

AN ILLUSTRATED GUIDE TO THE IDENTIFICATION AND DISTRIBUTION OF THE SPECIES OF *DENDROCTONUS* ERICHSON (COLEOPTERA: SCOLYTIDAE) IN BRITISH COLUMBIA

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Abstract

An illustrated key is presented separating adults of the eight species of *Dendroctonus* Erichson occurring in British Columbia. Punctuation on the episternal area of the prothorax and crenulations on the discal area of the elytra are used to provide reliable diagnoses of five species (*D. murrayanae*, *D. rufipennis*, *D. punctatus*, *D. simplex*, *D. pseudotsugae*) which could previously be distinguished only with considerable difficulty. Scanning electron micrographs illustrate these characters and simplify interpretation of the key. Distribution maps are provided which show many previously unpublished range extensions.

Résumé

Cet ouvrage présente une clé illustrée permettant de distinguer les adultes de huit espèces de *Dendroctonus* Erichson se trouvant en Colombie-Britannique. L'auteur se fonde sur les ponctuations de la partie épisternale du prothorax et sur les crénelations de la région discale de l'élytre pour identifier de façon fiable cinq espèces (*D. murrayanae*, *D. rufipennis*, *D. punctatus*, *D. simplex*, *D. pseudotsugae*) qui étaient auparavant très difficiles à distinguer. Des photographies de microscope électronique à balayage illustrent ces caractéristiques et facilitent l'interprétation. Des cartes des aires de répartition ont été ajoutées et montrent des aires d'extension autrefois inconnues.

Introduction

Eight species of *Dendroctonus* Erichson occur in British Columbia: *D. brevicornis* LeConte, *D. ponderosae* Hopkins, *D. valens* LeConte, *D. punctatus* LeConte, *D. murrayanae* Hopkins, *D. rufipennis* (Kirby), *D. simplex* LeConte and *D. pseudotsugae* Hopkins. Identification of the last five of these species is somewhat daunting using available keys. Wood (1963, 1982) and Bright (1976) distinguish them on the basis of differences in the size, density and distinctness of the punctures and granules on the frons.

The use of these characters on the frons has resulted in considerable difficulty and confusion in providing reliable identifications because of the relatively minor differences between species and the considerable variation within species. In this paper, differences in punctuation in the episternal area of the prothorax and in the crenulation on the discal area of the elytra are presented as alternative characters which reliably separate these species. To eliminate possible confusion and simplify use of the key, each critical character is illustrated with a scanning electron micrograph. Characters used in this guide are easily observed at 100X or less magnification.

Distribution maps of locality records within British Columbia, as determined from Forest Insect and Disease Survey records, are included for each species. Numerous range extensions are noted.

Methods and Materials

Several adult beetles of each species were prepared for scanning electron microscope study as follows: 1) dry specimens were mounted on stubs and oriented so that the features to be studied could be readily viewed; 2) each specimen was sputter coated with gold-palladium for 6 min using a Hummer V sputter coater; 3) specimens were viewed using a Jeol 35C SEM set at 15 KV and at magnifications ranging from 50X to 200X. Following a detailed examination of external morphological features, micrographs were taken to illustrate potential diagnostic characters. The search for useful characters included all areas of the external morphology but was concentrated primarily on the frons, pronotum and elytra. Constancy of

each character was confirmed by stereo microscopic viewing of an additional 40 specimens of each species under diffuse light at 100-200X magnification.

Beetles examined in this study were selected to include specimens collected throughout the known geographic distribution of each species and on all of the host tree species attacked in British Columbia. Specimens examined are deposited in the Forest Insect and Disease Survey collection, Pacific Forestry Centre, Canadian Forestry Service, Victoria, British Columbia.

Results and Discussion

The keys and descriptions provided by Wood (1963, 1982) and Bright (1976) provide distinctive, readily observable characters to reliably separate *D. brevicomis*, *D. ponderosae*, and *D. valens*. The remaining five species occurring in British Columbia are difficult to identify using their keys. The following key and diagnostic notes present alternative morphological features by which these five species can be reliably separated.

Glossary

Crenulate:	rounded surface projections rising to a ridge.
Declivity:	the steeply sloping posterior face of the elytra.
Discal area:	central area, on elytra refers to anterodorsal area of elytra.
Elytra:	chitinous forewings of beetles serve as coverings for hind wings.
Episternal area:	posteroventral area of prothorax.
Epistomal process:	flattened prominence at the base of the frons.
Frons:	front part of head extending from epistoma to the upper level of the eyes.
Granulate:	a surface bearing granules.
Granule:	acute or blunt prominence on a surface.
Interspace:	the area between two elytral striae.
Puncture:	small impression on the surface of a body.
Rugulose:	wrinkled, marked with coarse elevations.
Stria:	punctured, impressed line on the elytra.
Tubercle:	knoblike prominence or a coarse granule.
Vertex:	top of insect head, between the eyes.

Key to the Species of *Dendroctonus* in British Columbia

1. Frons with deep median groove extending from near epistomal process to vertex; lateral areas of frons somewhat protuberant and, in the male, armed with tubercles (fig. 1); length 2.5-5.0 mm; in *Pinus ponderosa* *brevicomis* LeConte
 Frons without deep median groove or protuberant lateral areas; frons of male not armed with tubercles (fig. 2) 2
2. Interspaces on elytral declivity minutely rugulose (fig. 3) 3.7-6.5 mm; in *Pinus* (occasionally in *Picea* in epidemics) *ponderosae* Hopkins
 Interspaces on elytral declivity not minutely rugulose (figs. 4,7,8) 3
3. Upper margin of all declivital interspace punctures granulate (fig. 4); episternal area of prothorax coarsely granulate (fig. 9); body uniformly reddish brown; 5.4 - 9.0 mm; in *Pinus*, *Picea* *valens* LeConte
 Upper margin of many to most declivital interspace punctures not granulate (figs. 5,6,7,8), episternal area of prothorax not granulate to minutely so (figs. 10, 11, 12); body not uniformly reddish brown 4
4. Declivital striae weakly to moderately impressed, if at all; declivital interspace 1 weakly to moderately elevated, interspace 2 not impressed and nearly as wide or wider than

- interspace 1 or 3 (fig. 5); lateral margins of epistomal process moderately oblique (less than 55 degrees from horizontal) (fig. 13) 5
- Declivital striae strongly impressed; declivital interspace 1 strongly elevated, interspace 2 weakly impressed and much narrower than interspace 1 or 3 (fig. 6); lateral margins of epistomal process strongly oblique (about 80° from horizontal) (fig. 14) 7
5. Punctures in episternal area of prothorax, distinctly marginate (figs. 10, 11) 6
- Punctures in episternal area of prothorax, lack a distinct margin anterodorsally (fig. 12). 4.4-7.1 mm; in *Picea* *rufipennis* (Kirby)
6. Strial punctures on declivity small (average <.15X interspace width) (fig. 7) body black with reddish brown elytra; 5.0-7.3 mm; in *Pinus contorta* *murrayanae* Hopkins
- Strial punctures on declivity large (average ≥.25X interspace width) (fig. 8); body uniformly dark brown; 6.0-7.5 mm; in *Picea* *punctatus* LeConte
7. A few transverse crenulations on sutural interspace of disc (average 5 crenulations/10 strial punctures) (fig. 15); diameter of strial punctures on disc average ≥.6X sutural interspace width; frons moderately protuberant; 3.4-5.0 mm; in *Larix laricina* *simplex* LeConte
- Many transverse crenulations on sutural interspace of disc (average 10 crenulations/10 strial punctures) (fig. 16); diameter of strial punctures on disc average <.45 X sutural interspace width; frons strongly protuberant; 4.7-7.0 mm; in *Pseudotsuga menziesii* occasionally *Larix occidentalis* *pseudotsugae* Hopkins

Diagnostic Notes

Dendroctonus punctatus (figs. 8,11): This species is closely related to *D. murrayanae* and *D. rufipennis* from which it is reliably distinguished by the very large strial punctures on the declivity. The diameter of the strial punctures in *punctatus* are on average ≥.25X the interspace width. By comparison, these punctures are on average <.20X the interspace width in *rufipennis* and <.15X in *murrayanae*. As well, *punctatus* can be distinguished from *rufipennis* by the size and margination of punctures in the episternal area of the prothorax. The episternal punctures in *punctatus* are large and clearly marginate whereas those of *rufipennis* are small and lack a distinct margin anterodorsally. Other less definitive diagnostic features include body color and granulation on the frons. Mature *punctatus* have a dark brown pronotum and elytra. By contrast, mature *rufipennis* are either uniformly black or have a black pronotum and reddish brown elytra (immature *rufipennis* are somewhat lighter and may resemble *punctatus*); mature *murrayanae* have a black pronotum and reddish brown elytra. The frons of *punctatus* is smooth and polished with relatively little granular development; the frons of *rufipennis* is typically strongly granulate, however, the frons of *murrayanae* often has reduced granulation and may closely resemble *punctatus*.

Dendroctonus murrayanae (figs 5,7,10,13): This species is distinguished from *punctatus* by the very small strial punctures on the declivity (average diameter <.15X the interspace width versus ≥.25X interspace width in *punctatus*) and by the black pronotum and reddish brown elytra compared to an almost uniformly dark brown body in *punctatus*. From *rufipennis* it differs by the size, shape and margination of punctures in the episternal area of the prothorax. The episternal punctures of *murrayanae* are large, shallow, flat bottomed and distinctly marginate around their entire perimeter whereas those of *rufipennis* are small, deep and the bottom slopes up anterodorsally from the base of the seta to form an indistinct to barely distinct anterodorsal margin.

Dendroctonus rufipennis (fig. 12): This species is distinguished from both *murrayanae* and *punctatus* by the much smaller indistinctly margined punctures in the episternal area of the prothorax. It also differs from *punctatus* by body color (uniformly black or black pronotum with reddish brown elytra of *rufipennis* versus uniformly dark brown body of *punctatus*) and by smaller stria punctures on the declivity (average diameter $<.20X$ interspace width versus $\geq.25X$ interspace width).

Dendroctonus simplex (figs. 6,15): This species is similar to *D. pseudotsugae* from which it is readily distinguished by a much reduced degree of crenulation on the discal area of the elytra (average 5 crenulations/10 stria punctures) and by the relatively large stria punctures on the disc (average diameter $\geq.6 X$ sutural interspace width). It also differs by having much larger pronotal punctures. Other less reliable characters include a less protuberant frons and smaller body (3.4-5.5 mm).

Dendroctonus pseudotsugae (fig. 16): This species is closely allied to *D. simplex* from which it is distinguished by a much greater degree of crenulation on the discal area of the elytra (average 10 crenulations/10 stria punctures in discal area) and by the relatively small stria punctures on the disc (average diameter $<.45 X$ sutural interspace width). The pronotal punctures of *pseudotsugae* are much smaller. Other less distinctive characters include a more protuberant frons and larger body size (4.4-7.0 mm).

Distribution

Locality records [plotted in Figs. 17-24] are based on Forest Insect and Disease Survey, Pacific Region collection records. Extensions to the known geographic distribution (Bright 1976; Wood 1982) within British Columbia are documented for several species. *D. punctatus* is now known to occur widely in the interior of British Columbia (Mackenzie, Likely, Howser). It was previously known in British Columbia from a single collection near the Yukon border. *D. murrayanae* previously recorded only from south central to south eastern British Columbia is now known to occur west to the coast range (Anahim Lake, Smithers, Atlin) and north into the Yukon. Other notable range extensions include *D. pseudotsugae* which occurs north of 54° (Fort St. James), *D. valens* whose range occurs north to 54° (Prince George) and *D. ponderosae* which occurs west to Terrace and north to 56° (Meziadin Lake).

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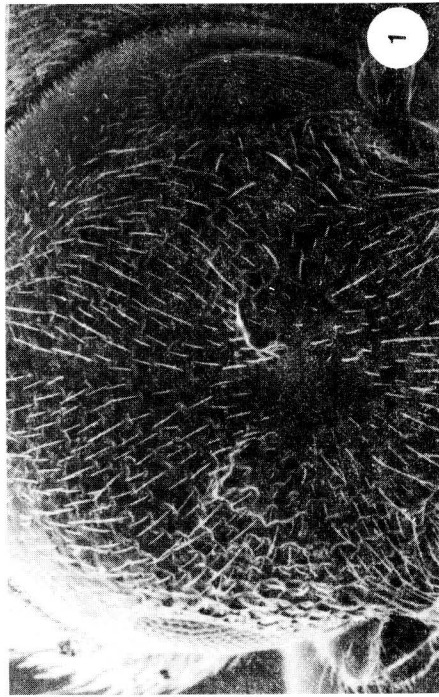


FIG. 1. *D. brevicornis*, deep median groove on frons

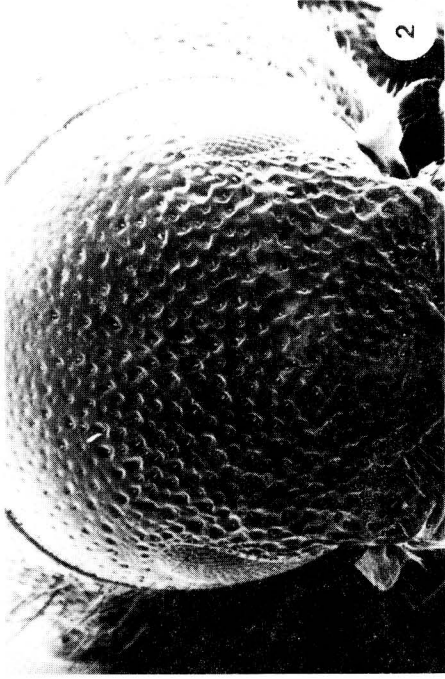


FIG. 2. *D. murrayanae*, lacks deep groove on frons

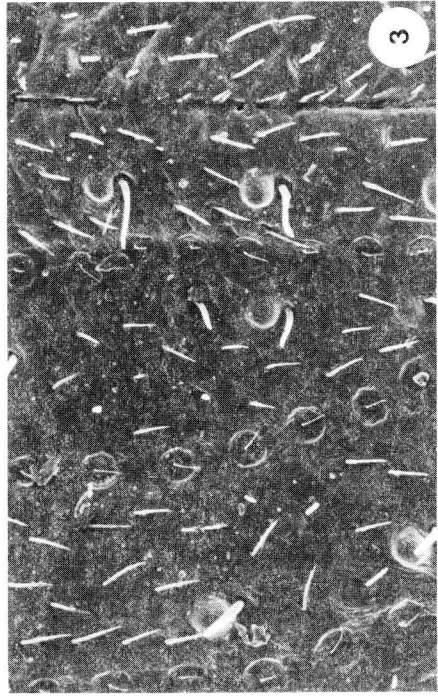


FIG. 3. *D. ponderosae*, minutely rugulose declivity

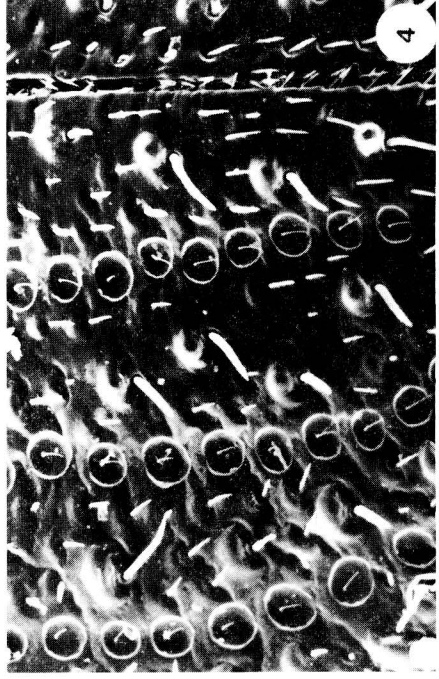


FIG. 4. *D. valens*, granulate punctures on declivity



FIG. 6. *D. simplex*, declivity

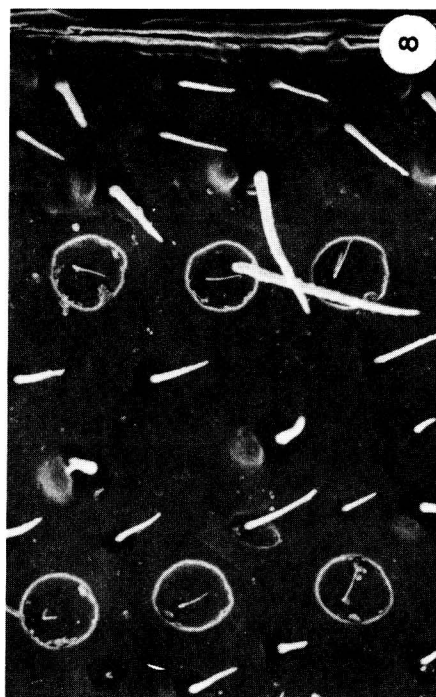


FIG. 8. *D. punctatus*, declivity

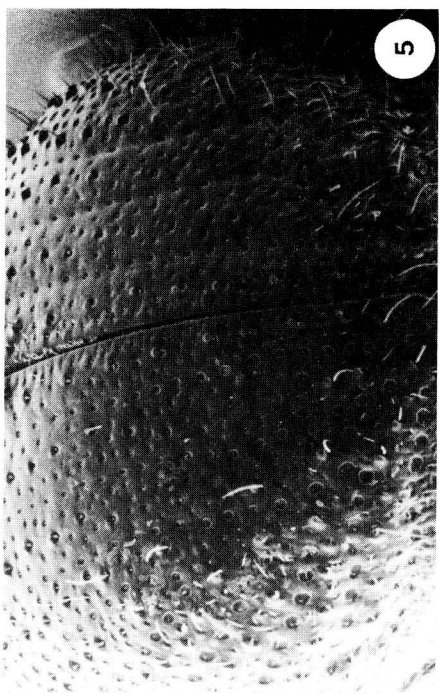


FIG. 5. *D. murrayanae*, declivity



FIG. 7. *D. murrayanae*, declivity

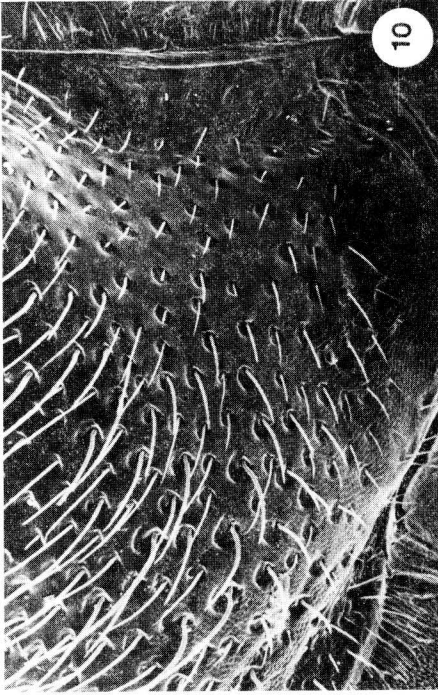


FIG. 10. *D. miravaniae*, non granulate episternal area bearing distinctly marginate punctures

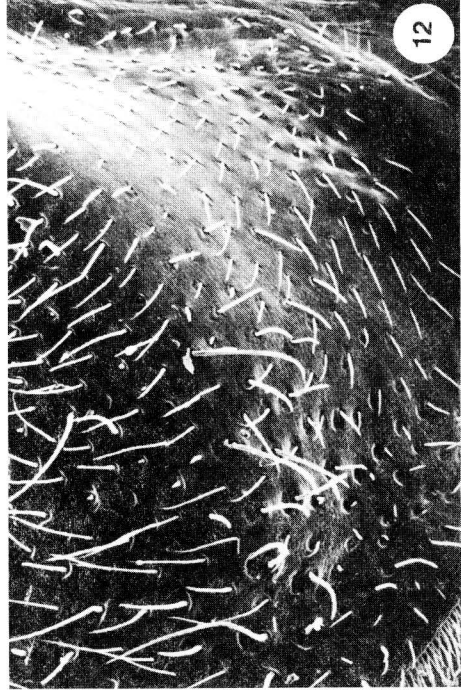


FIG. 12. *D. rufipennis*, non granulate episternal area bearing indistinctly marginate punctures

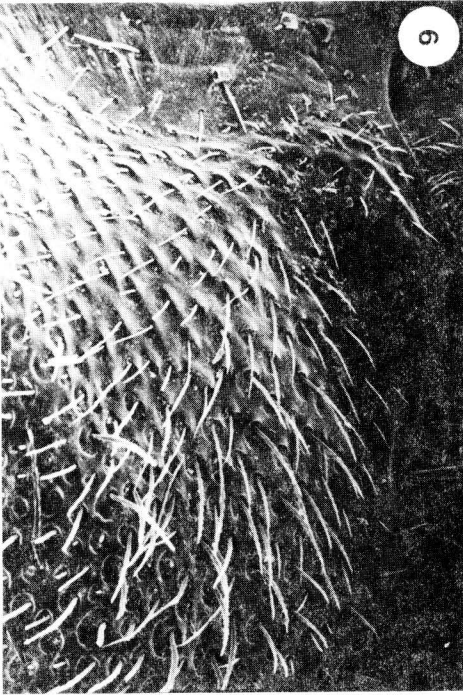


FIG. 9. *D. valens*, coarsely granulate episternal area of prothorax



FIG. 11. *D. punctatus*, non granulate episternal area bearing distinctly marginate punctures

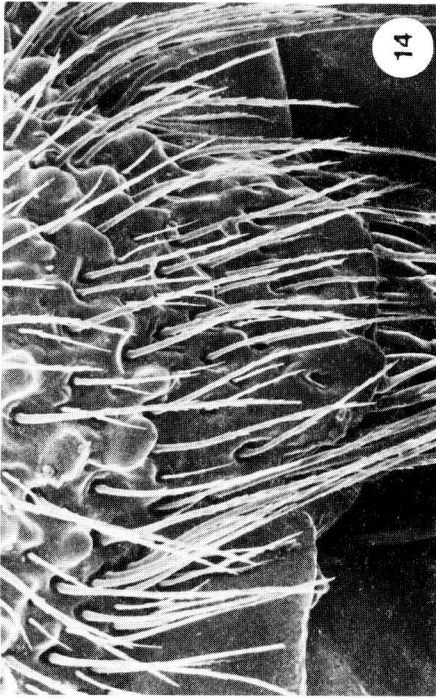


FIG. 14. *D. pseudotsugae*, strongly oblique margin of episternal process

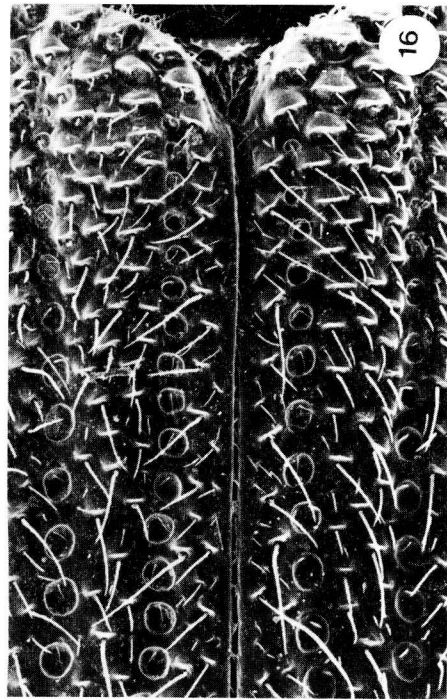


FIG. 16. *D. pseudotsugae*, strongly crenulate discal area

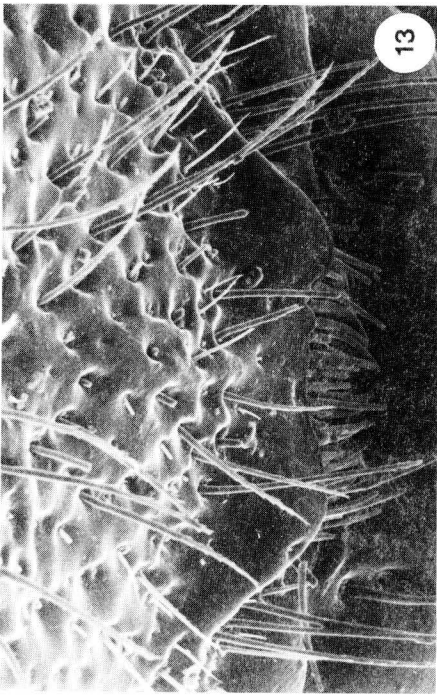


FIG. 13. *D. murayanae*, moderately oblique margin of episternal process

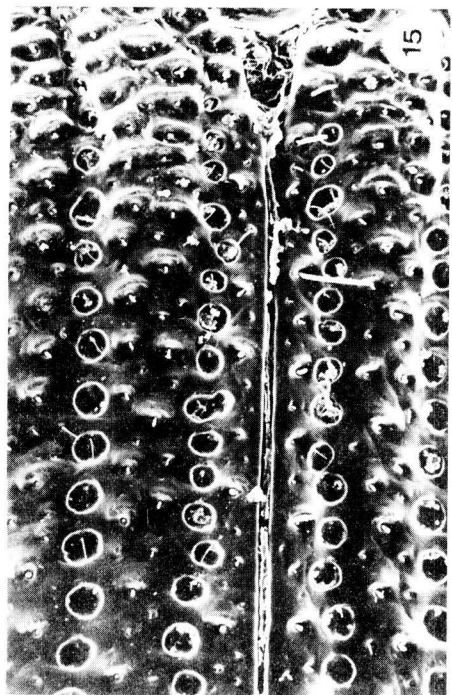


FIG. 15. *D. simplex*, moderately crenulate discal area

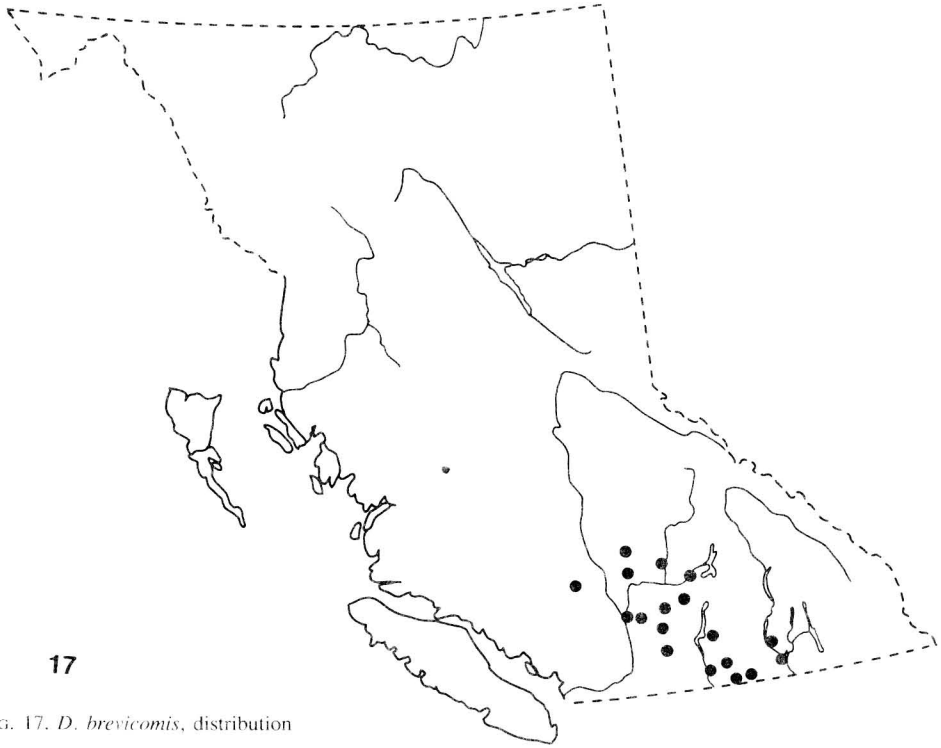


FIG. 17. *D. brevicomis*, distribution

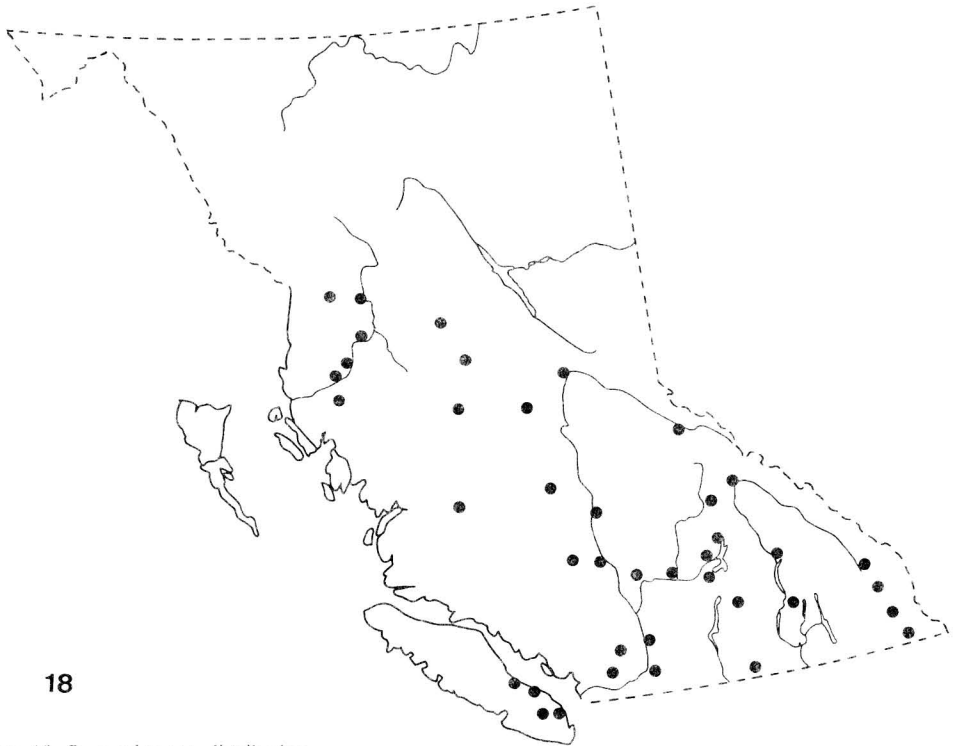
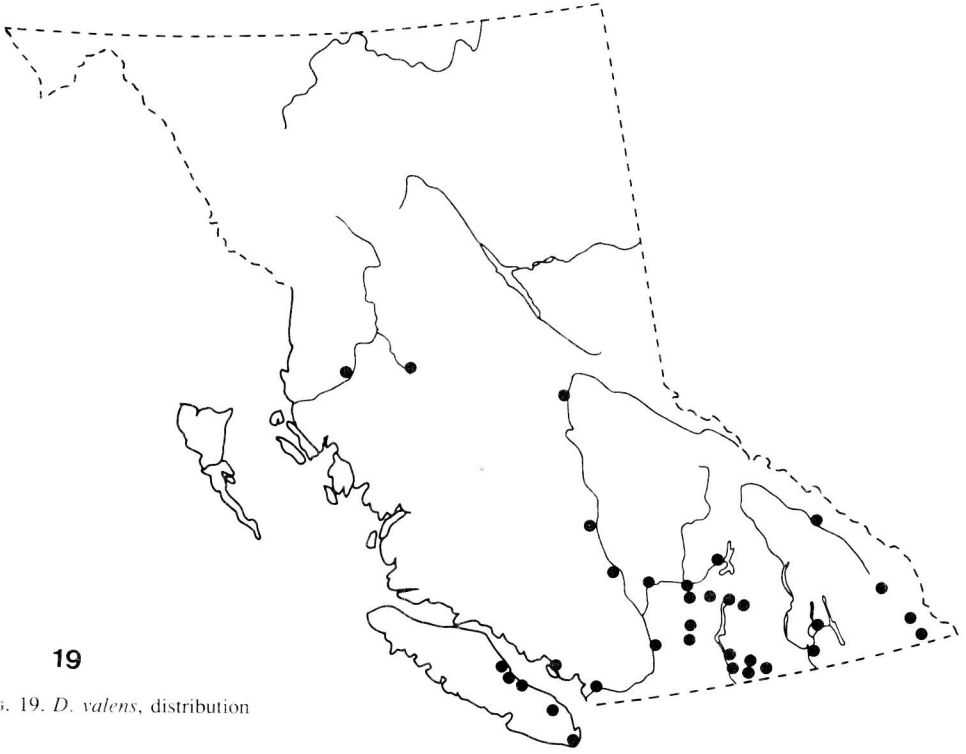


FIG. 18. *D. ponderosae*, distribution



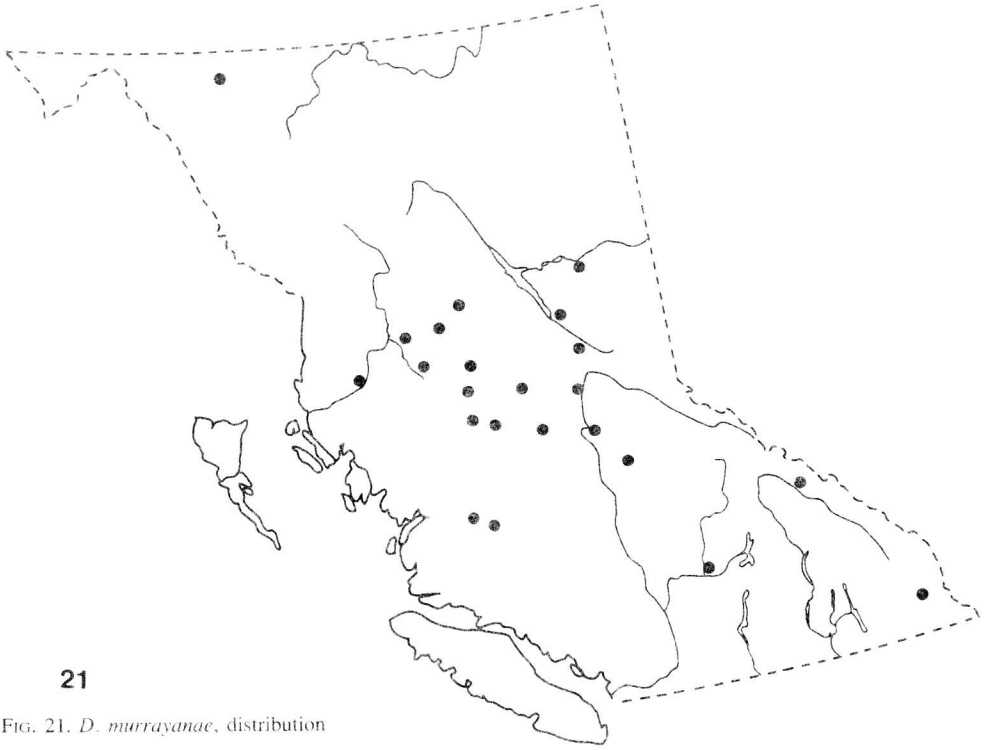
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FIG. 19. *D. valens*, distribution



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FIG. 20 *D. rufipennis*, distribution



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FIG. 21. *D. murrayanae*, distribution



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FIG. 22. *D. punctatus*, distribution

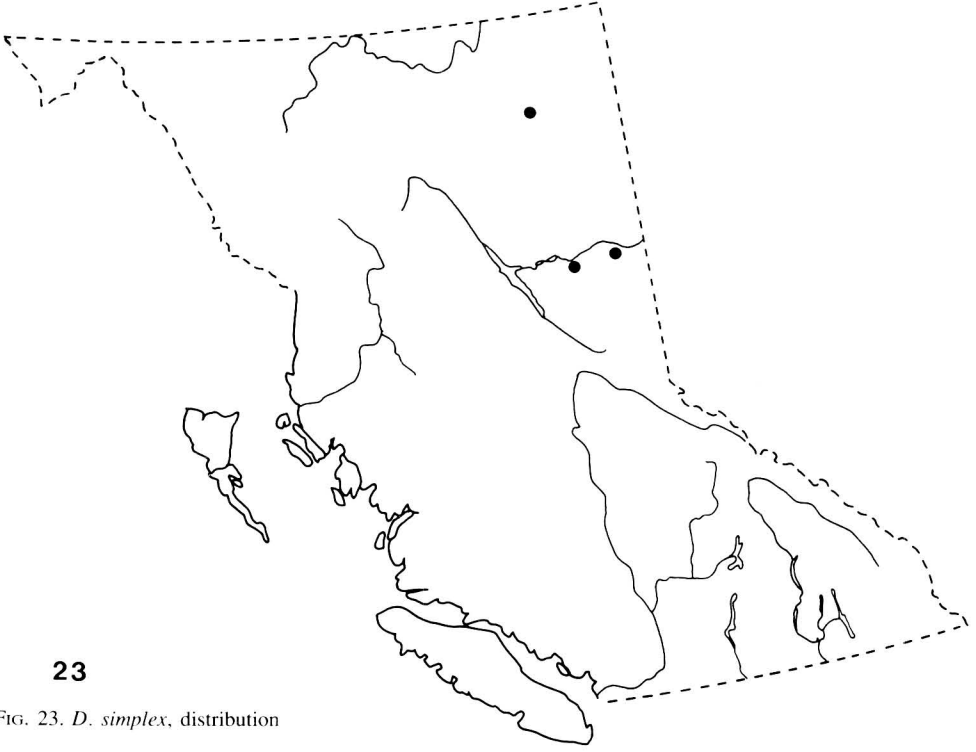


FIG. 23. *D. simplex*, distribution

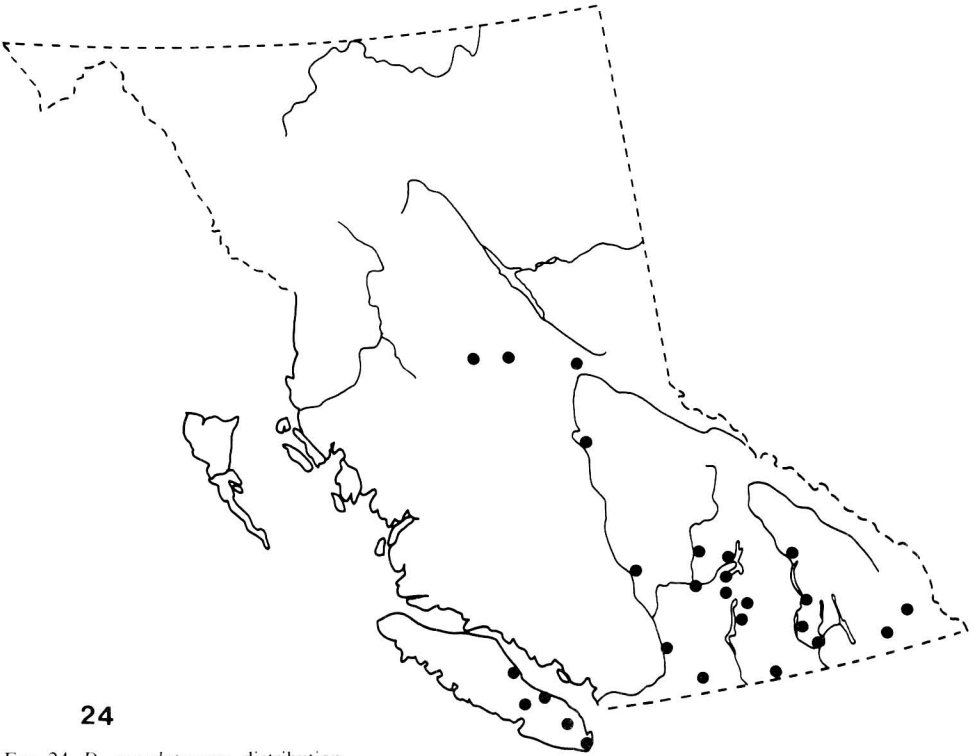


FIG. 24. *D. pseudotsugae*, distribution