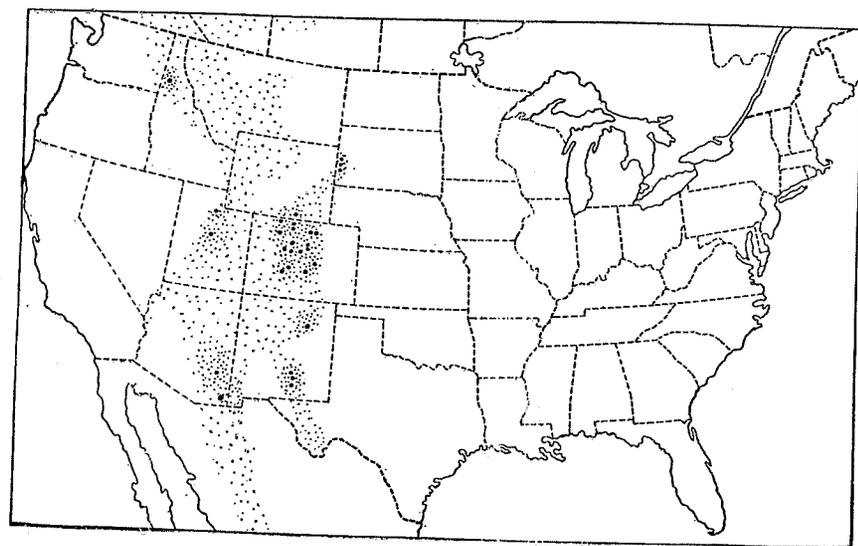


FIG. 82.—*Dendroctonus engelmanni*: Distribution map. (Original.)

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- Dendroctonus rufipennis* (not of Kirby) Le Conte, 1876, p. 385, revision (?). Le Conte, 1878, p. 469 (in part) (in collection 1900-1907, under *D. rufipennis*). Packard, 1887, pp. 177-243 (in part). Packard, 1890, p. 721 (in part), p. 722 (in part), quotes Le Conte. Dietz, 1890, p. 30, Colorado, Utah. Wickham, 1902, p. 309, list, localities.
- Dendroctonus dietzi* Hopkins, 1902a, manuscript name only for variation (Utah).
- Dendroctonus californicus* Hopkins, 1902a, p. 3, manuscript name only, locality.
- Dendroctonus wickhami* Hopkins, 1902a, p. 3, manuscript name only.
- Dendroctonus piceaperda* (not of Hopkins) Wickham, 1902, p. 310, in list, locality, host, reference to synonymy. Hopkins, 1906a, pp. 4, 5, old work on Pike's Peak.
- Dendroctonus piceaperda* var. *engelmanni* (Hopk.) Fall, 1907, p. 218, manuscript name, list, localities.
- Dendroctonus piceaperda* (not of Hopkins) var. Fall, 1907, p. 218, list, Cloudercroft, N. Mex.
- The Engelmann spruce beetle*. Hopkins, 1908, pp. 161-162, depredations.

#### 16. *Dendroctonus borealis* n. sp.

(Pl. V, fig. 16.)

*Adult*.—Type of species, female: Length 6 mm., nearly black. Head with front convex, with faint anterior and posterior impressions and faint anterior line; elytral declivity with striae not deeply im-

pressed; punctures of pronotum distinctly irregular; posterior half of proepisternal area not punctured; punctures of pronotum and elytra moderately coarse; elytral striæ scarcely impressed except in dorsal area; interspaces scarcely coarser and but faintly rugose, except toward base and vertex. Secondary sexual characters: Elytral declivity convex; striæ faintly impressed, with punctures moderately distinct; interspaces slightly convex, with distinct row of granules.

Type labeled "Type No. 7453 U.S.N.M.," name label, "Hopk. 1/22/08, U.S.N.M. 22, Alaska, ♀, U.S.N.M. Acc. 25431."

Male type: Length 6 mm., elytra red; thorax, head, and abdomen much darker; other characters the same as in female, except elytral declivity, which is shining, the striæ and stria punctures obscure;

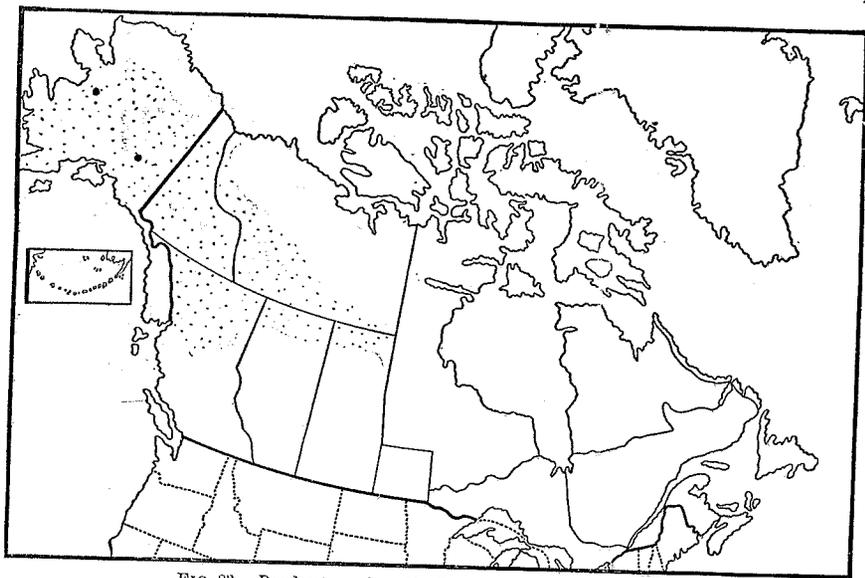


FIG. 83.—*Dendroctonus borealis*: Distribution map. (Original.)

interspaces flat, shining, and 1 and 2 without granules except toward vertex.

Male type labeled "type of drawing," "♂ type," name label, "Hopk. 1/22/08, *Picea canadensis*, Eagle, Alaska, W. H. Osgood, collector, ♂, Hopk. U. S. 1170a."

*Variations*.—There is scarcely any variation in the four specimens in the collections, but the color varies from nearly black in the type to the head, thorax, and abdomen dark, and the elytra red in the other specimens.

*Distinguishing characters*.—The short, stouter form, short and broad pronotum, with the punctures more uniform in size, the punctures of the dorsal striæ of the elytra finer and less distinct, serves to distinguish this species from all of the allied forms. It appears to be more closely allied to *D. obesus*, but is distinguished from it by its shorter pronotum and elytra, and the other characters mentioned.

*Revisional notes*.—It is quite evident that the specimens described by Mannerheim (1853, p. 238) under *D. rufipennis* are *D. borealis*. The single specimen in Le Conte's collection under *D. rufipennis*, labeled "*Hylurgus rufipennis* Kirby," and locality Kenai, is evidently from Mannerheim's collection, and probably one of the specimens before him when he prepared his description under that name. Superficially, this specimen resembles *D. picaperda*, which led Le Conte to identify his Anticosti and Canada specimens as *D. rufipennis*, and is evidently the one which represented the Alaska locality in his revisions (1838 and 1876).

The immature stages and galleries of this species have not been observed.

*Host tree*.—*Picea canadensis*.

*Distribution* (fig. 83).—*Alaska*: Eagle, (?) Kenai Peninsula.

*Identified specimens*.—Le Conte, 1 specimen; U.S.N.M., 2; Hopk. U. S., 2, collected by W. H. Osgood, of the Biological Survey, U. S. Department of Agriculture, at Eagle, Alaska, August, 1903, from white spruce.

#### BIBLIOGRAPHY AND SYNONYMY.

- Hylurgus rufipennis* (not of Kirby). Mannerheim, 1853, p. — (in part).  
*Dendroctonus rufipennis* (not of Kirby). Le Conte, 1868-1876 (in part).  
*Dendroctonus borealis* Hopkins, 1902a, p. 3, manuscript name only.

#### 17. *Dendroctonus obesus* (Mannerheim).

(Pl. VI, fig. 17.)

*Adult*.—Typical female: Length 6.5 mm., nearly black. Head with front convex, with faint anterior and posterior impression and moderately distinct anterior line. Elytral declivity with striæ not deeply impressed; punctures of pronotum distinctly irregular; posterior half of proepisternal area not punctured; punctures of pronotum and elytra moderately coarse; elytral striæ scarcely impressed; interspaces flat, finely, sparsely rugose on dorsal area and toward base of vertex. Secondary sexual characters: Declivity convex, subopaque; striæ faintly impressed, with punctures moderately distinct; interspaces faintly convex, with distinct row of granules.

Typical female labeled, name label, "Hopk. 1/22/08, *Picea sitchensis*, Queen Charlotte II., Keen [collector], ♀."

Typical male: Length 6.7 mm., black. Front convex, with faint anterior impression and distinct anterior line. Agrees with female, excepting that the punctures of elytral striæ and interspaces are coarser; declivity subopaque; stria impressions and punctures obscure; interspaces flat, faintly punctured, and with a few granules toward vertex; pronotum with distinctly elevated line.

Typical male labeled, name label, "1/22/08, *Picea sitchensis*, Queen Charlotte II., J. H. Keen, Collr., ♂."

*Variations.*—The length varies from 6 to 7 mm., with the average about 6.5 mm. The color ranges from uniform light red to brown in young specimens, to uniform black in matured ones, it being exceedingly rare to find examples with the pronotum darker than the elytra, which is so characteristic in the three preceding species. The sculpture and vestiture of the epistoma, front, pronotum, and elytra vary as usual. The greatest variation is in the punctures of the pronotum and in the presence and absence of the dorsal line; the presence or absence of a frontal carina is also an important variation, and in some examples the body is noticeably more elongate than in others.

*Distinctive characters.*—The characters which serve to distinguish this species from the three preceding are the uniform black color of the matured adults and the prevailing less impressed elytral striae, especially those of the lateral area, and also the prevailing slightly more elongate form. Its host tree and distribution also serve as distinguishing characters, except, perhaps, in the case of *borealis*, which may be found in the Sitka spruce.

*Revisional notes.*—There can be little or no doubt that the material under observation represents Mannerheim's species, whose varieties *a*, *b*, and *c* were evidently immature specimens. *D. similis* Lec. is to be referred to this, which fact was recognized by Le Conte in his 1868 paper, but the beetle was subsequently confused with the species discussed in the present paper under *D. pseudotsugæ*. *D. obesus* is represented in the Le Conte collection by two specimens, one specimen from Mannerheim's collection, labelled *D. obesus* ("Specimen 5" under *D. rufipennis* in 1900), and one specimen, the type of *D. similis*. It is possible that "specimen 2" under *D. rufipennis* is also *D. obesus*, but was not recognized by the writer when examined in 1900. Dietz, 1890, did not recognize or mention *D. obesus*, and it was not found by the writer in the Horn collection or that of the Academy of Natural Sciences.

*Pupa.*—In addition to the generic, divisional, and subdivisional characters, the apices of the front and middle tibiae are smooth or rarely with a single granule, abdominal tergites 2 to 6 with very small pleural spines, 1 without dorsal but with small lateral spines, and 2 to 6 with dorsal and lateral ones, 7 and 8 smooth, 9 with prominent pleural spine as usual. Pupal type labeled "Hopk. U. S. No. 4049a."

The usual variation in minor details prevails, but the pupa of this species is distinguished from that of the three preceding by the more evident lateral spines of the first abdominal tergite and the prevailing darker tips to the abdominal spines.

*Larva.*—In addition to the generic, divisional, subdivisional, and sectional characters, the front has a faint transverse elevation dis-

tinctly in front of the middle and the pronotal area is flat to apex. The clypeus is short and broad, with an anterior dorsal groove and the apex broadly emarginate, labium prominent, slightly longer than the clypeus, with the apex broadly rounded. Larval types, labeled "Hopk. U. S. Nos. 4081, 4046a, and 4049a."

The most distinctive characters appear to be the anteriorly placed transverse elevation of the front; the characters of the mandibles and anterior margin of the epicranium more nearly approach those found in *D. engelmanni*.

*Galleries.*—The galleries of this species are of the same, or of similar character to those of *D. piceaperda*, as given in divisional,

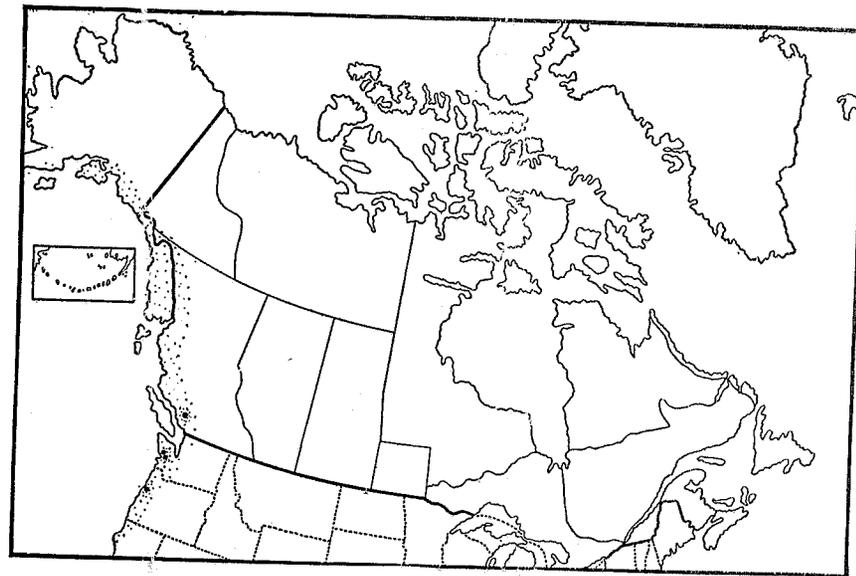


FIG. 84.—*Dendroctonus obesus*: Distribution map. (Original.)

subdivisional, or sectional characters, but differ in the more extended common larval chamber which precedes the independent larval mines which are usually so confused by crossing each other that they are difficult to follow.

*Distribution* (fig. 84).—(Hopk. U. S.) Oregon: Newport. Washington: Hoquiam, Aberdeen. Additional localities from other collections: (U.S.N.M.) (H. & S.) Vancouver, British Columbia; (Rev. Keen) Queen Charlotte Islands, British Columbia.

*Host tree.*—*Picea sitchensis*.

*Identified specimens.*—Le Conte collection, 2 specimens: U.S.N.M., 1 from Doctor Fletcher; H. & S., 3; Hopk. U. S., more than 120 specimens, including all stages.

## BIBLIOGRAPHY AND SYNONYMY.

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- Dendroctonus similis* Le Conte, 1860, p. 59, description (from one specimen which = *D. obesus*). Le Conte, 1868, p. 173, mentioned as synonymous with *D. obesus* Mann. Hopkins, 1902a, p. 3, recognized as synonymous with *D. obesus* (Mann.).
- Dendroctonus obesus* (Mann.) Le Conte, 1868, p. 173 (in part). Chapuis, 1869, p. 35; 1873, p. 243, revised description. Hamilton, 1894, p. 35 (in part). Hopkins, 1899b, pp. 15, 21, habits, host, etc. Schwarz, 1900a, p. 537, author's reprint p. 185 (in part), list. Hopkins, 1902a, p. 3, species recognized as distinct from *D. rufipennis* Kirby. Hopkins, 1902c, p. 22, habit and host. Hopkins, 1903a, p. 60, reference.
- Dendroctonus rufipennis* (not of Kirby). Le Conte, 1868, p. 173 (?=*D. obesus*). Le Conte, 1876, p. 385, revision, synonymy, bibliography, localities (in collection 1900-1907, under *rufipennis*). Packard, 1887, pp. 176, 243 (in part?).
- Dendroctonus rufipennis* (*obesus* Mann.) Harrington, 1890, p. 189, author's extra, p. 19.
- Dendroctonus keeni* Hopkins, 1902a, p. 3, manuscript name only on variation.
- Dendroctonus fletcheri* Hopkins, 1902a, p. 3, manuscript name only on variation.

18. *Dendroctonus rufipennis* (Kirby).

(Pl. VI, fig. 18.)

*Adult*.—Typical female: Length 6.2 mm. Elytra red; thorax, head, and abdomen reddish brown. Head convex, with faint anterior and posterior impression and short anterior line; elytral declivity with striae not deeply impressed; punctures of pronotum distinct, irregular; posterior half of proepisternal area punctured; striae of elytral declivity with fine punctures; elytral striae scarcely impressed, except toward suture; striae punctures moderately coarse; interspaces with rugosities moderately coarse, sparse, and acute; pronotal punctures coarse, deep, moderately dense. Secondary sexual characters: Elytral declivity convex; striae faintly impressed; punctures obscure; interspaces faintly convex, with row of fine granules.

Typical female labeled "type of drawing," name label, "Hopk., 4/25/02. Agrees with Kirby's type, compared by C. O. Waterhouse, H. S. 28, ♀, White Fish Point, [Lake] S[uperior]."

Typical male: Length 6.7 mm. Elytra dark red, thorax and head reddish brown. Agrees with female, excepting that the elytral declivity is more shining, the striae punctures are less distinct, and the interspaces have less distinct rows of granules.

Typical male labeled, name label, "Hopk. 1/22/08, *Pinus strobus*, Grand Island, Mich., W. F. Fiske, collector, ♂, Hopk. U. S. 3761."

*Variations*.—The length varies from 5 to 7.3 mm., with the average at about 6.5 mm., the head, thorax, and ventral segments from

<sup>a</sup>This was Eschscholtz's manuscript name, published in Dejean Cat., 3me. Edit., p. 331, but Mannerheim published the first description.

darker reddish brown to nearly black, while the elytra are light to dark red. The greatest variation noted in the few specimens under observation is in size, with less variation in sculpture and vestiture than in the preceding species, Nos. 14, 15, and 17.

*Distinctive characters*.—The characters which serve to at once distinguish this species from the preceding allied ones are the coarse punctures of the posterior section of the proepisternal area, the more distinctly red elytra, the bright-red hairs, and the much less distinctly impressed elytral striae of the lateral area.

*Revisional notes*.—There is quite extensive literature under the name *Hylurgus rufipennis* Kirby and *Dendroctonus rufipennis* Kirby. Apparently no part of it except the original description refers to Kirby's species, and even the type series in the British Museum represents at least one other species. It appears that up to the fall of 1906 the only representative of the species in the collections of this country was a female specimen in the Hubbard & Schwarz collection, U. S. National Museum, labeled "White Fish Point, L. S." This, with other specimens of the *Dendroctonus* of the U. S. National Museum and Hubbard & Schwarz collections, was submitted to the writer in December, 1898, for study, and was then labeled "H. S. 28." In 1900 this specimen, together with another labeled "H. B." (Northwest Territory) from the National Museum collection, and some specimens collected by the writer from the spruce in Maine, were sent to the British Museum for comparison with Kirby's type of *D. rufipennis*. They were compared by Mr. Charles O. Waterhouse who, in a letter dated November 1, 1900, wrote as follows:

I have examined your species, but am only concerned with your two largest specimens. We have three of the specimens which Kirby had before him, all marked exactly alike. The one to which he attached his ticket is a dark-brown variety (unless it is stained with grease), but in all other respects agrees with your H. S. 28, with fairly equally distributed punctuation on the thorax. Kirby's two other specimens have red elytra and agree with your H. B. 7401, 824, and have a closely punctured impression or flattening at the base of the thorax.

The specimen in the type series which bore the name label when the comparison was made should be recognized as the type. Thus it is quite certain that our H. S. 28 from White Fish Point, Lake Superior, is a true representative of the species, while the two other specimens with which our H. B. 7401, 824, etc., agree evidently represent *D. engelmanni* and are probably the specimens referred to by Kirby as coming from Lat. 65°. The writer is informed by Mr. Schwarz that our H. B. (No. 7401) specimen came from about the same latitude. The other specimens from Maine, which were so different from the type as to be at once recognized as distinct, were representatives of *D. piceaperda* Hopk.

The pupae, larvae, and galleries have not been observed.

*Distribution* (fig. 85).—*Michigan*: White Fish Point and Grand Island.

*Host tree*.—*Pinus strobus*.

*Identified specimens*.—U.S.N.M., H. & S., 1 specimen; Hopk. U. S., 14 specimens of adults, collected by W. F. Fiske at Grand Island, Mich.

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*Hylurgus rufipennis* Kirby, 1837, p. 195, No. 261, original description. Packard, 1887, p. 176, note. Hopkins, 1899c, p. 343 (in part?). Schwarz, 1900a, p. 537, author's copy, p. 185 (in part?). Hopkins, 1901a, p. 13, reference to distribution, characters, first time recognized since description.

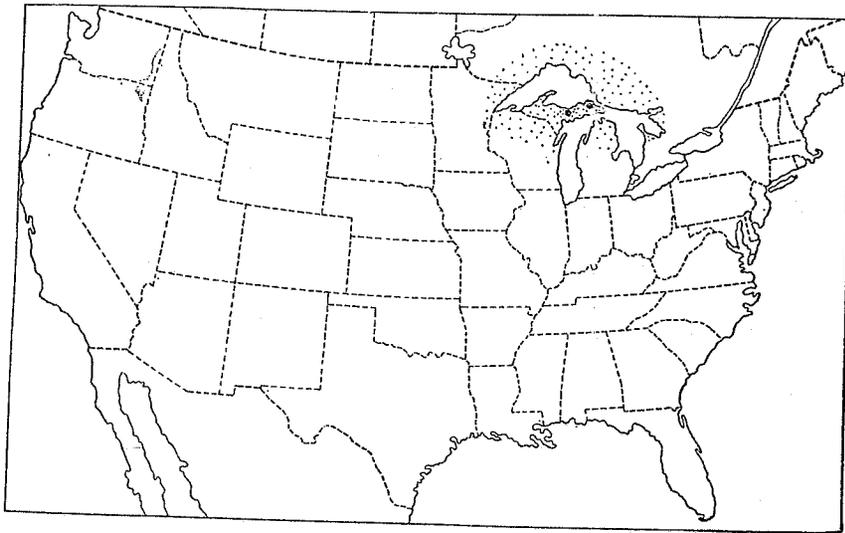


FIG. 85.—*Dendroctonus rufipennis*: Distribution map. (Original.)

#### 19. *Dendroctonus murrayanæ* n. sp.

*Adult*.—Type of species, female: Length, 6.9 mm; elytra red; thorax, head, and abdomen nearly black. Head convex, with obscure impression; elytral declivity with striae not deeply impressed; punctures of pronotum distinct, coarse, irregular; posterior half of propisternal area punctured; striae of elytral declivity with fine punctures; elytral striae scarcely impressed; punctures moderately coarse; interspaces with rugosities moderately coarse, acute, and rather coarsely placed; pronotal punctures coarse, deep, moderately dense. Secondary sexual characters: Elytral declivity convex; striae distinctly impressed; punctures obscure; interspaces convex, with irregular punctures and rows of granules.

Type labeled "No. 7454 U.S.N.M.," name label, "Hopk. 1/22/08, *Pinus murrayana*, Keystone, Wyo., J. L. Rebmann, collector, ♀, Hopk. U. S. 2690."

Male type: Length, 6.5 mm. Agrees with female, except that the elytral declivity is more shining and the interspaces are more distinctly punctured and less rugose.

Type labeled "♂ type," otherwise same as female.

*Variations*.—The length varies from 5.4 to 6.5 mm., with the average about 6 mm.; the head, thorax, and ventral segments are dark reddish brown to black, while the elytra are light to dark red. The greatest variation noted in the few specimens under observation is in the size, with less variation in sculpture and vestiture than in species Nos. 14, 15, and 17.

*Distinctive characters*.—The characters which serve to distinguish this species from *D. rufipennis*, to which it is more closely allied, are its slightly smaller size and more distinctly impressed elytral striae

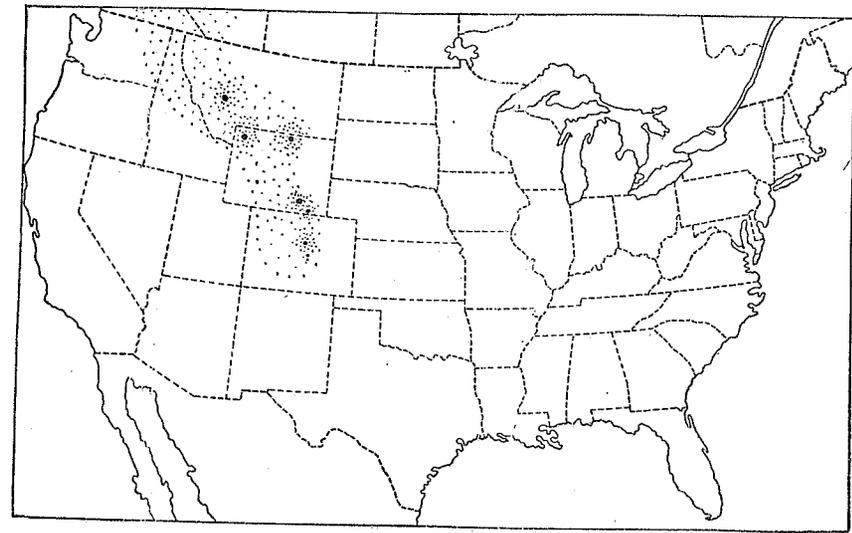


FIG. 86.—*Dendroctonus murrayanæ*: Distribution map. (Original.)

on the dorsal and lateral areas and the finely, densely punctured interspaces of the declivity in the male.

It appears that this species has not been referred to in literature. The pupa has not been observed.

*Larva* (Pl. VIII, fig. 19).—In addition to the generic, divisional, and subdivisive characters, the front has an impression toward the anterior angles and a faint transverse elevation in front of the middle. The clypeus is longer than the labrum and marked with a median groove, and with the apex broadly emarginate; labrum with apex faintly emarginate, and the mandibles with distinct dorsal impression. Larval type labeled "Hopk. U. S. No. 2690c."

*Galleries*.—Only fragmentary specimens of the galleries have been observed, but they appear to come between *piceaperda* and *valens*, the larvæ, for the most part, excavating a common chamber.

*Distribution* (fig. 86).—(Hopk. U. S.) *Wyoming*: Homestake, Saratoga, Keystone, Cheyenne National Forest, and Big Horn National Forest. *Colorado*: Jefferson. *Additional localities from other collections*: (U.S.N.M.) (H. & S.), National Park, Wyoming.

*Host trees*.—*Pinus murrayana* and *Picea engelmanni*.

*Identified specimens*.—H. & S., 5; Hopk. U. S., over 100 specimens, including adults, larvæ, and work.

## BIBLIOGRAPHY.

*Dendroctonus shoshone* Hopkins, 1902a, p. 3, manuscript name only.

20. *Dendroctonus punctatus* Le Conte.

(Pl. VI, fig. 20.)

*Adult*.—Typical female: Length 6.5 mm., dark reddish brown. Head convex, with moderately distinct anterior impression. Elytral declivity with striæ distinctly impressed. Punctures of pronotum distinct, coarse, irregular; posterior half of proepisternal area punctured; striæ of elytral declivity with coarse punctures; elytral striæ distinctly impressed; punctures coarse and distinct; interspaces rather narrow, convex, moderately rugose on corsal area, but nearly smooth on lateral area. Secondary sexual characters: Declivity convex, shining; striæ distinctly but not deeply impressed; punctures coarse and distinct; interspaces narrow, convex, with row of granules.

Typical female labeled "type of drawing," name label, "Hopk. 4/25/02, *Picea rubens*, Randolph County, W. Va., A. D. Hopkins, collector, ♀, Hopk. W. Va. 6312."

*Variations*.—There appears to be very little variation in the few specimens observed.

*Distinctive characters*.—This species is at once distinguished from all of the preceding by the coarse punctures of the elytral striæ, especially on the declivity. Its nearest ally is *D. micans*, of Europe, from which it differs in its smaller size, more elongate form, and more distinctly impressed elytral striæ.

*Revisional notes*.—While the original description does not include the more distinctive characters, it was based on a type which was readily recognized as a distinct species. Dietz referred the specimen in the Horn collection, labeled *D. punctatus* Lec., to *D. rufipennis* (Kirby), but it is certainly distinct from what is now recognized as *D. rufipennis*.

*Host tree*.—*Picea rubens*.

Pupæ, larvæ, and galleries of this species have not been observed.

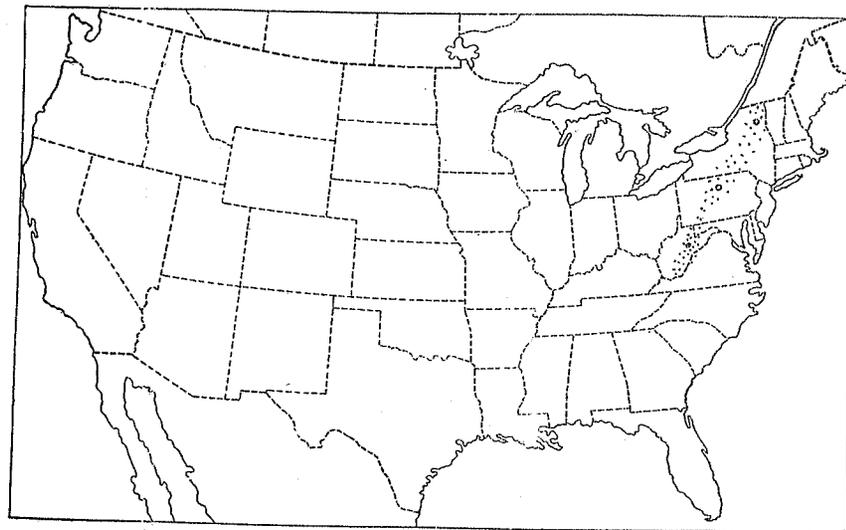
*Distribution* (fig. 87).—(Hopk., W. Va.) 1 specimen collected by the writer May 21, 1892, in the high mountains of Randolph County,

West Virginia, under bark on spruce stump. (Le Conte, M. C. Z.) 3 specimens labeled "New York"; (Horn, A. E. S.) 1 specimen labeled "Pa."

## BIBLIOGRAPHY AND SYNONYMY.

*Dendroctonus punctatus* Le Conte, 1868, p. 173, original description, synonymy, locality. Le Conte, 1876, p. 385, revision, synonymy, bibliography, localities. Packard, 1887, p. 177, Le Conte quoted. Packard, 1890, p. 722, Le Conte quoted. Hopkins, 1899a, p. 447, habit, etc., West Virginia. Hopkins, 1902a, p. 3, recognized as a good species and restored.

*Dendroctonus rufipennis* (not of Kirby) Dietz, 1890, p. 30, Pennsylvania.

FIG. 87.—*Dendroctonus punctatus*: Distribution map. (Original.)21. *Dendroctonus micans* (Kugelnann).

(Pl. VI, fig. 21.)

*Adult*.—Typical female: Length 7.25 mm., dark reddish brown. Head convex, with faint anterior impression, without anterior line; elytral declivity with striæ not deeply impressed; punctures of pronotum distinct, coarse, irregular; posterior half of proepisternal area punctured; striæ of elytral declivity with coarse punctures; elytral striæ not impressed, punctures moderately coarse, interspaces broad and flat, sparsely and finely rugose. Secondary sexual characters: Elytral declivity convex, subopaque; striæ faintly impressed; punctures coarse and distinct; interspaces moderately convex, with sparse, irregular granules.

Typical female labeled "type of drawing," name label, "Hopk. 4/25/02, ♀. Determination No. 20, Eichhoff, Sachsen, Horrung."

Typical male: Length 6 mm., black. Agrees with female in every respect, except that it may have stouter mandible, the club of antenna smaller, more elongate; the declivity of elytra with stria punctures finer, and the interspaces without granules.

Typical male labeled "♂, from Dr. Severin."

*Variations.*—Length 7 to 8 mm., average about 7.5 mm.; uniform reddish brown to nearly black, with usual variation in sculpture and vestiture.

*Distinctive characters.*—This species is more closely allied to *D. punctatus* than to any of the other species of the genus, from which it is distinguished by its larger size and stouter form, with the striae scarcely at all impressed, and the punctures smaller.

The male of this species appears to be far more rare than in the other species, from the fact that among 83 specimens examined only 2 males were found. While the declivity is somewhat more shining and smoother in the male, this character is by no means as striking as in the other species of the section to which it belongs.

The pupa has not been studied by the writer, but is evidently similar in general character to that of *D. piceaperda*.

*Larva.*—Abdominal tergite 8 without, 9 with, small dorsal plate, which is not rugose. Front with distinct elevation. In addition to the generic, divisional, and subdivisive characters, the frontal elevation is subopaque, and subdivisive characters, the frontal elevation is transversely wrinkled, situated in front of the middle and joined to the epistoma; lateral angles are curved back to their junction with the frontal sutures, which are broadly curved toward the apex. The area behind the elevation is broad, flat, and more shining. Clypeus broad, with faint median groove and the apex broadly emarginate. Labrum small, rather stout, with broad dorsal impression, the apex subtruncate; mandibles shining, with a distinct dorsal impression and oblique ridge near the middle; sternellar lobes of the thoracic segments moderately prominent and with distinct foot calli.

*Type.*—One of a large series of larvæ received from Dr. G. Severin, conservateur, Royal Museum of Natural History, Belgium.

The larva of this species is at once distinguished from that of all of the other species of the genus, so far as observed, by the faint dorsal plate of the ninth abdominal segment, by the absence of a plate on the eighth, by the frontal elevation connected with the epistoma, and by the greater number and more distinct hairs on the scutellar lobes of the thorax and abdomen.

*Galleries* (fig. 88).—The galleries are evidently quite similar to those of *D. terebrans* and *D. valens*, especially in the fact that the larvæ live together in a common chamber exposed in the inner bark. According to Dr. G. Severin, the egg gallery is vertical, frequently

curved and somewhat irregular, sometimes doubly inflected and from 12 to 20 cm. long. The female here deposits from 20 to 25 eggs in several places. The larvæ eat very close together, growing equally in size and age and making a common cavity underneath the bark. In order to go through the pupal stage, they return to the large space which they left behind them and which is now filled with excrement and resin. Departing from their common cavity, they eat out isolated galleries, and at the end of these they pupate.

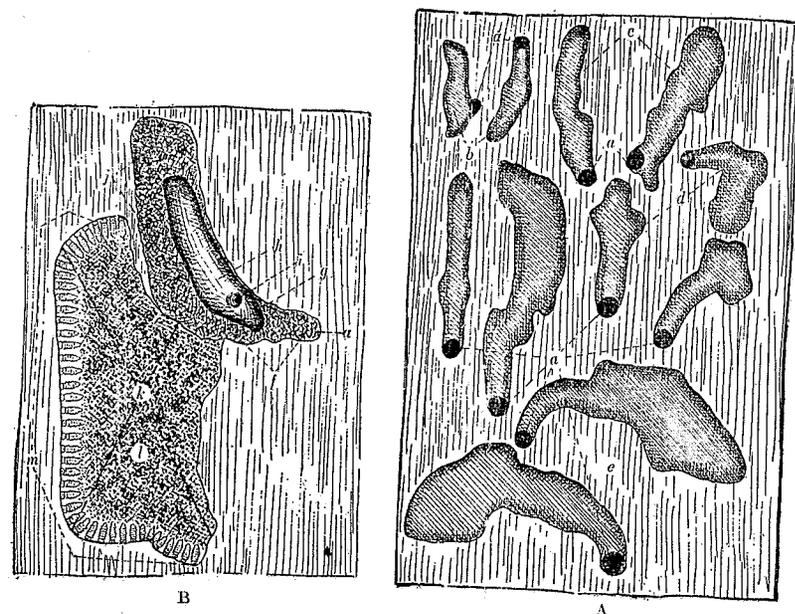


FIG. 88.—*Dendroctonus micans*. Egg galleries and larval chamber. A, Basal sections of egg galleries; B, advanced stage of work; a, entrance burrow; b, excavated July 8-16; c, excavated July 8-29; d, eight days old; e, three weeks old; f, basal section; g, boring-dust; h, subsequent or inner gallery ("mother gallery"); j, egg nest with eggs scattered about in boring-dust; k, social chamber excavated by larvæ; l, boring-dust and resin; m, larvæ at work. (Adapted from Pauly Forstlich-natur wissenschaftliche Zeitschrift, I Jahrgang, figs. 3 and 4.)

*Distribution* (fig. 89).—According to the literature, this species ranges from central to northern Europe and from Denmark and Russia eastward into Siberia.

*Host trees.*—It is said to infest *Pinus*, *Picea*, *Abies*, and *Larix*.

*Identified specimens.*—The writer has examined 1 specimen received from W. Eichhoff, 8 from B. W. Schlick, Denmark; 2 with specimens of work from Reitter's collection, collected in Bohemia, and about 70 specimens of adults, as well as larvæ and specimens of work from Dr. G. Severin, of the Musée Royale d'histoire Naturelle, Brussels, Belgium.

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*Bostrichus micans* Kugelann, 1794, p. 523, original description.  
 ?*Hylesinus ligniperda* Gyllenhal, 1813, pp. 335, 336 (in part).  
*Dendroctonus micans* (Kug.) Erichson, 1836, p. 53, type of genus. Bach, 1849, p. 144. Stein, 1854, pp. 277-279, habits, destructiveness. Kollar, 1858, pp. 23-28, habits, control. Eichhoff, 1864, p. 27, pl. 1, fig. 5, tarsi, fig. 6, maxilla, fig. 7, labium, in revision of genus. Lacordaire, 1866, p. 360, in revision of genus. Chapuis, 1869, p. 35; 1873, p. 243, revised description. Lindemann, 1875, pp. 213, 221, pl. 1, figs. 1-10, male reproductive organs described and illustrated. Eichhoff, 1881, pp. 125-128, fig. 23, adult, fig. 24, galleries, revision, bibliography, account of habits, distribution, etc. Altum, 1881, pp. 262-266, description, biology. Judeich and Nitsche, 1889, pp. 458-462, life history, habits, importance, remedy. Pauly, 1892, pp. 315-327, 4 figs. of galleries, habits. Verhoeff, 1896, pp. 124-133, anatomy. Ménégau & Cochon, 1897, pt. 2, p. 120, habits, etc. Severin, 1902, p. 145, habits in Belgium. Weber, 1902, p. 108, fig. 5, enemy. Brichet et Severin, 1903, pp. 244-258, habits, etc. Baudisch, 1903, pp. 151-152, habits, etc. Quairière, 1904, pp. 626-628. Nüsslin, 1905, pp. 175-178, habits, description, importance. Quiévy, 1905, pp. 334, 335. Severin, 1908, pp. 1-20, description, habits, depredations, control.
- Hylesinus micans* (Kug.) Ratzeburg, 1839, p. 217, Taf. VII, fig. 3, adult.  
*Hylesinus* (*Dendroctonus*) *micans* (Kug.) Ratzeburg, 1839, p. 217, Taf. VII, fig. 3, adult; Taf. VIII, figs. 1, 2, 3, galleries, young larvæ, pupæ.

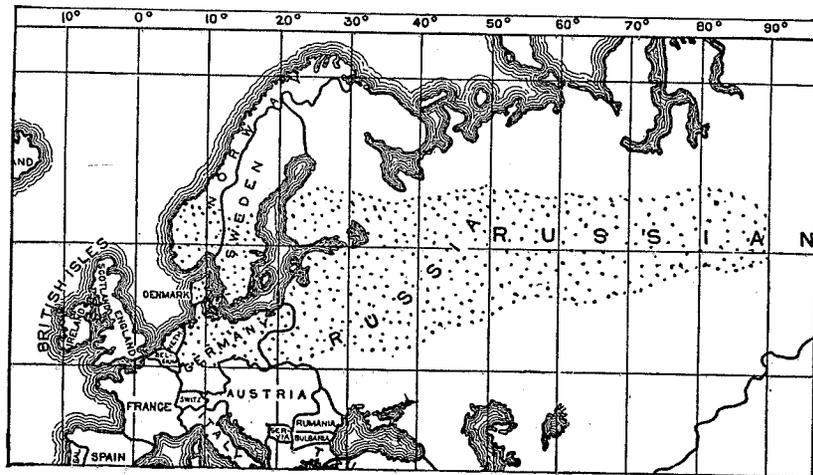


FIG. 89.—*Dendroctonus micans*: Distribution map. (Original.)

## SUBDIVISION D.

The distinguishing characters common to the species of the fourth subdivision are:

*Adult*.—Front without median or posterior impression. Pronotum somewhat elongate, slightly narrower than elytra, moderately constricted toward head, with regular punctures or without coarse and fine punctures intermixed, long hairs absent on median and posterior dorsal areas, present on anterior and lateral areas; head

broad, convex; epistomal process and elytral rugosities variable within the same species.

*Sexes*.—Females with front of head moderately broad; mandibles shining, moderately stout; antennal club broad and stout; elytral declivity slightly more rugose; striæ impressed with distinct punctures.

Males with front of head distinctly broader; mandibles opaque, stout; antennal club narrow, more elongate, and the elytral declivity slightly less rugose; striæ less distinctly impressed, and the punctures more obscure.

*Pupa*.—Vertex of head convex; front and middle femur each with a minute subapical spine; abdominal tergites with moderately distinct spines.

*Larva*.—Abdominal tergites 8 and 9 with distinct dorsal plates, each armed with three prominent teeth.

*Galleries*.—Egg galleries slightly winding to nearly straight; larval mines not separated, except very rarely near the outer extremity, but forming broad common larval chambers.

22. *Dendroctonus terebrans* (Olivier).

(Pl. VII, fig. 22.)

*Adult*.—Typical female: Length 5.6 mm., black. Front convex, without impressions; epistomal process moderately broad, lateral angles tuberculate. Pronotal punctures very coarse, regular, moderately dense, scarcely decreasing in size toward base; elytra without long hairs toward base.

Typical female labeled, name label, "Hopk. 1/22/08, *Pinus echinata*, Hopkins, collector, Tryon, N.C., ♀, Hopk. U. S. 530aa."

Typical male: Length 5.6 mm. Differs from female in stouter mandibles and slightly coarser rugosities of elytral declivity.

Typical male labeled same as female.

*Variations*.—The length varies from 5 to 8 mm., with the average about 7 mm. The color ranges from piceous to deep black, the latter prevailing. Immature specimens are reddish, but fully matured ones are always darker than the darkest *D. valens*. The greatest variation is in size, and while the usual variation prevails in some of the other characters, it is much less so than in *D. valens*. In New Jersey, Pennsylvania, Virginia, and West Virginia, where there is an overlapping of the range of *D. valens* and *D. terebrans*, specimens are sometimes found which appear to be hybrids, but it appears that the more dominant characters of *D. terebrans* prevail in such hybrids, so that the darker color and coarse punctures of the pronotum serve to distinguish them as being more closely allied to the latter species.

*Distinctive characters*.—The characters which serve to distinguish this species from *D. valens*, to which it is more closely allied, are its

prevailing black or dark color, the more uniform and coarser punctures of the pronotum, the narrower epistomal process, with the angles more tuberculate, and the less evident long hairs on the anterior dorsal area of the elytra.

*Revisional notes.*—While the type of this species has not been seen by the writer, it is clearly evident from Olivier's description and figures (Olivier, 1795) that the large black form common to the southern United States represents the species described. The only distinctive specific character mentioned, however, is the reference to the Black Scolytus and to the body being black, brown, or brownish-black. The confounding of *Dendroctonus valens* and *D. terebrans* under the latter name has resulted in much confusion in the literature. With our present knowledge, however, it is not difficult to clear up some of the confusion and to revise and correct the literature so that it may be known in many cases whether, or not one or both species was included in a given reference. Erichson, 1836, Lacordaire, 1866, and Chapuis, 1869, evidently did not compare *D. valens* and *D. terebrans*. While a specimen of this species has been in the Harris collection since 1839, Harris apparently made no reference to its characters. Zimmerman, 1868, page 149, did not mention *D. valens*, but evidently had the two species confused in his revised description. Le Conte, 1868, page 173, referred *D. valens* to *D. terebrans*, and in 1876, pages 384-385, confuses the characters and distribution of the two species. Dietz, 1890, page 29, included this species under his variety *a*, and (p. 30) evidently includes two specimens from Florida under his revision of *D. rufipennis*. In subsequent literature up to 1906 there is more or less confusion of this species with *D. valens*. The writer, 1906c, page 81, restored *D. valens* Lec. and called attention to the characters distinguishing *D. terebrans* (Oliv.). In 1900 the writer found one specimen in the Harris collection, under *Hylurgus terebrans*, under his No. 99, referred to in his note as "Dark specimen abundant under bark of pitch pine, October 27, 1839," but it appears that no reference was made to this dark specimen in any of his publications. The locality is not given, but it is presumably Cambridge. It appears that this species was not represented in the Horn collection under *D. terebrans* when Doctor Dietz prepared his revision, and that the only example involved in the revision under *D. terebrans* was the one in the Ulke collection from Pennsylvania, designated as "variety *a*." Two examples were found in the Horn collection under *D. rufipennis*, labeled "Fla.," and it was evidently on these that Doctor Dietz based his Florida locality in his revision of *D. rufipennis*. In 1907 this species was represented in the Le Conte collection by 9 specimens and 8 additional specimens in the general collection of the Museum of Comparative Zoology.

*Pupa.*—In addition to the generic, divisional, and subdivisional characters, the front and middle femora are armed each with a minute apical spine; abdominal tergites 1 to 6 have moderately small pleural spines, 1 is without dorsal spine, but with distinct lateral ones; 2 to 6 have small dorsal and lateral spines, the former increasing in size to 6. All have pale tips; 7 and 8 unarmed; 9 with usual stout pleural spine. Pupal type labeled "Hopk. W. Va. 7701."

The usual variation prevails in the number and arrangement of minor spines and between the young and older examples.

The character which in general serves to distinguish the pupa of this species from the preceding is found in the paler tips of the body spines.

*Larva.*—In addition to the generic, divisional, and subdivisional characters, front of head with posterior angle and median area not elevated but transversely rugose except near apex, where it is smooth; epistoma flat, opaque, smooth, with straight anterior margin; clypeus broad, prominent, convex, with faint median longitudinal line, sides rounded, apex broadly emarginate; labrum short, with sides nearly parallel and apex tuberculate. Prothoracic tergum with two broad, shining dorsal plates separated by a rather broad median space, and a smaller lateral plate each side; sternellar lobes each with a faint foot callus; mesoterga and metaterga with shining plates on the lateral lobes. Abdominal scutellar lobes with a rather prominent tubercle on each epipleurum. Larval type labeled "Hopk. U. S. 1201."

The larva of this species is scarcely to be distinguished from that of *D. valens*.

*Galleries.*—The egg galleries are generally longitudinal, more or less winding, and vary greatly in length, sometimes being very long. They are irregular in width, sometimes with branches, and are slightly grooved in the surface of the wood. The eggs are placed in masses at intervals along the sides and in the inner bark; the larvæ excavate broad chambers which vary in size from a square inch to many square feet. The galleries of this species do not differ materially from the following, and have a wide range of variation in size and general character.

*Distribution* (fig. 90).—(Hopk. U. S.) *Alabama*: Calhoun. *Delaware*. *District of Columbia*: Takoma. *Georgia*: Cornelia, Thomasville. *New Jersey*: Lakewood, New Brunswick. *New York*: Islip (Long Island). *South Carolina*: Chicora, Lumber, New Landing, Pregnall. *Texas*: Austin, Call, Deweyville, Kirbyville, Tarkington. *Virginia*: Glen. *West Virginia*: Kanawha Station. (Hopk. W. Va.) *West Virginia*: Crow, Marion County, Morgantown, Romney. *Additional localities from other collections*: (Le Conte) Georgia, North Carolina, New Hampshire, Pennsylvania. (M. C. Z.) Texas, South

Carolina, Maryland. (A. E. S.) New Jersey, Delaware. (A. N. S.) Marion County, Fla. (U.S.N.M.) Lakewood, N. J. (D. A.) Islip, Long Island, N. Y. (Laurent) Pennsylvania.

*Host trees*.—*Pinus palustris*, *P. rigida*, *P. taeda*, *P. serotina*, *P. strobus*, *P. echinata*, *Picea rubens*.

*Identified specimens*.—Le Conte, 9 specimens; M. C. Z., 8; Horn, 7; U.S.N.M., 2; H. & S., 4; D. A., 7; Hopk. U. S., about 400 specimens, including adults, larvæ, and work.

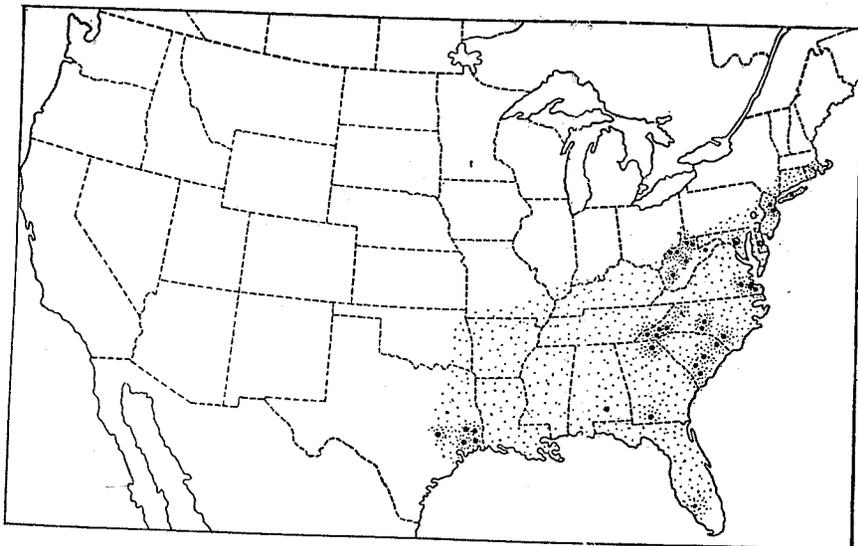


FIG. 90.—*Dendroctonus terebrans*: Distribution map. (Original.)

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- ?*Dendroctonus* sp. Blandford, 1897, p. 147, reference to black form from Texas.

#### 23. *Dendroctonus valens* Le Conte.

(Pl. VII, fig. 23.)

*Adult*.—Typical female: Length, 8.7 mm. Head with front broad, convex, and with broad anterior impression. Epistomal process broad, with lateral sections oblique. Pronotum with punctures moderately coarse, much smaller and denser toward base. Elytra with a few long hairs toward base; declivity convex; striæ impressed, with small distinct punctures; interspaces moderately convex, distinctly rugose.

Typical specimen labeled, name label, "Hopk. 1/22/08, *Pinus ponderosa*, Hopkins, collector, McCloud, Cal., ♀, Hopk. U. S. 18a."

Typical male: Length 7.6 mm. Differs from female in stouter mandibles, narrower antennal club, more opaque declivity, less distinctly impressed striæ, and more obscure punctures.

Typical male labeled same as female.

*Variations*.—The length ranges from 5.7 to 9 mm., with the average about 8 mm. The color of the elytra, pronotum, and vertex of head ranges from light to dark red, but is never black, while the ventral part of the body varies from light red to black. The greatest variation is in size, but there is a wide and remarkable range in the epistoma and front and in the sculpture of the pronotum and elytra, as in almost every other character. Thus a large number of individuals may be easily selected, each of which might be considered as representing a good species, but when a large series of specimens is examined from any given faunal region or locality no sufficiently distinctive and constant characters have been found by which they can be readily recognized as distinct from those of any other faunal region, so that those examples from Maine can not be distinguished from examples collected in the mountains of Mexico.

*Distinctive characters*.—The characters which serve to distinguish this species from *D. terebrans*, to which it is closely allied, are its prevailing red color, the less uniform and more densely placed pronotal punctures, the much broader epistomal process, with the lateral sections less angular and more oblique, and the more evident and numerous hairs on the anterior dorsal area of the elytra.

*Revisional notes*.—See same heading under *D. terebrans*.

The typical specimen on which Le Conte's original description (Le Conte, 1860) was based is from California and represents the common red form which has heretofore been confused with *D. terebrans*. The distinguishing character, "finer and denser punctures of the thorax," mentioned by Le Conte is undoubtedly a good specific character when taken with color and other characters. The species is represented in the Le Conte collection by the type and 9 speci-

mens, and in the collection of the Museum of Comparative Zoology by over 50 specimens.

*Pupa*.—In addition to the generic, divisional, and subdivisive characters, the front and middle femora are armed each with a minute apical spine; abdominal tergites 1 to 6 with moderately small pleural spines; 1 is without dorsal spines, but with distinct lateral ones; 2 to 6 have small dorsal and lateral spines, the former increasing in size to 6, and all have dark tips; 7 and 8 are unarmed; 9 has the usual stout pleural spine. Pupal type labeled "Hopk. U. S. 2824."

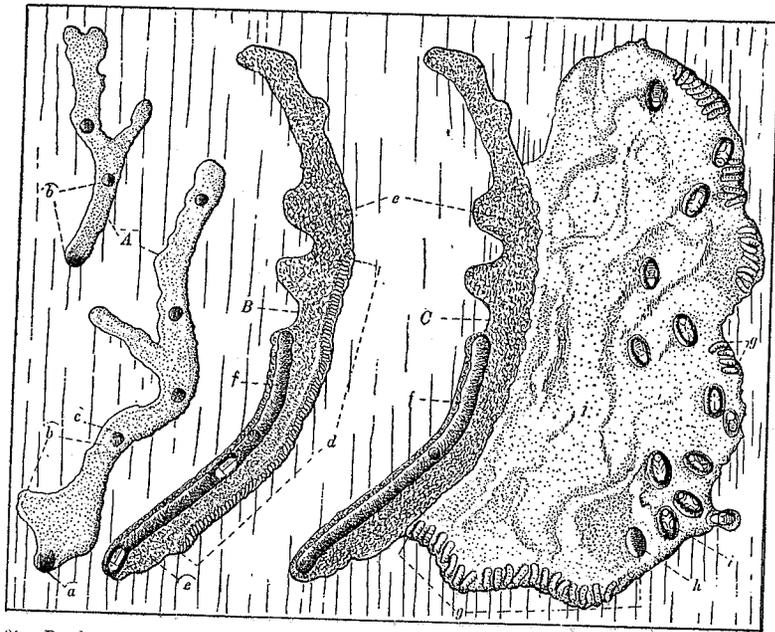


FIG. 91.—*Dendroctonus valens*: Egg galleries and larval chamber. A, Incomplete egg galleries with boring dust removed; B, normal gallery; C, advanced stage of work; a, entrance burrow; b, basal section; c, ventilating burrow; d, egg nest with eggs; e, boring dust; f, subsequent or inner galleries; g, larvæ at work; h, pupal cell in boring dust mixed with resin. (Original.)

The usual variation prevails in the number and arrangement of minor spines and between the young and older examples.

The character which in general serves to distinguish the pupa of this species from the preceding is found in the darker tips to the body spines.

*Larva* (text fig. 39 and Pl. VIII, fig. 23).—In addition to the generic, divisional, and subdivisive characters, front of head with posterior angle, median area not elevated but transversely rugose, except near apex, where it is smooth; epistoma flat, opaque, smooth, with straight anterior margin; clypeus broad, prominent, convex, with faint median longitudinal line, sides rounded, apex broadly emarginate;

labrum short, sides nearly parallel, and apex tuberculate. Prothoracic tergum with two broad, shining dorsal plates separated by a rather broad median space, and a smaller lateral plate each side; sternellar lobes each with a faint foot callus; the mesoterga and metaterga with shining plates on the lateral lobes. Abdomen with a rather prominent tubercle on each epipleurum. Larval type labeled "Hopk. U. S. 2824."

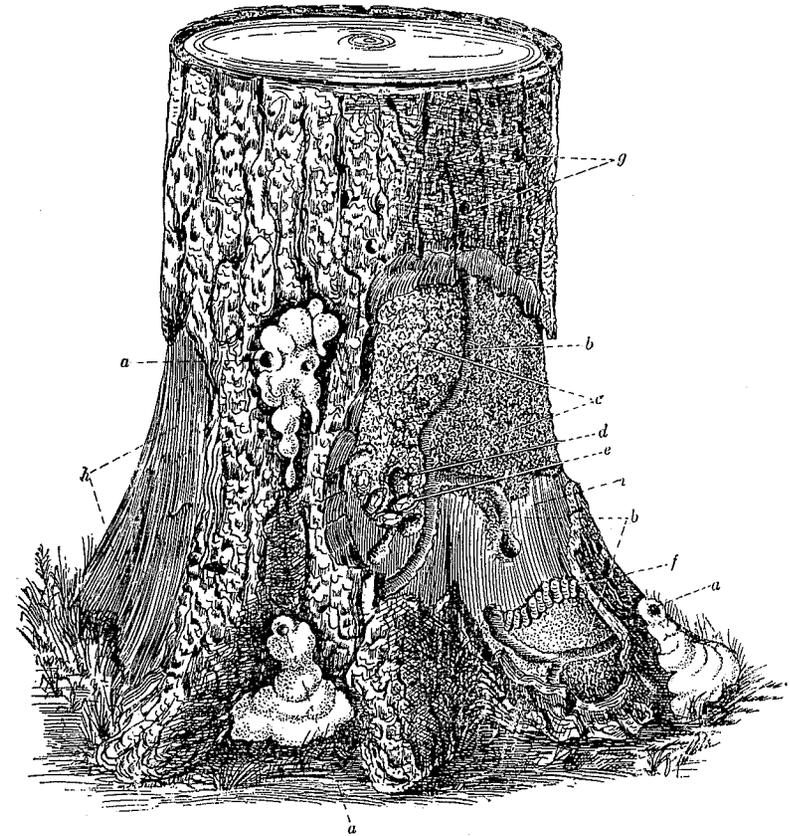


FIG. 92.—*Dendroctonus valens*: Work in bark at base of stump. a, Entrance and pitch tube; b, egg gallery; c, boring dust and resin; d, pupal cell; e, pupa; f, larvæ at work feeding on inner living bark; g, exit burrows; h, resulting old scar or basal wound, often referred to as basal fire wound; i, inner bark with outer corky bark removed. (Original.)

The larva of this species is scarcely to be distinguished from the preceding.

*Galleries* (figs. 91–93).—The egg galleries are generally longitudinal, more or less winding, and vary greatly in length, sometimes being very long; they are irregular in width and sometimes with branches, and are slightly grooved into the surface of the wood. The eggs are placed in masses at intervals along the sides in the inner bark, and the larvæ excavate broad chambers, which vary in size from a

square inch to many square feet. The galleries of this species do not differ materially from the preceding, and have a wide range of variation in size and general character.

*Distribution* (fig. 94).—(Hopk. U. S.) *Arizona*: Chiricahua Mountains, Flagstaff, Fredonia, Grand Canyon, Paradise, Ramsey Canyon, Rincon Mountains, Santa Catalina National Forest, Williams. *California*: Alder Creek, Berkeley, Chester, Del Monte, La Moine, Little Yosemite, Madera County, Merced, McCloud, Nevada City, Pacific Grove, Palo Alto, Pinogrande, San Bernardino, Sterling, Summerdale, Wawona, Yosemite. *Canada*. *Colorado*: Fort Garland, Manitou Park, Palmer Lake, San Isabel National Forest. *Guatemala*: Cabon.

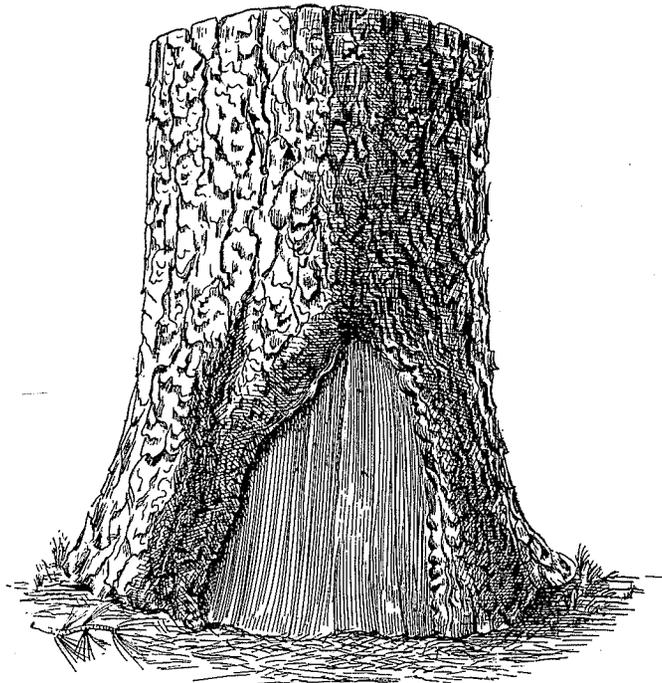


FIG. 93.—*Dendroctonus valens*: Basal wound in living tree resulting from primary injury by this species. Often mistaken for fire wound. (Original.)

*Idaho*: Cedar Mountain, Centerville, Grimes Pass, Harris Ridge (Kooskai), Pioneerville, Priest River, Smiths Ferry. *Kansas*. *Maine*: Brunswick, Casco Bay, Limerick, Peak Island, Portland. *Massachusetts*: Lynn, Wyoming. *Mexico*: Chalco, Chihuahua, Mexico City, Michoacan, Ponada, Satazin. *Michigan*: Grand Island. *Montana*: Missoula. *Nevada*. *New Hampshire*: Durham, Webster. *New Mexico*: Capitan, Capitan Mountains, Clouderoft, Lincoln National Forest, Vermejo, White Mountains. *New York*: Ithaca. *North Carolina*: Biltmore, Pink Beds. *Oregon*: Albany, Hood River, Joseph, Slate Creek. *Pennsylvania*: Milford, Philadelphia. *South*

*Dakota*: Black Hills, Elmore, Lead, Spearfish. *Utah*: Escalante, Kamas, Kanab, Panguitch Lake. *Vermont*: Fairlee. *Virginia*. *Washington*: Buckeye, Easton, Pullman, Skykomish. *West Virginia*: Crow, Hampshire County, Hardy County, Kanawha Station,

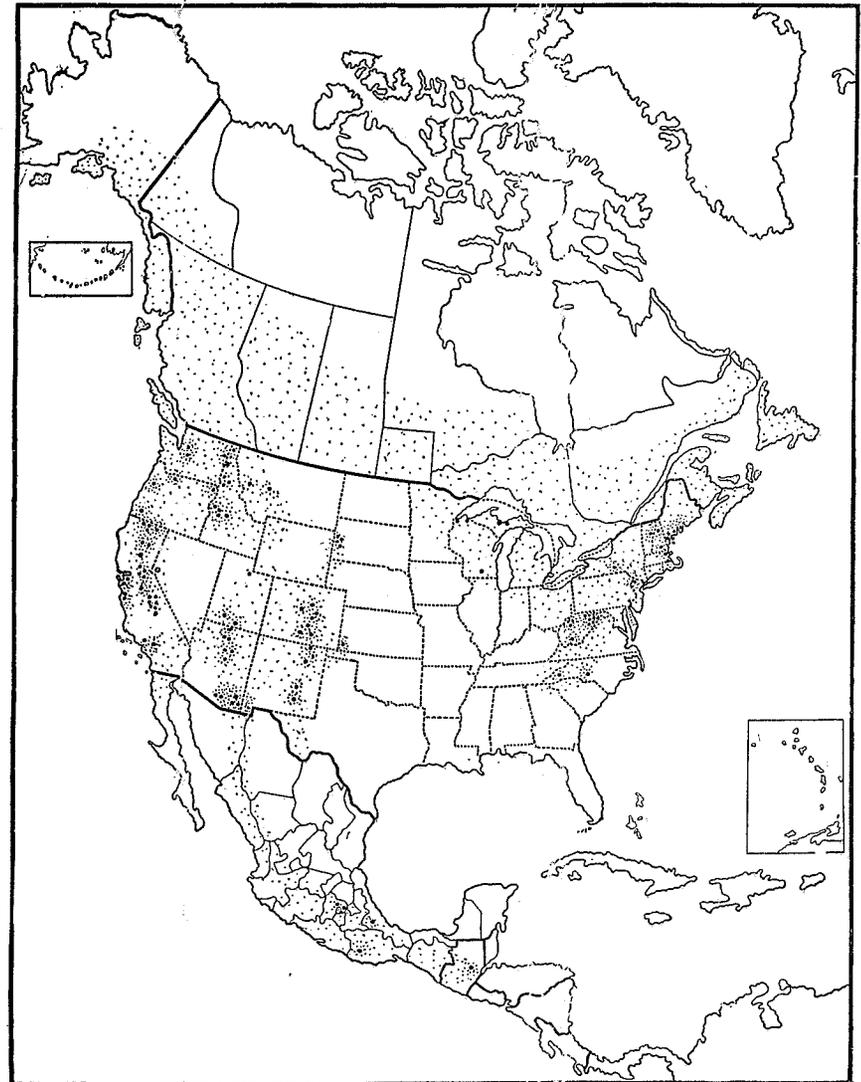


FIG. 94.—*Dendroctonus valens*: Distribution map. (Original.)

Monongalia County, Morgantown, Pendleton, Raleigh County, Romney, Roosevelt, Tucker. *Wisconsin*: Ashland, Madison. (Hopk. W. Va.) *West Virginia*: Bretz, Cranesville, Deckers Creek, Dellslow, Mayfield Hill, Moorefield, Morgantown, Pendleton, Randolph,

Romney. *Additional localities from other collections:* (M. C. Z.) New Mexico; California; Pennsylvania; Idaho; Maine; Massachusetts; Cambridge, Mass. (Le Conte) Middle States; Connecticut; Garland, Colo.; California. (Horn) North Carolina, Oregon, Wisconsin, Maine, California, New Mexico, and Pennsylvania. (A. E. S.) Kansas, Idaho, Nevada, Colorado, Canada, Virginia, Illinois, New Jersey. (W. & F.) Durham, N. H. (U.S.N.M., H. & S.) Marquette, Mich.; Cambridge, Mass.; Helena, Mont.; Garland, Colo.; Coeur d'Alene, Idaho; Hood River, Oregon; Chiricahua Mountains, Arizona; Sisson, Cal.; Coldridge, N. Mex. (U.S.N.M., B. & S.) Las Vegas, N. Mex.; Bright Angel, Prescott, Flagstaff, and Williams, Ariz. (Gillette) Colorado; Bailey, Colo. (U.S.N.M.) Easton, Wash.; Placer, Colo.; Shasta County, Cal.; Powder River, Colorado; Lake Superior; Skokomish River, Washington; New Mexico; Siskiyou County, Cal. Ozumba Mountain, Mexico. (Weed & Fiske) Durham, N. H. (Webb) Pullman, Wash. (Dietz) Pennsylvania, California, Arizona, Washington [State]. (D. A.) Dunsuir, Cal.; Custer County, Cal. (Chittenden) Duluth, Minn.; Ithaca, N. Y.; Grangeville, Idaho; California. (Baldwin) Ventura County, Cal. (Soltau) Colorado.

*Host trees.*—*Pinus ponderosa*, *P. strobus*, *F. radiata*, *P. rigida*, *P. lambertiana*, *P. murrayana*, *P. strobiformis*, *P. chihuahuana*, *P. edulis*, *P. jeffreyi*, *P. sylvestris*, *P. virginiana*, *P. arizonica*, *P. sp.*; *Picea canadensis*, *P. excelsa*, *P. rubens*; *Abies concolor*; *Larix laricina*.

*Identified specimens.*—Le Conte, 10 specimens; M. C. Z., 55; Horn, 14; A. E. S., 8; U.S.N.M., 12; H. & S., 20; Dietz, 5; D. A., 3 specimens. This species is also represented in the forest insect collection of this Bureau by about 5,000 specimens, including all stages and work.

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24. *Dendroctonus adjunctus* Blandford.

## ORIGINAL DESCRIPTION.

"Long. 4.6-5.3 millim.

"Oblong, less elongate than *D. parallelcolliis*, slightly depressed, piceous-black, with apex of elytra lighter. Median segment of epistoma shorter than the lateral segments, its sides very oblique and elevated, its apical border concave; front covered with close granules and punctures, with an interrupted median impressed line deepest at its junction with a slight transverse subocular impression; vertex finely punctured; antennæ piceous, the scape with rounded club, second joint of funiculus scarcely longer than first, club transverse oval, its sutures curved toward apex. Prothorax more transverse than in *D. parallelcolliis*, constricted in front, the apical emargination and basal bisinuation distinct; surface impressed behind apex and somewhat flattened, shining, the punctures sparse and not strong, the median line obsolete. Elytra feebly striato-punctate, shining, except

at the closely granulate base, with somewhat scattered granules, obsolete on the declivity, interstices with rows of distinct long dark hairs from middle to apex, the first with a single series of stronger granules. Legs piceous.



FIG. 95.—*Dendroctonus adjunctus*: Distribution map. (Original.)

“*Hab.* [See fig. 95.] Guatemala, Tonicapam (*Champion*).

“A distinct species, resembling a *Myelophatus* rather than a *Dendroctonus*. But two specimens were taken.”

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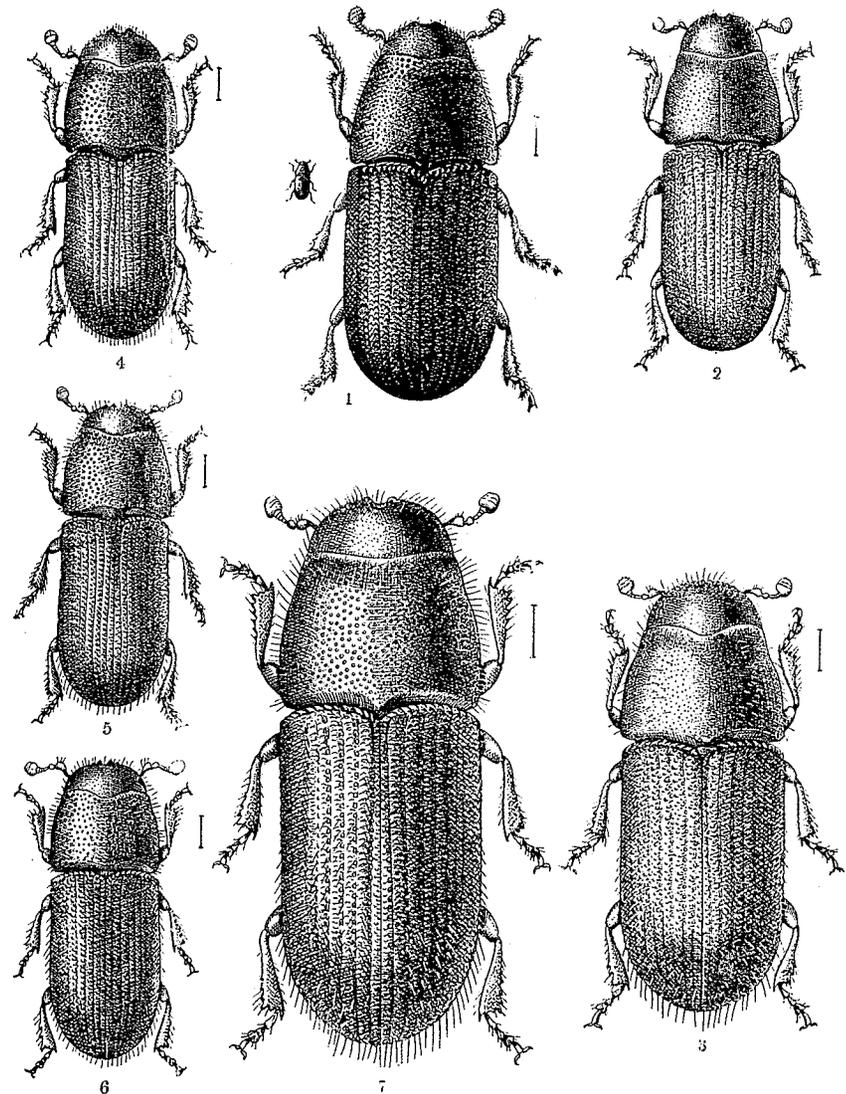
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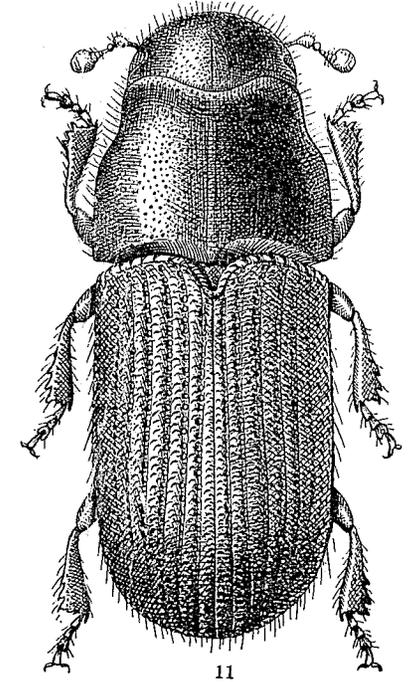
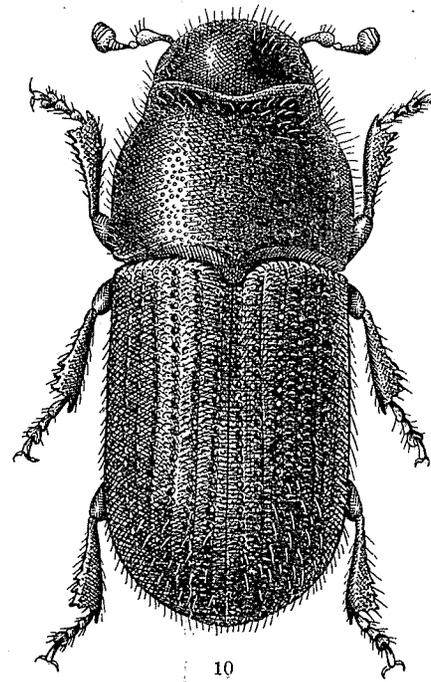
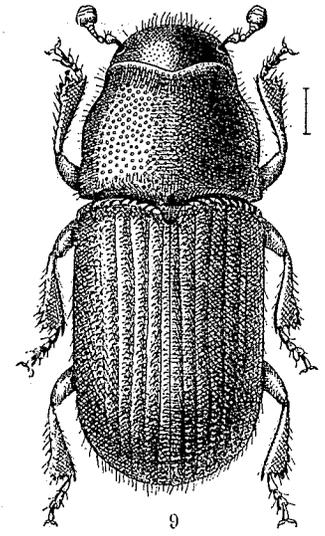
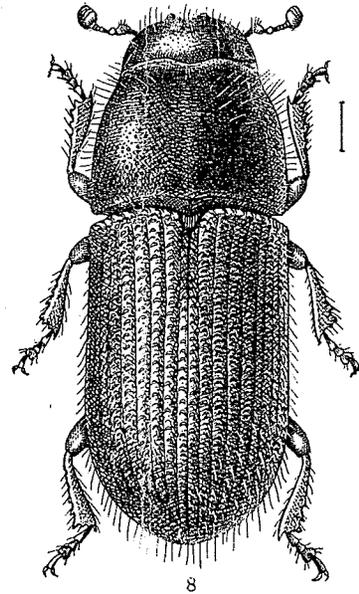
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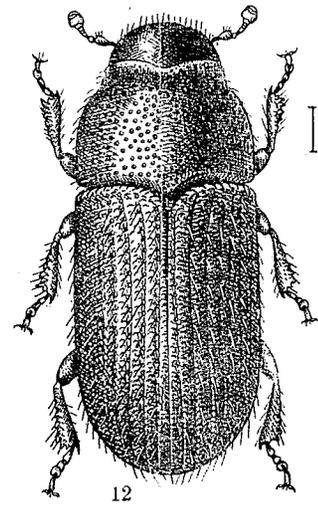
DENDROCTONUS ADULTS.

Fig. 1.—*D. brevicornis*. Fig. 2.—*D. barberi*. Fig. 3.—*D. convexifrons*. Fig. 4.—*D. frontalis*. Fig. 5.—*D. arizonicus*. Fig. 6.—*D. mexicanus*. Fig. 7.—*D. parvicollis*. (Original.)

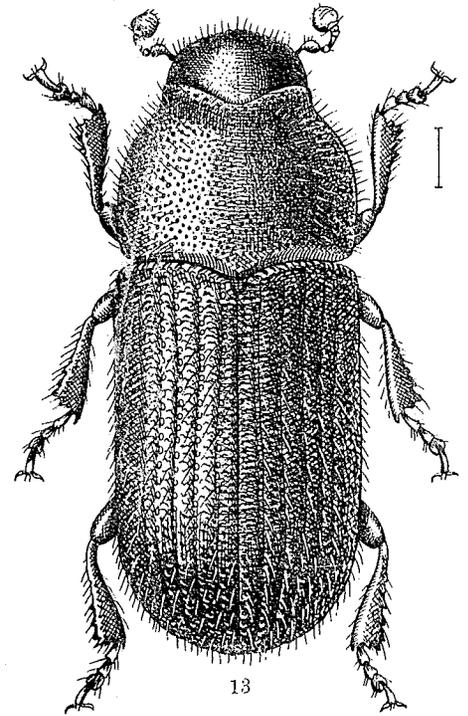


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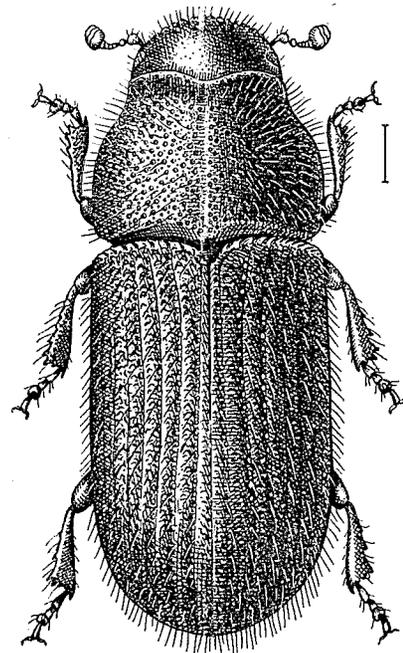
Fig. 8.—*D. approximatus*. Fig. 9.—*D. monticola*. Fig. 10.—*D. ponderosae*. Fig. 11.—*D. jeffreyi*. (Original.)



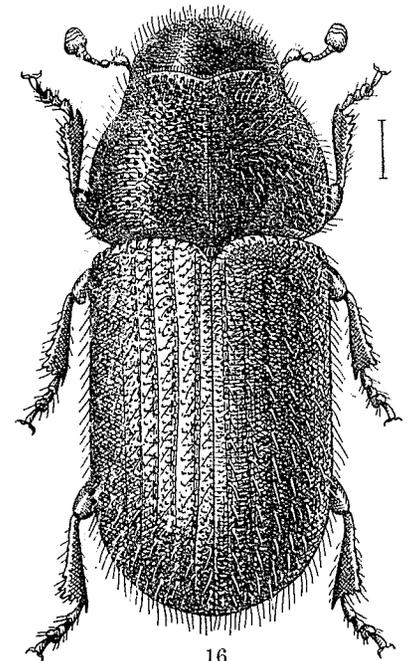
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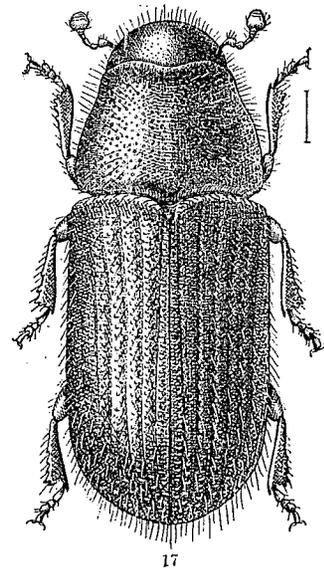
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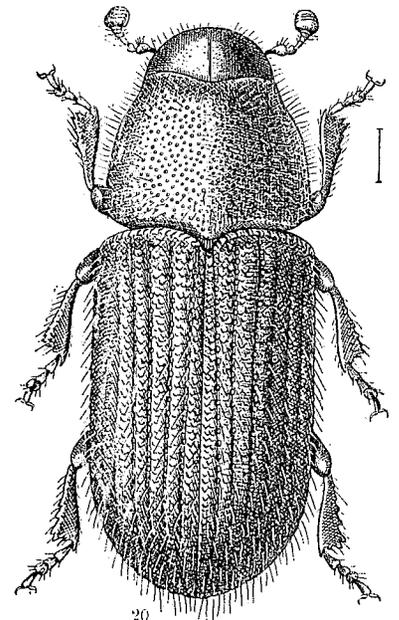
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DENDROCTONUS ADULTS.

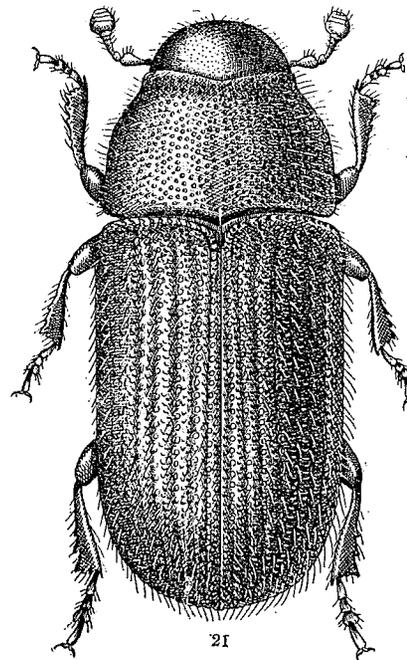
Fig. 12.—*D. simplex*. Fig. 13.—*D. pseudotsugae*. Fig. 14.—*D. piceae*. Fig. 16.—*D. borealis*



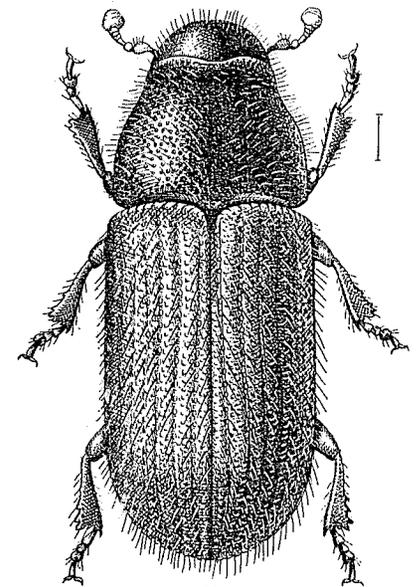
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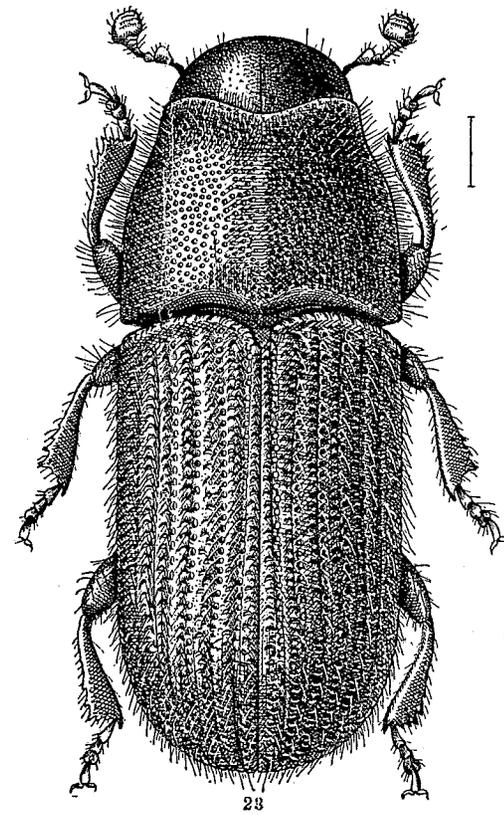
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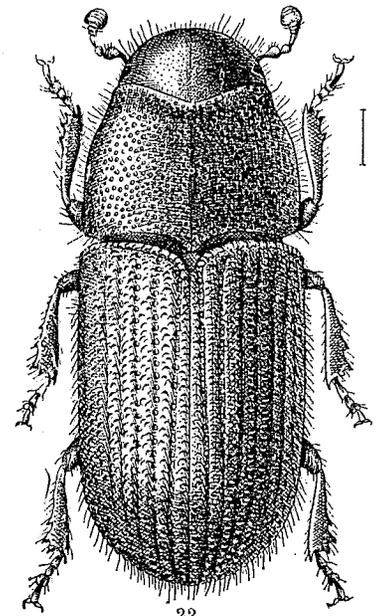
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DENDROCTONUS ADULTS.

Fig. 17.—*D. obsesus*. Fig. 18.—*D. rufipennis*. Fig. 20.—*D. panczatus*. Fig. 21.—*D. micans*. (Original.)



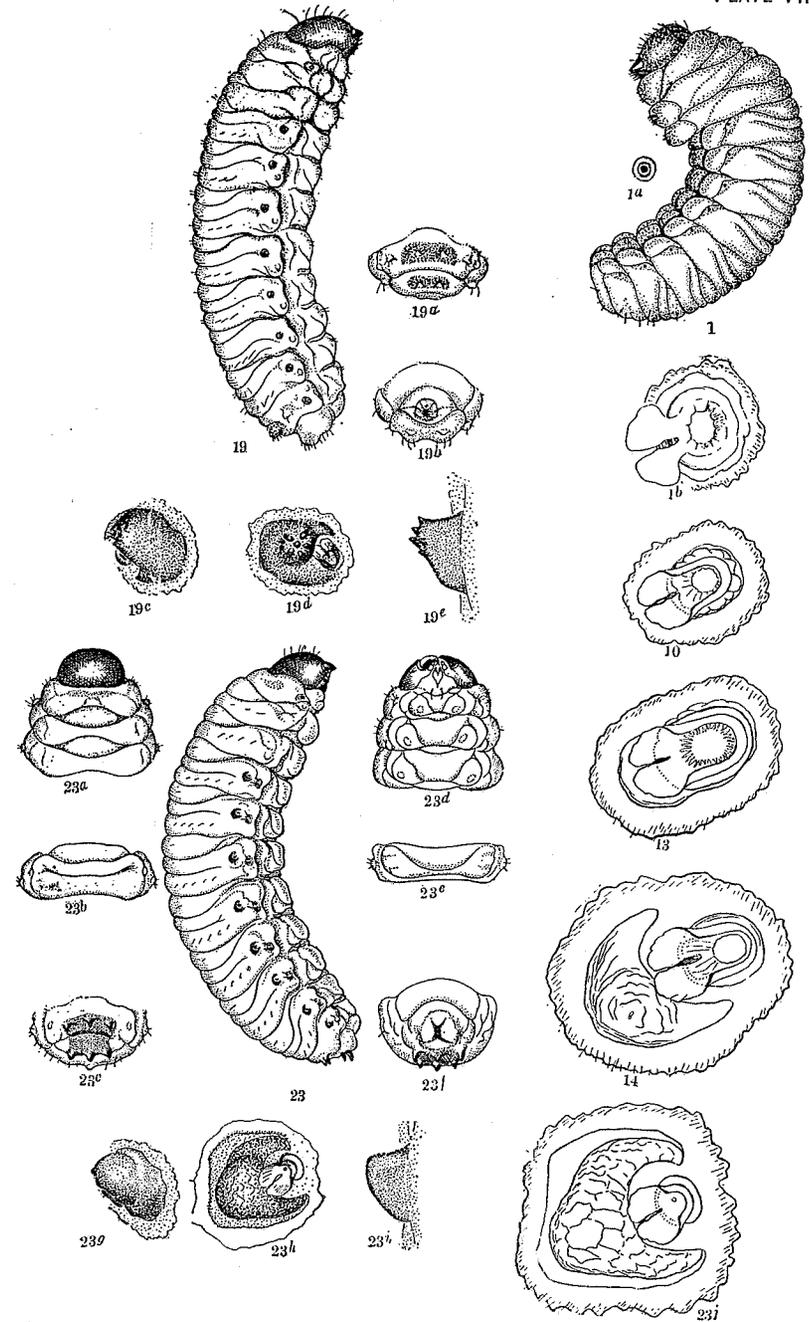
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DENDROCTONUS ADULTS.

Fig. 22.—*D. terebrans*. Fig. 23.—*D. valens*. (Original.)



DENDROCTONUS LARVÆ.

Fig. 1.—*D. brevicornis*; 1a, spiracle, enlarged; 1b, spiracle, greatly enlarged, showing simple bifid processes. Fig. 10.—*D. ponderosa*, spiracle, greatly enlarged. Fig. 13.—*D. pseudotsugae*, spiracle, greatly enlarged. Fig. 14.—*D. piceaperda*, spiracle, greatly enlarged. Fig. 19.—*D. murrayana*; 19a, dorsal aspect of abdominal segments 8 and 9, showing armed plates; 19b, anal aspect of abdominal segments 8 and 9, showing armed plates; 19c, 19d, and 19e, different aspects of segments 8 and 9, showing armed plates; 19f, ventral aspect of thoracic segments; 19g, ventral aspect of abdominal segment; 19h, anal aspect of abdominal segments 8, 9, and 10; 19i, 19j, 19k, different aspects of spiracular tubercles, moderately enlarged; 19l, spiracle, enlarged.