

Ambrosia Beetles of the Tribe Xyloterini (Coleoptera: Scolytidae) in North America¹

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The tribe Xyloterini is widely distributed in the Holarctic realm. It is comprised of three rather small but well known genera. The largest of these, *Trypodendron* Stephens, consists of about a dozen species and occurs throughout the Holarctic realm; five of these species occur in North America. *Dendrotrypum* Schedl contains six species that are known only from eastern Asia. *Xyloterinus* Swaine contains one species from eastern North America.

All species in the tribe bore into the woody tissues of the host tree, where they feed largely upon the ambrosial fungus that stains the walls of their burrows. They breed in the larger parts (more than four inches in diameter) of both coniferous and deciduous trees and, as is common with other ambrosia beetles, many species reproduce in a wide variety of unrelated host species. For example, in North America *Trypodendron lineatum* is known to breed in at least eight coniferous and three deciduous host genera, and *Xyloterinus politus* in nine deciduous and three coniferous genera. However, normally a certain degree of host preference is manifest even in these essentially polyphagous species.

The entrance gallery is constructed by the female. It penetrates the bark and extends into the sapwood, where it may branch several times. The larvae are reared in separate chambers arranged in series above and below the main tunnel. These chambers, or cradles, are enlarged by the larvae as they mature and when complete are just large enough to accommodate the mature beetles. In *Xyloterinus* there are two series of cradles above and two below the main gallery; in *Trypodendron* there are only one series above and one below. The young adults leave the brood tree through the parent entrance gallery. Apparently they may overwinter either on the forest floor or in their burrows; evidently there may be either one or two generations each year. The beetles are monogamous; mating may occur on the surface of the bark before the entrance tunnel is started, or at any time during the breeding season.

The economic loss caused by these wood-boring ambrosia beetles is sometimes tremendous. They normally attack only weakened or dying trees; consequently, freshly cut logs are very attractive to them. The black stain produced by the ambrosial fungus always associated with the beetles discolors the wood for some distance around the burrow and together with the gallery holes in the lumber, seriously reduces the quality of lumber from such logs. When severe, the damage may render the lumber commercially valueless.

History

As originally described by Stephens (1830:353), the genus *Trypodendron* included two species, *Dermestes domesticus* L. and *Bostrichus dispar* Fabr. Eight years later Westwood (1838:39) designated *domesticus* as type of the genus. Presumably unaware of Stephens' genus, Erichson (1836:60) described *Xyloterus* for three species, *Dermestes domesticus* L., *Bostrichus lineatus* Oliv., and *Bostrichus 5-lineatus* Adams. The type of *Xyloterus* was later designated as

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Bostrichus lineatus Oliv. by Thomson (1859:146), who, on the same page, also recognized the genus *Trypodendron*. Several authors, including Ferrari (1867:8-9), recognized both genera; however, more recent writers have considered them synonymous and used either one name or the other. Although the name *Trypodendron* had priority, an objection to its use arose because of gross errors in the original diagnosis. In spite of this, the name was properly validated and must continue to be recognized in favour of *Xyloterus*.

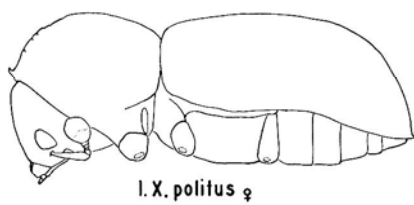
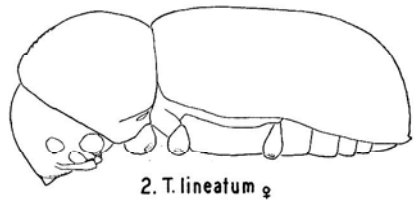
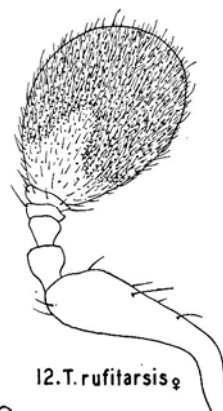
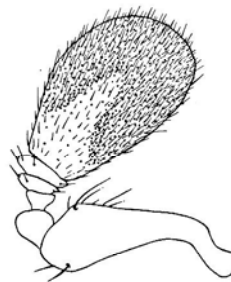
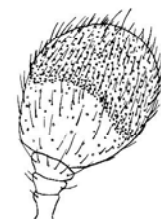
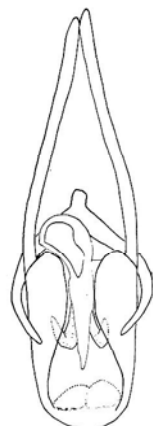
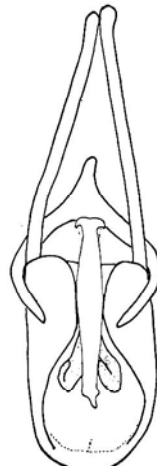
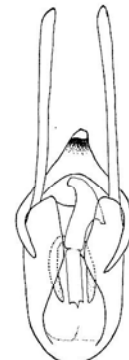
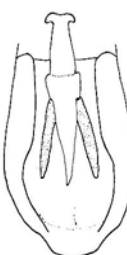
The group of beetles designated by the name *Trypodendron* (or *Xyloterus*) was recognized very early as representing a distinct subdivision of the Scolytidae. A name, Xyloterioideae, was first applied to it by Lindmann (1876:165). Since that time it has been recognized as a distinct group equivalent to a tribe by virtually all authors except Hagedorn (1910:114), who placed it in Xyleborinae, and Hopkins (1915:224) and his followers, who included it in Corthylinae. Only two divisions within the Xyloterini have been made. The first occurred with the recognition of the monobasic Nearctic genus *Xyloterinus* by Swaine (1918:83); the second was made when Schedl (1951:76) erected the oriental genus *Dendrotrypum*.

Intraspecific Variation

Sexual differences are conspicuous in all three genera. In all of them the females have a conspicuous proepimeral excavation (Figs. 1, 2, 5, 6) that is usually ornamented by setae; the cavity is not evident in the males. The female frons is convex in all three genera; it is flattened in the males of *Xyloterinus* (Fig. 11) and *Dendrotrypum*, and is deeply excavated in the males of *Trypodendron* (Figs. 3, 10). The females of *Xyloterinus* are conspicuously larger than the males (Figs. 33, 34); the females of *Trypodendron* are also larger than the males but principally because the pronotum is shortened and subquadrate in the male rather than subcircular as in the female (Figs. 23, 24, etc). The median area of the anterior margin of the pronotum is evenly rounded in the females of *Dendrotrypum*, but is rather strongly produced in the males. The anterior tibiae of *Trypodendron* females are subinflated and tuberculate (Fig. 8); they are flattened and devoid of tubercles in the males (Fig. 7).

Variations between individuals of a particular sex and species were observed in size, colour, and sculpture. The size, determined by measuring the length by means of an ocular micrometer, generally varies much less in ambrosia beetles than in bark-boring scolytids. The difference in length between the largest and smallest available specimen was found to vary from 7 per cent (*Xyloterinus politus* males) to 26 per cent (*Trypodendron betulae* males) of the length of the smallest specimen, the average variation for each sex of the six North American species being 14 per cent. Variation in colour evidently depended upon the age of the specimen more than any other factor. For example, teneral specimens of *T. retusum* (Fig. 26) varied from yellow to striped to the mature black colour (Fig. 25). Specimens from a series of any one species

Figs. 1-16.—*Trypodendron*, *Dendrotrypum*, and *Xyloterinus* spp.: 1, *X. politus*, lateral aspect of female; 2, *T. lineatum*, lateral aspect of female; 3, *T. lineatum*, lateral aspect of anterior parts of male; 4, *T. rufitarsis*, lateral aspect of elytral declivity of female; 5, *T. lineatum*, ventrolateral aspect of proepimeral area of female; 6, *D. aceris*, ventrolateral aspect of proepimeral area of female; 7, *T. lineatum*, posterior aspect of anterior tibia of male; 8, *T. lineatum*, posterior aspect of anterior tibia of female; 9, *X. politus*, posterior aspect of anterior tibia of female; 10, *T. betulae*, anterolateral aspect of head of male; 11, *X. politus*, anterolateral aspect of head of male; 12, *T. rufitarsis*, cephalic aspect of antenna of female; 13, *T. rufitarsis*, cephalic aspect of antenna of male; 14, *X. politus*, cephalic aspect of antenna of male; 15, *T. lineatum*, lateral aspect of antennal club of male; 16, *X. politus*, lateral aspect of antennal club of male.

1. *X. politus* ♀2. *T. lineatum* ♀7. *T. lineatum* ♂8. *T. lineatum* ♀9. *X. politus* ♀3. *T. lineatum* ♂4. *T. rufitarsis* ♀10. *T. betulae* ♂11. *X. politus* ♂5. *T. lineatum* ♀12. *T. rufitarsis* ♀13. *T. rufitarsis* ♂14. *X. politus* ♀6. *D. aceris* ♀17. *T. betulae*18. *T. retusum*19. *T. lineatum*20. *T. rufitarsis*15. *T. lineatum* ♂16. *X. politus* ♂21. *T. scabricollis*22. *X. politus*

emerging from hibernation at a particular locality were essentially similar in colour; however, these mature specimens often appeared sufficiently different in colour and colour pattern, when compared with teneral specimens of their own brood, to represent a different species. Considerable variation in sculpture, apparently independent of sex or age, was observed in all six North American species. The depth, spacing, and diameter of striae punctures were particularly confusing. Except in *T. scabricollis*, where the punctures were sharply and regularly impressed, the striae punctures varied from large and rather conspicuous to complete obscurity. A waxy or oily substance on the elytra, presumably coming from the walls of the tunnels, may have contributed to this apparent variation. The weak declivital sulci of *Trypodendron* species were so shallow that very minor variations completely changed their appearance. Not only did these sulci vary considerably between specimens of a series, but the difference between the sulci of the left and right elytra of one specimen sometimes appeared greater than the apparent difference between any two of the five native species.

Geographic Variation

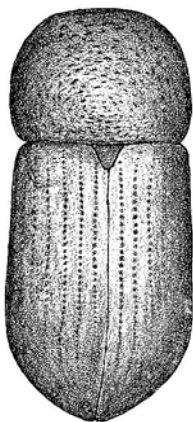
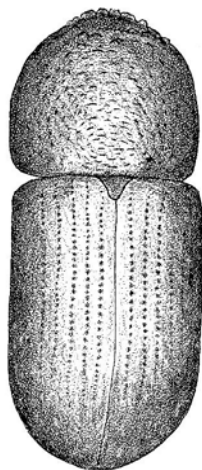
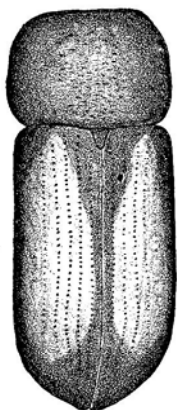
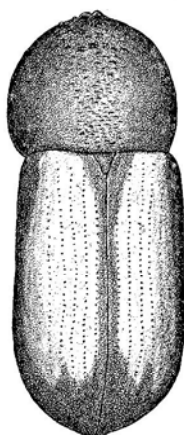
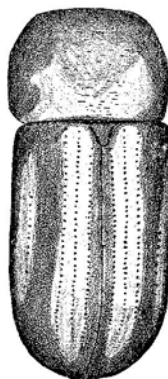
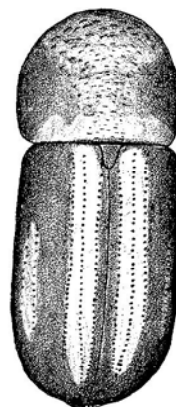
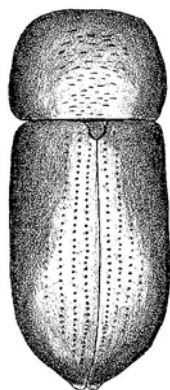
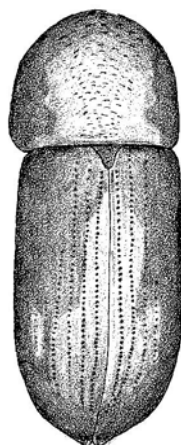
The distinguishing characters of the species of *Trypodendron* were often so obscure that it was rather difficult to identify certain specimens without first dissecting and examining the male genitalia. Partly because of this, and partly because of extreme individual variation in colour and in details of surface sculpture, variations that could be correlated with distribution were not readily detected. However, one character that appeared to vary geographically was the colour of *T. lineatum*. Of 229 specimens examined from southern British Columbia, 70 were unicolorous, about a third of these being almost uniformly black; many of the striped specimens from that area also appeared much darker than is normal for the species, but were not considered unicolorous. Of 204 specimens from Quebec and New Brunswick only three could be classed as unicolorous, and only one of these almost uniformly black. The stripes of the eastern specimens were usually more sharply defined than most of those from the west. The ratio of unicolorous to striped specimens from Alberta to Ontario appeared to be intermediate between these extremes, but the high percentage of teneral specimens made an accurate count of the variations inadvisable. Although the difference in colour between the eastern and western series was obvious, even in teneral specimens, it should be pointed out that a higher percentage of the western specimens had spent a winter in hibernation than those from the east.

Discussion of Characters

The genera of Xyloterini may be readily distinguished by characters of the antennae. The club of *Xyloterinus* appears obliquely truncate (Figs. 15, 16), but has the basal area less corneous and somewhat more pubescent than usual; in outline it is symmetrical. In *Trypodendron* the club is rather similar to that of *Xyloterinus*, but is more elongate and the central portion of the subcorneous area is rather strongly and narrowly produced toward the apex (Figs. 13, 14); in outline it may be asymmetrical with the outer distal angle produced. The club of *Dendrotrypanum* is similar to that of *Xyloterinus*, but is not thickened basally and appears uniformly membranous throughout; in outline it is symmetrical.

Figs. 17-22.—*Trypodendron* and *Xyloterinus* spp., dorsal aspect of male genitalia: 17, *T. betulae*; 18, *T. retusum*; 19, *T. lineatum*; 20, *T. rufitarsis*; 21, *T. scabricollis*; 22, *X. politus*.

Figs. 23-34.—*Trypodendron* and *Xyloterinus* spp., dorsal aspect: 23, *T. scabricollis* male; 24, *T. scabricollis* female; 25, *T. retusum* male; 26, *T. retusum* teneral female; 27, *T. betulae* male; 28, *T. betulae* female; 29, *T. lineatum* male; 30, *T. lineatum* female; 31, *T. rufitarsis* male; 32, *T. rufitarsis* female; 33, *X. politus* male; and 34, *X. politus* female.

23. *T. scabricollis* ♂24. *T. scabricollis* ♀25. *T. refusum* ♂26. *T. refusum* ♀27. *T. betulae* ♂28. *T. betulae* ♀29. *T. lineatum* ♂30. *T. lineatum* ♀31. *T. rufitarsis* ♂32. *T. rufitarsis* ♀33. *X. politus* ♂34. *X. politus* ♀

In the generic classification the sexual differences, mentioned in connection with intraspecific variation above, were also useful, as were the sculpture of the head and shape of the pronotum of the male (Figs. 3, 10). In the female, the shape of the proepimeral excavation (Figs 2, 5) and features of the anterior tibiae (Figs. 8, 9) were also of value. The long axis of the proepimeral excavation of *Trypodendron* is longitudinal and very narrow (Figs. 2, 5); it is longitudinal, short, and rather wide in *Dendrotrypum* (Fig. 6); and it is transverse and wide in *Xyloterinus* (Fig. 1). The anterior tibiae of *Trypodendron* females are sub-inflated and asperate on the posterior surface (Fig. 8); they are flat and very finely asperate in the male (Fig. 7). The anterior tibiae in *Dendrotrypum* and *Xyloterinus* (Fig. 9) are flat and the posterior surface is smooth.

The classification of the genus *Trypodendron* was formerly based, to a large extent, on rather obscure differences of colour and colour pattern. In an effort to discover more reliable characters a detailed study of both external and internal characters was made. Several useful characters that were overlooked by previous writers were found. Of these, the most consistent and easily recognized differences are in the male genitalia (Figs. 17-21). The genitalic differences are largely limited to the sclerotized structure at the apical end of the ductus ejaculatorius, normally resting inside of the genital capsule. When the genitalic characters alone were used to sort series of associated males and females other differences became obvious immediately. Under a magnification of about 70 diameters the elytral interspaces were observed to be smooth and shining, but punctured by numerous, confused, very minute pores in *T. scabricollis*, *T. retusum*, and *T. lineatum*; in *T. betulae* and *T. rufitarsis* the interspaces were minutely reticulate and appeared dull. The anterior margin of the female pronotum was armed by a series of about four teeth in *T. scabricollis*, *T. retusum*, and *T. betulae*; it was unarmed in *T. lineatum* and *T. rufitarsis*. The extent to which colour may be relied upon also became apparent. The mature colour of adults emerging from hibernation was: black in *T. retusum* (and some of *T. lineatum*); brown in *T. scabricollis* and *T. rufitarsis*; dark brown to black with a pale yellowish-brown stripe between interspaces two and seven that extends from the base of the elytra to the declivital margin in *T. betulae*; and dark brown to black with pale yellowish-brown stripes on interspaces two to four, and on seven in *T. lineatum* (the pale areas were reduced or absent in some specimens). The teneral colour and colour pattern varied extensively with the age of the specimen and became useful only after considerable experience with fully mature specimens had been acquired. Other characters found to be useful in distinguishing individual species are: the presence of a large, pointed median tubercle in the frontal excavation of *T. betulae* males (Fig. 10); the sharply impressed stria punctures and the finely asperate posterolateral areas of the pronotum of *T. scabricollis*; the absence of asperities on the median basal area of the pronotum of most *T. retusum* females; and the difference in lateral profile of the declivity of *T. lineatum* and *T. rufitarsis* (Figs 2, 4).

Phylogeny

The preguila of all species of the Xyloterini is rather strongly depressed below the general posteroventral surface of the head; the antennal club, as clearly seen in *Xyloterinus* (Figs. 15, 16), is a derivation of the obliquely truncate type; and the metepimeron is not covered posteriorly by the elytra (Figs. 1, 2). In addition, the female begins the entrance tunnel; and the male is either smaller than the female or has the frons excavated. The only other groups in the family Scolytidae with this combination of characters are the allies of *Xyleborus* and of *Scolytoplatus*. From both the morphological and biological evidence it is

clear that the Xyloterini are allied to these groups rather than to the allies of *Corthyli*, which have none of these characters. It is presumed that the Xyloterini are somewhat intermediate between the *Xyleborus* and *Scolyto-platypus* groups; however, a detailed consideration of their exact position in relation to these groups must await further study.

Evolution within the Xyloterini is presumably a continuation of that which has proceeded from the more primitive hylesinine type of bark beetle to a form more suitably adapted to the woodboring-ambrosial-fungus-feeding habit (almost ideally exemplified by most Platypodidae). Progressive changes in that direction in the Xyloterini appear to be: modification of the antennal club from obliquely truncate (still observable in *Xyloterinus*) to one that is flat, membranous, and uniformly pubescent (as in *Dendrotrypanum*); modification of the flattened anterior tibiae having an essentially smooth posterior face (*Xyloterinus* and *Dendrotrypanum*) to one that is subinflated and tuberculate on the posterior face (*Trypodendron*); and loss of the vestiture on the dorsal parts of the pronotum and elytra (*Trypodendron*). Other changes apparently peculiar to the tribe that are correlated with these characters are: modification of the male pronotum and frons; and a change in the long axis of the proepimeral excavation of the female from transverse (*Xyloterinus*) to longitudinal (*Trypodendron*). In almost all cases the more primitive characters, both inter- and intra-tribal, are associated with *Xyloterinus*, and the more specialized with *Trypodendron*. *Dendrotrypanum* is intermediate between the two, but is evidently more closely allied to *Xyloterinus*.

The direction of progressive changes that have occurred in the North American species of *Trypodendron* is not clear. The armed anterior margin of the female pronotum in *T. scabricollis*, *T. retusum*, and *T. betulae*; the striped colour patterns of *T. lineatum*, *T. betulae*, and teneral specimens of *T. retusum*; and the presence of a large frontal tubercle in *T. betulae* males are probably of significance in the evolution of the genus. However, consideration of these characters, as well as many others, did not give a clear picture of phyletic relationships; one species appeared to be equally as specialized or as primitive as any of the other four. Examination of two additional European species only increased the problem.

Tribe Xyloterini

Xyloterioideae Lindemann, 1876, Bull. soc. imp. nat. Moscou 51:165.

Xyloteri Leconte, 1876, Proc. Amer. Philos. Soc. 15:356.

Xyloteridae Eichhoff, 1878, Mem. soc. roy. sci. Liège, série 2, 8:411.

Xyloterini Reitter, 1913, Wien. ent. Zeit. (Beiheft) 32: 74; Schedl, 1951, Mitt. forstl. Bundes-Vers. Anst. Mariabrunn 47:74.

Xyloterina Balachowsky, 1949, Faune de France 50:196.

Trypodendrinae Trédl, 1907 (in part), Ent. Bl. 3:18.

Xyleborinae Hagedorn, 1910 (in part), Coleopterorum Catalogus 4:97; Hagedorn, 1910 (in part), Genera Insectorum 111:149.

Corthyliinae Hopkins, 1915 (in part), U.S. Dept. Agr. Tech. Bull. 17:224.

Corthylini Blatchley and Leng, 1916 (in part), Rhynchophora of North Eastern America, p. 640; Stark, 1952, Fauna U.S.S.R. 31:359.

In the classification of the Scolytidae, as understood at present, the Xyloterini are somewhat intermediate between the allies of *Xyleborus* and of *Scolyto-platypus*. They may be distinguished from these and other groups by the following combination of characters: eye completely divided, pregonal area depressed, a proepimeral cavity present in the female, antennal funicle four-segmented, antennal club aseptate and unmarked by sutures but derived from an obliquely truncate type, and metepisternum visible its entire length.

Description.—Length 0.8-4.6 mm.; about 2.5 times as long as wide; body colour varying from reddish-brown to black, some species with alternate dark and pale stripes; vestiture hairlike, rather short and scanty; secondary sexual characters on head or prothorax usually conspicuous.

Head more or less withdrawn into prothorax, not visible from above; front of head convex in the female, varying from slightly flattened to deeply and broadly concave in the male. Eye completely divided into two subequal halves. Antennal scape rather long and club-shaped; funicle four-segmented; club without distinct sutures or septa, the basal area usually thicker, subcorneous, and more sparsely pubescent than the distal area.

Pronotum variable in outline; anteromedian area asperate to behind the summit, the asperities moderately high, rather abundant, broad, and decreasing in size posteriorly; basal margin with a very fine raised line; a rather large proepimeral cavity present in female.

Elytra cylindrical, the basal margins unarmed, and the sides subparallel on more than the basal half; declivity convex, often feebly bisulcate; sculpture variable, usually fine.

Fore coxae contiguous; fore tibiae variable; middle and hind tibiae flattened, with outer margin armed by a series of fine teeth; tarsal segments one to three laterally compressed; abdomen appearing horizontal from lateral aspect.

Key to the Genera of Xyloterini

1. Antennal club (Figs. 12-14) with the subcorneous basal area strongly, rather narrowly procurved; anterior tibiae (Figs. 7, 8) thickened and tuberculate on the posterior face in the female, flattened and finely tuberculate in the male; male head deeply and broadly concave between eyes from epistomal margin to vertex, convex in female; male pronotum subquadrate, the anterior margin straight or slightly recurved and unarmed, female pronotum with the anterior margin rounded (procurved) and armed by marginal teeth; long axis of proepimeral excavation of female longitudinal and very narrow (Fig. 5) *Trypodendron* Stephens
- Subcorneous basal area of antennal club broadly and only feebly procurved, or not at all corneous; anterior tibiae flattened and devoid of tubercles on posterior face in both sexes; frons convex or somewhat flattened in both sexes; anterior margin of pronotum rounded and armed by a series of teeth in both sexes 2
2. Basal area of antennal club not thickened or corneous, uniformly pubescent to base; males and females equal in size; anterior margin of pronotum medially produced in male; long axis of proepimeral excavation of female longitudinal, rather short and broad (Fig. 6); eastern Asia *Dendrotrypum* Schedl
- Basal area of antennal club subcorneous, thickened, and weakly procurved on anterior face (Figs. 15, 16); males distinctly smaller than females; anterior margin of pronotum in male as in female, but usually about half of the marginal teeth reduced or absent; proepimeral excavation of female transverse, rather large, broad (Fig. 1); North America *Xyloterinus* Swaine

Genus *TRYPODENDRON* Stephens

Trypodendron Stephens, 1830, Illustrations of British Entomology, Mandibulata 3:353 (original description); Westwood, 1838 (1840), Synopsis of the Genera of British Insects, p. 39 (type designated); Thomson, 1859, Scandinaviens Coleoptera synoptiskt bearbetade 1:146; Lacordaire, 1866, Hist. Nat. Ins., Gen. Coléoptères 7:377; Ferrari, 1867, Die Forst- und Baumsuchtschädlichen Borkenkäfer, p. 8; Provancher 1877, Petite Faune Entomologique du Canada 1:566; Eichhoff, 1878, Mem. soc. roy. sci. Liège 8:412; Bedel, 1888, Ann. soc. ent. France, hors série, 6:396; Blandford, 1894, Trans. Ent. Soc. London, p. 124; Lovendal, 1898, De Danske Barkbiller, p. 194; Barbey, 1901, Les scolytides de l'Europe centrale, p. 110; Swaine, 1909, New York State Mus. Bull. 134, 24th Rept. State Entomologist for 1908, p. 147; Swaine, 1918, Canadian Dept. Agr. Ent. Br. Bull. 14(2):84; Blackman, 1922, Mississippi Agr. Expt. Sta. Tech. Bull. 11:79; Dodge, 1938, Minnesota Agr. Expt. Sta. Tech. Bull. 132:36; Chamberlin, 1939, The Bark and Timber Beetles of North America, p. 296; Beal and Massey, 1945, Bull. Duke Univ. School Forestry 10:107; Schedl, 1951, Mitt. forstl. Bundes-Vers. Anst. Mariabrunn 47:74; Stark, 1952, Fauna U.S.S.R. 31:360.

Xyloterus Erichson, 1836, Archiv. f. Naturgesch. 2(1): 60 (original description); Küster, 1844, Käfer Europas 4:64; Bach, 1854, Käferfauna für Nord- und Mitteleuropa, p. 138; Thomson, 1859, Skandinaviens Coleoptera synoptiskt bearbetade 1:146 (type designated as *Bostrichus lineatus* Olivier); Eichhoff, 1864, Berl. Ent. Zeit. 8:36; Thomson, 1865, Skandinaviens Coleoptera synoptiskt bearbetade 7:357; Lacordaire, 1866, Hist. Nat. Ins., Gen. Coléoptères 7:378; Ferrari, 1867, Die Forst- und Baumzuchtschädlichen Borkenkäfer, p. 9; Puton, 1867, Ann. soc. ent. France, serie 4, 7:631; Redtenbacher, 1874, Fauna austriaca, die Käfer 2:382; Leconte, 1876, Proc. Amer. Philos. Soc. 15:357; Reitter, 1894, Verh. Naturf. Ver. Mähren 33: 92; Hubbard, 1897, U.S. Dept. Agr., n.s., Bull. 7: 28; Tredl, 1907, Ent. Bl. 3: 19; Niisima, 1909, Jour. College Agr., Sapporo, Japan, 3(2):163; Hagedorn, 1910, Coleopterorum Catalogus 4:114; Hagedorn, 1910, Genera Insectorum 111:157; Reitter, 1913, Wien. Ent. Zeit., Beiheft 32:74; Hopkins, 1915, U.S. Dept. Agr. Tech. Bull. 17:226; Blatchley and Leng, 1916, Rhynchophora of North Eastern America, p. 644; Balachowsky, 1949, Faune de France 50:196.

This genus can be readily distinguished from the allied genera by the asperate posterior face of the fore tibia (Figs. 7, 8), the narrowly and strongly procurved subcorneous basal area of the antennal club (Figs. 12-13), the broadly and deeply concave frons and the subquadrate pronotum of the male (Figs. 23, 25, 27, 29, 31), and the narrow longitudinal proepimeral cavity of the female (Figs. 2, 5).

Description.—Frons convex in the female, broadly and deeply concave from epistomal margin to well above the eyes in the male; antennal club with the subcorneous basal area strongly and rather narrowly procurved. Pronotum subcircular in the female with the anterior margin rather strongly procurved and armed, subquadrate in the male with the anterior margin almost straight or slightly recurved and unarmed; foveate excavation on proepimeral area of female longitudinal, rather narrow. Elytra feebly striate, the interstitial punctures usually obsolete; declivity usually feebly bisulcate; the subapical line sharply elevated, usually visible from above. Anterior tibia subinflated and rather coarsely asperate on posterior face in female, flattened and very finely asperate in male.

Type Species.—*Dermestes domesticus* L., subsequent designation by Westwood (1838: 39).

Key to the North American Species of *Trypodendron*

1. Pronotum asperate over entire surface, including posterolateral areas; elytral striae with the punctures regular, rather deep, and sharply defined on both disc and declivity *scabricollis* (Leconte)
- Pronotum with posterolateral areas punctate; elytral striae rather obscure, the punctures very shallow, usually visible but not sharply defined on either disc or declivity 2
2. Frons of male armed by a rather large, sharply pointed, median tubercle between upper halves of the eyes; posterolateral areas of pronotum more closely and deeply punctured (particularly on females); pronotum dark brown to black in colour; mature colour of elytra dark brown to black, usually with a pale area extending from elytral base to declivital margin between interspaces two and seven; surface of pronotum and elytra minutely reticulate; male genitalia as figured (Fig. 17); from *Betula* spp. *betulae* Swaine
- Frons of male without a tubercle at centre; posterolateral angles of pronotum very finely, less closely punctured (particularly on females); colour pattern variable, the pronotum often with at least part of the basal area pale 3
3. Larger, males 3.6-4.3 mm., females 3.8-4.6 mm.; female pronotum usually not asperate on median area at base; mature colour black, young adults pale on an area between interspaces two to seven from base to declivital margin and continuing on sides of declivity between interspaces five to seven from base to the apex; surface of elytra smooth, shining; male genitalia as figured (Fig. 18); from *Populus* spp. *retusum* (Leconte)
- Smaller, males 2.7-3.3 mm., females 3.0-3.7 mm.; median area of pronotum asperate to basal margin on both sexes; colour variable, but almost never uniformly black; from coniferous hosts 4

4. Elytral surface smooth and shining, the interspaces usually very minutely and irregularly punctured; elytra more broadly rounded behind, the declivity abrupt (Fig. 2), and the subapical margin appearing broadly rounded from above; colour dark brown to almost black, with pale yellowish-brown markings on base of pronotum and on elytra on interspaces two to four, seven, and on declivity (five dark alternating with four pale longitudinal stripes); the transition in colour from light to dark abrupt; male genitalia as figured (Fig. 19).....*lineatum* (Olivier)
- Elytral surface rather dull, minutely reticulate; elytra more narrowly rounded behind, the declivity not as steep (Fig. 4), the subapical raised margin appearing subacuminate from above; colour brown, the anterior and lateral areas of the pronotum and the sides of the elytra usually a darker brown, the transition from light to dark gradual; male genitalia as figured (Fig. 20) *rufitarsis* (Kirby)

***Trypodendron scabricollis* (Leconte)**

Figs. 21, 23, 24

Xyloterus scabricollis Leconte, 1868, Trans. Amer. Ent. Soc. 2:158; Leconte, 1876, Proc. Amer. Philos. Soc. 15:358; Eichhoff, 1878, Mem. soc. roy. sci. Liège 8:419; Hopkins, 1893, West Virginia Agr. Expt. Sta. Bull. 31: 134, 32: 210; Hubbard, 1897, U.S. Dept. Agr. Div. Ent. Bull., n.s., 7:29; Hopkins, 1899, West Virginia Agr. Expt. Sta. Bull. 56:444; Skinner, 1905, Ent. News 16:248; Fall and Cockerell, 1907, Trans. Amer. Ent. Soc. 33:217; Hagedorn, 1910, Coleopterorum Catalogus 4:116; Blatchley and Leng, 1916, Rhynchophora of Eastern North America, p. 646.

Trypodendron scabricollis, Provancher, 1878, Additions et Corrections à la Faune coleopterologique de la Quebec, p. 13 (1878, Le Nat. canad. 10:381); Swaine, 1918, Canadian Dept. Agr. Ent. Br. Bull. 14(2):84; Blackman, 1922, Mississippi Agr. Expt. Sta. Tech. Bull. 11:79; Chamberlin, 1939, The Bark and Timber Beetles of North America, p. 299; Beal and Massey, 1945, Bull. Duke Univ. School For. 10:107; Craighead, 1950, U.S. Dept. Agr. Misc. Pub. 657:339.

This species is distinguished from other North American representatives of the genus by the finely and sparsely asperate posterolateral areas of the pronotum, by the sharply impressed stria punctures, by the smooth and shining elytral surface, and by the colouration.

Female.—Length 3.6-4.1 mm., 2.5 times as long as wide; body brown, the basal one-fourth of the pronotum and the elytra between interspaces two and seven usually somewhat lighter in colour.

Frons convex, weakly impressed above epistoma; a short broad carina on lower half reaching epistomal margin; surface rather coarsely granulate; vestiture moderately long, sparse, inconspicuous. Antennal club oval, with the medio-distal margin very slightly produced.

Pronotum 1.1 times as wide as long; sides weakly arcuate and converging toward the broadly rounded anterior margin; anterior margin armed by four teeth, the median pair larger; the asperities decreasing in size posteriorly to the basal margin; posterolateral areas usually finely punctate-asperate; vestiture sparse, inconspicuous.

Elytra 1.7 times as long as wide; sides subparallel on basal two-thirds, rather narrowly rounded behind; stria punctures sharply and deeply impressed on both disc and declivity; interstriae more than twice as wide as striae, the surface smooth and shining, with extremely minute, rather abundant, confused punctures (visible at a magnification of 70 diameters or more). Declivity convex, moderately steep; the stria punctures as on disc, but usually a little smaller; interspace two impressed and narrower than one or three; the subapical margin giving the elytra a subacuminate appearance when viewed from above. Vestiture visible only on declivity, very short.

Male.—Similar to female except: size slightly smaller, length 3.5-3.7 mm., 2.3 times as long as wide; frons broadly excavated from epistoma to vertex, more or less foveate at center in most specimens, lateral margins ornamented by longer, more abundant hair; pronotum subquadrate, 1.4 times as wide as long, the

anterior margin straight and unarmed. Male genitalia as figured (Fig. 21, this illustration was prepared from a damaged genital capsule, the only one available.)

Type Locality.—Washington, D.C.

Hosts.—*Pinus* and *Tsuga*.

Distribution.—The southeastern United States from New York to Mississippi.

Fifty specimens from the following localities were examined:—Mississippi: "A and M", and Trims Swamp. *New Jersey*: Brown's Mills Junction, Grenlock, Iona, and "Lahaway." *North Carolina*: Durham and Tryon. *Pennsylvania*: "Pa." *Virginia*: Gloucester County. *West Virginia*: Dellslow, Morgantown, and Pocahontus County.

The above description of the female was made from the third specimen in Swaine's series; the male was described from the first specimen, his homotype. The second specimen of the series, from New Mexico, is of *lineatum*.

Trypodendron betulae Swaine

Figs. 10, 17, 27, 28

Trypodendron betulae Swaine, 1911, Can. Ent. 43:216; Swaine, 1918, Canadian Dept. Agr., Ent. Br. Bull. 14(2):84, 85; Dodge, 1938, Minnesota Agr. Expt. Sta. Tech. Bull. 132:36; Chamberlin, 1939, The Bark and Timber Beetles of North America, p. 299; Leach, 1940, Phytopathology 30:277; Craighead, 1950, U.S. Dept. Agr. Misc. Pub. 657:339; Nash, 1951, Maine For. Serv. Bull. 15:46.

This species is distinguished from other North American representatives of the genus by the more coarsely punctured posterolateral areas of the pronotum, by the dull, minutely reticulate surface of the pronotum and elytra, by the colour pattern of the mature beetle (Figs. 27, 28), by the presence of a rather large, sharply pointed median tubercle between the upper halves of the eyes of the male (Fig. 10), and by the distinctive male genitalia (Fig. 17).

Female.—Length 3.1–3.5 mm., 2.6 times as long as wide; body colour dark brown to black, with a pale yellowish-brown area between interspaces two and seven extending from base to declivital margin (the pale area larger or smaller depending on the age of the specimen).

Frons convex, a weak transverse impression just above the epistoma; a broad, low median carina extending from epistoma almost to upper level of eyes; surface rather coarsely and sparsely granulate; vestiture sparse, inconspicuous. Antennal club oval, symmetrical in outline.

Pronotum 1.1 times as wide as long, slightly wider than elytra; sides feebly arcuate and indistinctly converging on posterior half; anterior margin armed by two rather large and two small median teeth; asperities decreasing in size posteriorly to base; surface of posterolateral area minutely reticulate and punctured, the punctures comparatively coarse and close, some of them subgranulate; vestiture sparse, short, inconspicuous.

Elytra 1.7 times as long as wide, the sides straight and subparallel on basal two-thirds; striae indicated by indistinct, feebly impressed punctures; surface rather dull, appearing minutely reticulate (under magnification of at least 70 diameters). Declivity convex, moderately steep; interspace two narrower than one or three and rather strongly impressed; interspaces one and three sometimes bearing a few minute granules; the subapical raised line appearing rather narrowly rounded from above.

Male.—Similar to female except: average size smaller, 2.7–3.4 mm., 2.2 times as long as wide; frons broadly excavated from epistoma to vertex, a median carina at center ending dorsally between upper halves of eyes in a rather large, pointed tubercle; lateral margins of frontal excavation ornamented by more numerous, longer hairs; pronotum subquadrate, 1.5 times as wide as long, the anterior margin straight and unarmed. Male genitalia as figured (Fig. 17).

Type Locality.—Ste. Anne de Bellevue, Quebec.

Hosts.—*Betula* spp., rarely from *Alnus incana*.

Distribution.—Eastern North America; it probably occurs throughout the range of White birch.

One hundred and forty-six specimens from the following localities were examined:—*Manitoba*: Aweme. *Ontario*: Black Sturgeon Lake, Ottawa, and Rockcliffe. *Quebec*: Chelsea, Ile Perrot, Laniel, Montebello, and Ste. Anne de Bellevue. *Maine*: Cupsupic. *Massachusetts*: Arlington, and Cambridge. *Minnesota*: Itasca Park. *New Hampshire*: Mount Washington, and Waterville. *New Jersey*: Springfield. *New York*: Cranberry Lake.

The above description of the female was made from the seventh specimen in Swaine's type series; the male was described from the holotype. The second specimen in Swaine's series in his female plesiotype of *retusum*.

***Trypodendron retusum* (Leconte)**

Figs. 18, 25, 26

Xyloterus retusus Leconte, 1868, Trans. Amer. Ent. Soc. 2:158; Leconte, 1876, Proc. Amer. Philos. Soc. 15:357; Eichhoff, 1878, Mem. soc. roy. Liège 8:420; Hopkins, 1893, West Virginia Agr. Expt. Sta. Bull. 31: 134, 32: 210; Hopkins, 1894, Can. Ent. 26:278; Hubbard, 1897, U.S. Dept. Agr. Div. Ent. Bull., n.s., 7:29; Hagedorn, 1910, Coleopterorum Catalogus 4:116; Blatchley and Leng, 1916, Rhynchophora of Eastern North America, p. 645.

Trypodendron retusum, Swaine, 1913, Rept. Ontario Ent. Soc. 43:89; Swaine, 1918, Canadian Dept. Agr. Ent. Br. Bull. 14(2):85; Dodge, 1938, Minnesota Agr. Expt. Sta. Tech. Bull. 132:36; Chamberlin, 1939, The Bark and Timber Beetles of North America, p. 298; Leach, 1940, Phytopathology 30:227; Craighead, 1950, U.S. Dept. Agr. Misc. Pub. 657:339; Hodson, 1951, U.S. Dept. Agr. Lake States For. Expt. Sta. Aspen Rept. 22:9.

This species is distinguished from other North American representatives of the genus by the larger size, by the smooth and shining surface of the elytra, by the colouration, in the female by the absence of asperities in the median basal area of the pronotum of most specimens, and in the male by the genitalic characters (Fig. 18).

Female.—Length 3.8-4.6 mm., 2.5 times as long as wide; body colour uniformly black when fully mature (as in Fig. 25), young adults (Fig. 26) with pale yellowish-brown areas at base of pronotum and on elytra between interspaces two and seven from base to declivital margin and continuing on sides of declivity between interspaces five and seven to apex, the extent of the pale areas depending upon the age of the specimen.

Frons convex, moderately impressed above the epistoma, with a short, broad, rather indefinite median carina above the epistoma; surface rather coarsely and sparsely granulate; vestiture sparse, rather long, inconspicuous. Antennal club oval, with the mediobasal portion very slightly produced.

Pronotum 1.2 times as wide as long; sides weakly arcuate, anterior half of pronotum semicircularly rounded; anterior margin armed by four teeth, the median pair larger; asperities decreasing in size posteriorly to behind summit, very finely and sparsely asperate in basal area (basal area entirely devoid of asperities in about two-thirds of available specimens); posterolateral areas feebly reticulate, finely and sparsely punctured, the punctures not at all granulate; vestiture rather short, and inconspicuous.

Elytra 1.7 times as long as wide; sides subparallel on basal two-thirds, narrowly rounded behind; striae punctures very fine, rather indistinctly and shallowly impressed; interspaces smooth and brightly shining, with extremely minute, rather abundant, confused punctures (visible at a magnification of 40 or more diameters). Declivity convex, moderately steep; striae punctures reduced; interspace two impressed and narrower than one or three; the subapical margin sharply elevated and produced on a portion at apex giving the elytra a subacuminate appearance from above. Vestiture sparse, short, fine.

Male.—Similar to female except; size slightly smaller, length 3.6-4.3 mm., 2.3 times as long as wide; frons broadly excavated from epistoma to vertex, lateral margins ornamented by longer, more abundant hair; pronotum subquadrate, 1.5 times as wide as long, the anterior margin feebly recurved and unarmed, the asperities extending to base of median area. Male genitalia as figured (Fig. 18).

Type Locality.—Canada, the exact locality unknown.

Hosts.—*Populus grandidentata*, and *P. tremuloides*.

Distribution.—Canada and the northern United States; evidently occurring throughout the distributions of the hosts.

Two hundred and forty-nine specimens were examined from the following localities:—*Alberta*: Edmonton, and Medicine Hat. *British Columbia*: Kaslo, and Quamechan Lake (Vancouver Island). *Manitoba*: Aweme, and Riding Mountain National Park. *New Brunswick*: Bathurst (from Spruce), Fredericton, and Oak Bay. *Ontario*: Ottawa, and Sudbury. *Quebec*: Ft. Coulonge, Ile Perrot, Laniel, and Ste. Anne de Bellevue. *Saskatchewan*: Indian Head. *California*: Chester, Lassen National Park, and Plumas County. *Colorado*: Cheyenne Canyon. *Idaho*: Priest River. *Nevada*: Baker. *New Hampshire*: Webster. *New Mexico*: Cloudcroft. *New York*: Elka Park, and West Point. *Oregon*: Klamath. *Utah*: Logan Canyon. *West Virginia*: Dellslow, and Morgantown.

The above description was made from Swaine's homotype of this species.

***Trypodendron lineatum* (Olivier)**

Figs. 2, 3, 5, 7, 8, 15, 19, 29, 30

- Bostrichus lineatus* Olivier, 1795, Entomologie 4(77):18.
Xyloterus lineatus, Hamilton, 1894, Trans. Amer. Ent. Soc. 21:406; Hopkins, 1899, West Virginia Agr. Expt. Sta. Bull. 56:444; Fall and Cockerell, 1907, Trans. Amer. Ent. Soc. 33: 217; Blatchley and Leng, 1916, Rhynchophora of Eastern North America, p. 646; Hagedorn, 1910, Coleopterorum Catalogus 4:114.
Trypodendron lineatum, Eichhoff, 1878, Mem. soc. roy. Liège 8:417; Hamilton, 1888, Trans. Amer. Ent. Soc. 16:158; Hamilton, 1894, Trans. Amer. Ent. Soc. 21:35, 406; Swaine, 1913, Rept. Ontario Ent. Soc. for 1912:89; Chamberlin, 1918, Oregon Agr. Expt. Sta. Bull. 147:38; Chamberlin, 1939, The Bark and Timber Beetles of North America, p. 300.
Apate bivittata Kirby, 1837, Faun. Bor. Amer. 4:192; Bethune, 1872, Can. Ent. 4:152.
Xyloterus bivittatus, Mannerheim, 1853, Bull. Mosc. 26:236; Leconte, 1868, Trans. Amer. Ent. Soc. 2:158; Eichhoff, 1871, Berl. Ent. Zeit. 15:137; Leconte, 1876, Proc. Amer. Philos. Soc. 15:426; Hubbard and Schwarz, 1878, Proc. Amer. Philos. Soc. 17:643; Schwarz, 1888, Proc. Ent. Soc. Washington 1:80; Hamilton, 1889, Trans. Amer. Ent. Soc. 16:158; Riley and Howard, 1891, Insect Life 3:435; Hopkins, 1894, West Virginia Agr. Expt. Sta. Bull. 35:295; Hopkins, 1894, Can. Ent. 26:278; Chittenden, 1895, Insect Life 7:419; Hubbard, 1897, U.S. Dept. Agr. Div. Ent. Bull. 7:28; Hopkins, 1901, U.S. Dept. Agr. Ent. Bull., n.s., 28:23.
Trypodendron bivittatum, Provancher, 1877, Petite Faune Entomologique du Canada 1:567; Hopkins, 1904, U.S. Dept. Agr. Div. Ent. Bull. 48:16; Currie, 1905, U.S. Dept. Agr. Div. Ent. Bull. 53:71; Swaine, 1918, Canadian Dept. Agr. Ent. Br. Bull. 14(2):85; Craighead, 1924, Canadian Dept. Agr. Ent. Br. Bull. 25:42; Felt, 1924, Manual of Tree Insects, p. 275; Peirson, 1927, Maine For. Serv. Bull. 5:120; Dodge, 1938, Minnesota Agr. Expt. Sta. Tech. Bull. 132:37; Kimmey and Furnis, 1943, U.S. Dept. Agr. Tech. Bull. 851:22; Beal and Massey, 1945, Bull. Duke Univ. School For. 10:107; Craighead, 1950, U.S. Dept. Agr. Misc. Pub. 657:339.
Bostrichus cavifrons Mannerheim, 1843, Bull. Moscou 16:297; Mannerheim, 1852, Bull. Moscou 25:359.
Trypodendron cavifrons, Swaine, 1918, Canadian Dept. Agr. Ent. Br. Bull. 14(2):85; Hopping and Jenkins, 1933, Canadian Dept. Int. For. Serv. Circ. 38, 14 p.; Chamberlin, 1939, The Bark and Timber Beetles of North America, p. 300; Prebble, 1944, British Columbia Lumberman 28(6): 50.
Trypodendron vittiger Eichhoff, 1880 (1881), Die europäischen Borkenkäfer, p. 298; Schwarz, 1886, Ent. Amer. 2:41; Chamberlin, 1939, The Bark and Timber Beetles of North America, p. 302.
Trypodendron borealis Swaine, 1917, Canadian Dept. Agr. Ent. Br. Bull. 14(1):21; Swaine, 1918, Canadian Dept. Agr. Ent. Br. Bull. 14(2):85; Chamberlin, 1939, The Bark and Timber Beetles of North America, p. 301.

This species is distinguished from other North American representatives of the genus by the smooth and shining elytral surface, by the steeper declivity (Fig. 2), with the raised subapical margin appearing broadly rounded when visible from above (Figs. 29, 30), by the colouration (Figs. 29, 30; five dark alternating with four pale longitudinal stripes), and in the male by the genitalic characters (Fig. 19).

Female.—Length 3.0–3.5 mm., 2.5 times as long as wide; body colour (Figs. 29, 30) very dark brown to black, with base of pronotum and interspaces two to four and seven to eight light yellowish-brown to dark brown, the transition from light to dark colour abrupt, the pale areas quite variable in extent, apparently depending upon the age of the specimen as well as other factors (presumably environmental).

Frons convex, weakly impressed above epistoma, with a short, broad rather indefinite median carina above the epistoma; surface reticulate, with rather fine sparse granules; vestiture fine, rather long, inconspicuous. Antennal club oval, with the mediodistal angle slightly produced.

Pronotum 1.2 times as wide as long; sides weakly arcuate, rather broadly rounded in front; anterior margin unarmed, several irregularly placed submarginal asperities present; asperities decreasing in size posteriorly to base; posterolateral area finely reticulate, with sparse, fine, shallow punctures; vestiture fine, sparse, inconspicuous.

Elytra 1.6 times as long as wide; sides subparallel on basal two-thirds, rather broadly rounded behind; striae punctures very fine, rather indistinctly and shallowly impressed; interspaces smooth and shining, with extremely minute, rather abundant, confused punctures (visible at a magnification of 40 diameters or more). Declivity convex, steep; striae punctures reduced; interspace two weakly impressed and slightly narrower than one or three; the subapical margin sharply elevated, scarcely or not at all visible from above, when visible the outline appearing broadly rounded from above. Vestiture sparse, short, fine.

Male.—Similar to female except: size slightly smaller, length 2.7–3.2 mm., 2.4 times as long as wide; frons broadly excavated from epistoma to vertex (Fig. 3), lateral margins ornamented by longer, more abundant hair; pronotum subquadrate, 1.4 times as wide as long, the anterior margin straight and unarmed. Male genitalia as figured (Fig. 19)

Type Locality.—Northern Europe, the exact locality is not known.

Hosts.—Almost any conifer within its range, including species of *Abies*, *Juniperus*, *Larix*, *Picea*, *Pinus*, *Pseudotsuga*, *Thuja*, and *Tsuga*; the series available at this time also include six records from *Alnus*, three from *Betula*, and two from *Malus*.

Distribution.—North Carolina to Minnesota, New Mexico to California, and northward through the coniferous forests to the northern limits of tree growth; also in northern Eurasia.

More than 3,000 specimens were examined from the following localities:—*Alberta*: Athabasca Landing, Edmonton, and Lesser Slave Lake. *British Columbia*: Avola, Blue River, Caycuse River, Copper Mountain, Creighton Valley, Duncan, Englewood, Franklin River, Glacier, Gordon River, Harris Creek, Hope Mountain, Jasper National Park, Kingsvale, Lens Creek, Likely, Lorna, "Mainland" (probably near Prince Rupert), Parker Creek, Pender Harbor, Saanich, Sarita River, Squamish, Stanley Park, Steelhead, Trinity Valley, Vancouver, Vermillion Summit, Vernon, and Victoria. *Manitoba*: Aweme, and Riding Mountain National Park. *New Brunswick*: Bathurst, Maple Grove, Nepisquit River, and "Pisquit Br." *Nova Scotia*: North Range. *Ontario*: Black Sturgeon Lake, Frater, Hymers, Ottawa, and Sudbury. *Quebec*: Chalk River, Ft. Coulonge, Gaspé, Granby, Ile Perrot, Lake Opasatica, Laniel, Memphremagog, and Ste. Anne de Bellevue. *Saskatchewan*: Prince Albert. *Alaska*: Hunter's Bay, and Sitka. *Arizona*: Flagstaff. *California*: Big Bear

Lake. *Colorado*: Newcastle, and Pitkin. *Idaho*: Coeur d'Alene, Kootenai, Lakeview, Pierce, and Prichard. *Maine*: *Camp Caribou*, Lewiston, and Orono. *Montana*: Columbia Falls, Henderson, Lincoln County, and Pine Grove. *Michigan*: Marquette. *Minnesota*: Lake Itasca. *New Mexico*: Cloudcroft, Las Vegas, and Sacramento Mountains. *New York*: Cranberry Lake, Elka Park, and Lake Placid. *North Carolina*: Great Smoky National Park, Pisgah Ridge, and Tryon. *Oregon*: Astoria, Clatsop, Corvallis, Forest Grove, Mary's Peak, Minam National Forest, Mount Ashland, Portland, and Santiam National Forest. *Pennsylvania*: North Mountain, and Philadelphia. *South Dakota*: Elmore. *Utah*: Alta, Beaver, Mammoth Mountain, and Logan Canyon. *Washington*: Buckeye, Easton, Hoquiam, Junction, London, Longmire, Merideth, Nasalle, Randle, Rock Creek and Satsop. *West Virginia*: Bayard, Crow, Davis, Grant County, and Randolph County. *Wyoming*: Yellowstone Lake.

The above descriptions of the male and female were prepared from Swaine's plesiotypes of *bivittatum*. The specimens in his collection under the names *cavifrons* and *borealis* represent normal colour variations of this species. After a careful and fruitless search for morphological and biological differences the writer reluctantly agreed with others (Chamberlin, 1939:300; (?)Schedl, 1951: 100) that the North American *bivittatum* is identical with the Eurasian *lineatum*.

***Trypodendron rufitarsis* (Kirby)**

Figs. 4, 12, 13, 20, 31, 32

Apate rufitarsis Kirby, 1837, Faun. Bor. Amer. 4:193; Leconte, 1868, Trans. Amer. Ent. Soc. 2:177; Bethune, 1872, Can. Ent. 4:152; Leconte, 1876, Proc. Amer. Philos. Soc. 15:426.

Trypodendron rufitarsis, Swaine, 1917, Canadian Dept. Agr. Ent. Br. Bull. 14(1):22, and 1918, 14(2):85; Dodge, 1938, Minnesota Agr. Expt. Sta. Tech. Bull. 132:36; Chamberlin, 1939, The Bark and Timber Beetles of North America, p. 302.

Trypodendron ponderosae Swaine, 1917, Canadian Dept. Agr. Ent. Br. Bull. 14(1):22, and 1918 14(2): 86; Chamberlin, 1918, Oregon Agr. Expt. Sta. Bull. 147:39; Chamberlin, 1939, The Bark and Timber Beetles of North America, p. 301.

This species is distinguished from other North American representatives of the genus by the dull, finely reticulate surface of the elytra, by the colouration by the narrowly rounded posterior outline of the elytra (Figs. 31, 32), in the female by the unarmed anterior margin of the pronotum, and in the male by the genitalic characters (Fig. 20).

Female.—Length 3.4–3.7 mm., 2.6 times as long as wide; body colour brown, the anterior and lateral areas of the pronotum and the sides of the elytra usually a darker brown, the transition from the light to dark colour gradual.

Frons convex, weakly impressed above epistoma, with a short, broad, rather indefinite median carina above the epistoma; surface reticulate, with rather fine sparse granules; vestiture fine, rather long, inconspicuous. Antennal club oval, with the mediodistal angle slightly produced.

Pronotum 1.2 times as wide as long; sides weakly arcuate, rather broadly rounded in front; anterior margin unarmed, several irregularly placed submarginal asperities present; asperities decreasing in size posteriorly to base; posterolateral area finely reticulate, with the sparse, fine, shallow punctures scarcely perceptible; vestiture fine, sparse, inconspicuous.

Elytra 1.7 times as long as wide; sides subparallel on basal two-thirds, narrowly rounded behind; striae punctures very fine, rather indistinctly and shallowly impressed; interspaces dull, minutely reticulate (visible at a magnification of 70 diameters or more). Declivity convex, moderately steep (Fig. 4); striae punctures smaller; interspace two rather weakly impressed and narrower than one or three; the subapical margin sharply elevated and produced on the apical portion giving the elytra a subacuminate appearance from above. Vestiture sparse, short, fine.

Male.—Similar to female except: size slightly smaller, length 2.9–3.2 mm., 2.5 times as long as wide; frons broadly excavated from epistoma to vertex, lateral margins ornamented by longer, more abundant hair; pronotum sub-

quadrate, 1.5 times as wide as long, the anterior margin straight and unarmed. Male genitalia as figured (Fig. 20).

Type Locality.—Boreal America, the exact locality in Canada not known.

Hosts.—*Picea* spp., *Pinus banksiana*, and *P. contorta*; rarely from other trees, including two authentic records from alder.

Distribution.—The coniferous forests of Canada and of the high mountains in the western United States.

Two hundred and twenty-eight specimens were examined from the following localities:—*British Columbia*: Likely, Lorna, Midday Valley, Mount Apex, Peachland, Stanley and Trinity Valley. *Manitoba*: Riding Mountain National Park. *New Brunswick*: Maple Grove, Nictor Lake, and "Pisquit Br." *Ontario*: Black Sturgeon Lake, and Hymers. *California*: Medicine Lake, and Yosemite National Park. *Colorado*: Newcastle. *Idaho*: Centerville. *Montana*: Beaver National Forest. *Oregon*: Cablicore, Detroit, Grant County, Klamath Falls, Pineville, and Whitman National Forest. *Utah*: Logan Canyon, and Mammoth Mountain. *Washington*: Longmire, and Olympia.

The above descriptions were prepared from Swaine's plesiotypes; they were compared with Kirby's types at the British Museum of Natural History (Swaine, 1917:22). Swaine described *ponderosae* from a male and a female of *rufitarsis*; most of the other specimens before him were dark specimens of *lineatum*. The "constantly darker colour, deep shining black" to which he referred (Swaine, 1917:22) applies to the specimens of *lineatum*, but not to the specimens labeled as the types of *ponderosae* in his collection.

Genus *DENDROTRYPUM* Schedl

Dendrotrypum Schedl, 1951, Mitt. forstl. Bundes-Vers. Anst. Mariabrunn 47: 76.

Trypodendron, Blandford, 1894 (in part), Trans. Ent. Soc. London, p. 124; Stark, 1952, Fauna U.S.S.R. 31:360.

Xyloterus, Niisima, 1909 (in part), Jour. College Agr. Sapporo, Japan, 3(2):163.

The genus *Dendrotrypum* is known only from six east Asian species. It is considered here only because of its significance in the evolution of the tribe. Only one female specimen, *D. aceris* (Niisima), was available for this study.

Genus *XYLOTERINUS* Swaine

Xyloterinus Swaine, 1918, Canadian Dept. Agr. Ent. Br. Bull. 14(2):83; Blackman, 1922, Mississippi Agr. Expt. Sta. Bull. 11:78; Dodge, 1938, Minnesota Agr. Expt. Sta. Tech. Bull. 132:34; Chamberlin, 1939, The Bark and Timber Beetles of North America, p. 285; Beal and Massey, 1945, Duke Univ. School Forestry Bull. 10:106; Schedl, 1951, Mitt. forstl. Bundes-Vers. Anst. Mariabrunn 47:74.

This genus is distinguished from the allied genera by the broadly and weakly procurved subcorneous basal area of the antennal club (Fig. 15), and the rather large, broad, transverse proepimeral excavation of the female (Fig. 1).

Description.—Female distinctly larger than the male. Frons convex in both sexes, although somewhat flattened in the male (Fig. 11). Antennal club with the subcorneous basal area much thicker and broadly procurved (Figs. 14, 16). Pronotum subcircular, with the anterior margin strongly procurved and armed in both sexes (Figs. 33, 34); the foveate excavation on proepimeral area of the female (Fig. 1) rather long and broad, transverse. Elytra with punctures of striae and interstriae distinct; declivity convex. Anterior tibia flattened, with the posterior face smooth in both sexes (Fig. 9).

Type Species.—*Bostrichus politus* Say, monobasic.

Xyloterinus politus (Say)

Figs. 1, 9, 14, 16, 22, 33, 34

Bostrichus politus Say, 1826, Jour. Acad. Nat. Sci. Philadelphia 5:256.

Xyloterus politus, Leconte, 1859, The Complete Writings of Thomas Say 2:318; Leconte, 1868, Trans. Amer. Ent. Soc. 2:159; Leconte, 1876, Proc. Amer. Philos. Soc. 15:358; Hubbard and Schwarz, 1878, Proc. Amer. Philos. Soc. 17:666; Eichhoff, 1878, Mem. soc. roy. sci. Liège 8:420; Fletcher, 1886, Ont. Ent. Soc. 17:32; Schwarz, 1889, Proc. Ent. Soc. Washington 1:149; Packard, 1890, U.S. Ent. Comn. Rept. 5:387;

Schwarz, 1890, *Insect Life* 3:87; Schwarz, 1891, *Proc. Ent. Soc. Washington* 2:77; Hopkins, 1893, *West Virginia Agr. Expt. Sta. Bull.* 31:134; Hopkins, 1894, *Can. Ent.* 26:278; Hamilton, 1895, *Trans. Amer. Ent. Soc.* 22:346, 378; Hubbard, 1897, *U.S. Dept. Agr. Div. Ent. Bull.* 7:28; Hopkins, 1899, *West Virginia Agr. Expt. Sta. Bull.* 56:444; Blatchley and Leng, 1916, *Rhynchophora of North Eastern America*, p. 645.

Xyloterinus politus, Swaine, 1918, *Canadian Dept. Agr. Ent. Br. Bull.* 14(2):83; Drake, 1921, *Ohio Jour. Sci.* 21:205; Blackman, 1922, *Mississippi Agr. Expt. Sta. Bull.* 11:78; Dodge, 1938, *Minnesota Agr. Expt. Sta. Tech. Bull.* 132:34; Chamberlin, 1939, *The Bark and Timber Beetles of North America*, p. 286; Beal and Massey, 1945, *Duke Univ. School Forestry Bull.* 10:106; Nash, 1951, *Maine For. Serv. Bull.* 15:46.

Xyloterus unicolor Eichhoff, 1871, *Berl. Ent. Zeit.* 15:136; Hopkins, 1893, *West Virginia Agr. Expt. Sta. Bull.* 31:134; Hopkins, 1894, *Can. Ent.* 26:278.

Trypodendron unicolor Eichhoff, 1878, *Mem. soc. roy. sci. Liège* 8:419.

Female.—Length 3.3–3.7 mm., 2.7 times as long as wide; body colour dark brown.

Frons convex, a weak transverse impression just above epistoma, and a feeble median elevation from epistoma to upper level of eyes; surface of epistoma smooth and shining, reticulate and sparsely, rather coarsely granulate above; vestiture sparse, fine, rather long. Eye completely divided, the subequal halves separated by a distance equal to the width of the upper half; finely granulate. Antennal scape rather long; funicle four-segmented; club as long as scape, oval, the basal area thicker, subcorneous and on the anterior face broadly procurved.

Pronotum very slightly wider than long (1.02 times); sides feebly arcuate on basal two-thirds, subcircularly rounded in front; anterior margin armed by four teeth; the asperities decreasing in size posteriorly, very fine and rather sparse behind summit; surface of posterior and lateral areas reticulate, shallowly, rather finely punctured; vestiture inconspicuous, fine, short, sparse. Proepimeral excavation rather large, about four times as long as wide, the long axis transverse, extending from the posterolateral coxal margin more than two-thirds of the distance toward the sharply margined posterolateral angles of the disc.

Elytra 1.7 times as long as wide, sides subparallel on basal two-thirds, rather broadly rounded behind; striae not impressed, the punctures small, distinctly impressed; interstriae two to three times as wide as striae, smooth, the punctures about half as large as those of striae, shallow, in irregular rows. Declivity rather steep, convex; striae weakly impressed, the punctures somewhat larger than on disc; costal margin sharply raised near apex. Vestiture consisting of sparse, fine, hairlike setae; short on disc, longer and more abundant on declivity.

Male.—Similar to female except: length 2.7–2.9 mm., 2.4 times as long as wide; frons (Fig. 11) more strongly impressed from epistoma to above eyes, only feebly convex; teeth on anterior margin of pronotum usually reduced in size, sometimes obsolete; and the proepimeral excavation poorly developed and smaller. Male genitalia as figured (Fig. 22).

Type Locality.—An unspecified locality in the United States.

Hosts.—*Acer*, *Alnus*, *Betula*, *Carya*, *Castanea*, *Fagus*, *Fraxinus*, *Quercus*, *Picea*, *Pinus*, *Tsuga*, and *Ulmus*. Records from coniferous hosts are comparatively rare.

Distribution.—Eastern North America from New Brunswick to Minnesota and south to Mississippi and northern Florida.

Four hundred and twenty-three specimens from the following localities have been examined:—*New Brunswick*: Fredericton. *Ontario*: Ottawa, Ridgeway, and Toronto. *Quebec*: Chelsea, Granby, Ile Perrot, Lac Tremblant Nord, Montreal, Mount Orford, Plessisville, Quebec, Ste. Anne de Bellevue, and Ste. Hilaire. *District of Columbia*: Washington. *Illinois*: Champlain. *Kentucky*: Cumberland State Park, and Louisville. *Maine*: Brunswick, and Orono. *Maryland*: Bladensburg, and Plummers Island. *Massachusetts*: Cambridge, Framingham, and W. Springfield. *Michigan*: Detroit, and Grand Ledge. *Missis-*

sippi: Luke. *New Hampshire*: Claremont, and Webster. *New Jersey*: Boonton, Morristown, and Orange Mountains. *New York*: Buffalo, Cranberry Lake, Fourth Lake of the Fulton Chain, Ithaca, Syracuse, and West Point. *North Carolina*: Pink Beds. *Ohio*: Cleveland. *Pennsylvania*: Angora, Frankford, and Inglenook. *Virginia*: Jones Creek. *West Virginia*: Bayard, Little Falls, Monongalia County, Morgantown, Wood County, and Wayne County. *Wisconsin*: Madison.

The above descriptions were prepared from specimens collected at Lac Tremblant Nord, Quebec.

Methods

During the course of this study more than 4,200 specimens were examined. Slightly less than 2,000 of these were studied at the U.S. National Museum, at Washington, the remainder were examined at Ottawa. The types of Swaine's *T. betulae*, *T. borealis*, and *T. ponderosae* were examined personally. The writer's concept of *T. scabricollis*, *T. retusum*, and *X. politus* was based on Swaine's homotypes of these species; studies of the types by Hopkins and Blackman supported Swaine's identification of these species. The concept of *T. bivittatum*, *T. cavrifrons*, and *T. rufitarsis* was based on Swaine's plesiotypes of these species; his specimen of *T. rufitarsis* was compared directly with Kirby's types. The identity of *T. vittiger* was determined by a study of Eichhoff's original diagnosis. The concept of *lineatum* was obtained from a study of more than 60 European examples of this species.

All drawings were prepared with the aid of an ocular grid.

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