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U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ENTOMOLOGY.
L. O. HOWARD, Entomologist and Chief of Bureau.

TECHNICAL PAPERS ON MISCELLANEOUS FOREST INSECTS.

I. CONTRIBUTIONS TOWARD A MONOGRAPH OF THE BARK-WEEVILS OF THE GENUS PISSODES.

BY

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In Charge of Forest Insect Investigations.

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Entomology,
Washington, D. C., July 25, 1910.

Sir: I have the honor to transmit herewith manuscript of the first part of a bulletin of the technical series to be entitled "Technical Papers on Miscellaneous Forest Insects. I. Contributions Toward a Monograph of the Bark-weevils of the Genus Pissodes," by Dr. A. D. Hopkins. Although the bark-weevils are among the most important enemies of coniferous forest trees, and especially of the young growth, comparatively little has been known heretofore of the species; hence the special need for this contribution as a basis for economic investigations and publications. It embodies the results of extensive systematic work by Doctor Hopkins on new material contained in the collections of the Bureau of Entomology and the United States National Museum and includes the descriptions of twenty-three species new to science.

I recommend the publication of this manuscript as Technical Series No. 20, Part I, of the Bureau of Entomology.

Respectfully,

L. O. Howard,
Entomologist and Chief of Bureau.

Hon. James Wilson,
Secretary of Agriculture.

PREFACE TO BULLETIN.

It is the purpose of this bulletin to include such miscellaneous technical papers on insects, other than the scolytid beetles, as are either injurious or beneficial and of more or less importance in their relation to American forests. These papers are based largely, if not entirely, on original observations and investigations, supplemented by material in the United States National Museum, and serve as a necessary basis for the nontechnical papers on the same insects. As they are intended to be of service especially to the economic entomologist and to the student of forest entomology, they are, as a rule, presented in a somewhat less formal style than if intended for the systematist only.

A. D. H.

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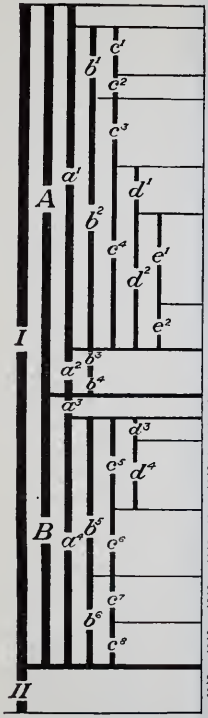

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Classification of the Genus Pissodes, Showing Technical and Common Names and Species Numbers. (Original.)

This diagram will enable the reader to refer at once to the technical and common names of any species number mentioned in the text, and will show at a glance the position and relations of the divisions, subdivisions, sections, subsections, series, subseries, minor series, and species into which the genus is divided.

U. S. D. A., B. E. Tech. Ser. 20, Pt. I. F. I. I., January 7, 1911.

TECHNICAL PAPERS ON MISCELLANEOUS FOREST INSECTS.

I. CONTRIBUTIONS TOWARD A MONOGRAPH OF THE BARK-WEEVILS OF THE GENUS PISSODES.

By A. D. Hopkins,

In Charge of Forest Insect Investigations.

INTRODUCTORY.

The bark-weevils of the genus *Pissodes* represent an important class of enemies of pine, spruce, and fir trees. For this reason, in the future management of federal, state, and private forests there will be a demand for information on the species and on practical methods of preventing or reducing the damage from their attacks. Heretofore comparatively little has been known about the North American species, and consequently there has been much confusion in collections and in published information, due to the possession of insufficient facts relating to the destructive characters and habits of the described species, and especially because of the number of undescribed species which have not been recognized or have been wrongly identified.

It is the object of this contribution to revise the generic and specific descriptions, to describe the species recognized by the author as new to science, and to record some of the results of the more technical features of the investigations. This is part of a manuscript on the genus *Pissodes* which was prepared by the author in 1905, but which, owing to the pressure of other duties, was not completed.

The study of this group of beetles has made it plain to the author that there is urgent need for special work on the rhynchophorous beetles of the world, with a view to determining the more important characters on which to base a satisfactory classification of this important division of the Coleoptera. This is, however, too great a task to be undertaken by any one systematist until the principal genera have been thoroughly studied and monographed by specialists.

For a number of years the writer has given special attention to the family Scolytidæ, with a view to monographing it, and in connection

with this work the genus *Pissodes* has been studied in some detail and many other genera of the Rhynchophora and other Coleoptera have received attention in order that a broader knowledge of the order, and of the division to which the Scolytidæ belong, might be acquired, but there has been no idea of specializing on any but the Scolytidæ and possibly a few genera, like *Pissodes*, which are of special interest in connection with forest entomology.

The material which has served as a basis for this bulletin is that collected by the writer between 1890 and 1902, that collected by him and by the assistants in forest insect investigations, Bureau of Entomology, between 1902 and 1907, and that found in the collections of the United States Department of Agriculture and United States National Museum, especially in the Hubbard and Schwarz collection. Studies were made also of good series of specimens of 5 European species sent to the Bureau through the kindness of Dr. R. Heymons and Prof. H. Kolbe, of the Royal Zoological Museum of Berlin, and 3 European species represented in the United States National Museum collection.

The abbreviations adopted in this publication in referring to material in the different collections examined and that identified by the writer are as follows:

D. A.—Division and Bureau of Entomology, United States Department of Agriculture, Washington, D. C., other than *Hopk. U. S.*

Hopk. U. S.—Branch of Forest Insect Investigations, Bureau of Entomology, United States Department of Agriculture, Washington, D. C.

Hopk. W. Va.—West Virginia Agricultural Experiment Station, Morgantown, W. Va.

U. S. N. M.—United States National Museum, Washington, D. C.

H. & S.—H. G. Hubbard and E. A. Schwarz collection in the United States National Museum.

A. M. N. H.—American Museum of Natural History, New York, N. Y.

The author desires to acknowledge in this connection the assistance of Messrs. W. F. Fiske, H. E. Burke, and J. L. Webb in the collecting of material and recording of field observations, to Messrs. C. B. Dyar and E. J. Kraus for assistance in compiling the bibliography, and to Mr. J. F. Strauss for assistance in the preparation of the illustrations.

HISTORICAL REFERENCES.

The name *Pissodes* (pitch-colored) was first proposed by E. F. Germar (1817, p. 340) without description, but to include *Rhynchænus bufo* Fab., *Lixus notatus* Fab., and *Rhynchænus pini* L. Later (Germar, 1824, pp. 316–319) he described the genus, part of which was based on the mouth parts of *Pissodes pini* and *P. notatus*, but among the 10 species described only one, *P. nemorensis*, has been retained. A copy of the original description of the genus and of this species follows:

COPY OF ORIGINAL DESCRIPTION OF THE GENUS.

PISSODES. Genus novum.[a]

Character generis.

[p. 316] Rostrum thoraci subaequale aut longius, teres, scrobe sensim subtus flexa. Antennae pone medium rostri insertae, breves, funiculo septemarticulato, articulis subaequalibus. Oculi distantes, immersi. Thorax subtus integer. Scutellum distinctum. Coleoptera oblonga, abdomen et alas obtegentia. Pedes fortes, sub [p. 317] aequales, tibiis apice unco inflexo armatis, tarsis brevibus, latis, articulo penultimo bilobo.

Pissodis corpus oblongum, obscurum, maculis squamosis variegatum. Rostrum thoraci subaequale aut longius, tenue, arcuatum, teres, apicem versus planiusculum, scrobe lineari, sensim subtus flexa, basi rostri subtus connivente.

Antennae pone medium rostri insertae, breves, fractae, scapo recto, parum clavato, funiculo septemarticulato, articulis lenticularibus, 1. 2. sublongioribus, obconicis, clava ovali.

Caput parvum, rotundatum, oculis rotundis, lateralibus, immersis.

Mandibula valida, cornea, tridentata. Maxilla membranacea, intus biloba: lobo majore ovato, ciliato, denticulato, altero parvo, ensiformi, basali. Palpi quatuor aequales, conici. Glossarium corneum, oblongum, basi angustatum, intergerio parvo, basali, ciliato. Inveni instrumenta cibaria in P. pini et P. notato.

Thorax transversus, convexus, apice subito angustatus, coarctatus, subtus pone gulam leviter emarginatus, canali pro receptione rostri nullo praeditus.

Scutellum distinctum.

Coleoptera basi thorace parum latiora, oblonga, convexa, postice callosa, apice rotundata, abdomine haud breviora, alas obtegentia.

[p. 318] Pedes fortes, subaequales, antici approximati. Femora clavata, plerumque dentata, tibiae parum compressae, apice intus angulatae, extus unco magno introrsum flexo armatae, tarsi breves lati, articulis 1. 2. trigonis, penultimo latiore bilobo, ultimo clavato, biunguiculato.

Degunt species indigenae in truncis arborum resinosorum, captivi hostem tibiarum unco arcte complectuntur.

([No.] 456) Pissodes nemorensis: femoribus muticis, piceus, thorace punctato rugoso, punctis duobus albis, elytris fulvo-subfasciatis, macula infra medium alba. Habitat in America boreali. (Kentucky.)

Affinis certe P. notato, paullo minor et macula elytrorum alba apici propius. Rostrum thorace longius, punctulatum, piceum. Thorax lateribus parum rotundatus, apice coarctatus, rugoso-punctatus, obsolete carinatus, piceus, punctis duobus disci albo-squamosis. Scutellum albido-squamosum. Coleoptera thorace paullo latiora, et latitudine sesqui longiora, lateribus recta, apice obtuse rotundata, utrinque impressa; convexa, striato-punctata, interstitiis alternis latioribus, elevatioribus, picea, brunneo parum squamosa, fasciis utrinque duabus obsoletis fulvis, posteriore juxta suturam macula alba terminata. Corpus subtus piceum. [p. 319] grisco-squamosum. Pedes picei, femoribus muticis, ante apicem griseo-annulatis.

[TRANSLATION OF ORIGINAL DESCRIPTION.]

PISSODES. New genus

Generic characters. Beak not quite as long or longer than the prothorax, cylindrical, scrobe noticeably flexed under. Antennae

[a] From "Insectorum species novae," by E. F. Germar, vol. 1 (Coleoptera), pp. 316-319, 1824

inserted behind the middle of the beak, short, funiculus 7-segmented, the segments subequal. Eyes separate, sunken [impressed]. Thorax entire below. Scutellum distinct. The elytra oblong, covering the abdomen and wings. Feet strong, subequal, tibiæ armed at apex with an incurved hook, tarsi short, broad, the penultimate segment bilobed.

The body of *Pissodes* is oblong, obscure, variegated with spot-covered scales. The rostrum not quite equal to or longer than thorax, slender, curved, cylindrical, somewhat flattened toward the apex, scrobe linear, noticeably flexed under, in close approximation to the base of the rostrum below.

Antennæ inserted posterior to the middle of the beak, short, elbowed, scape straight, somewhat clavate, funiculus 7-segmented, the segments lenticular, 1 and 2 somewhat longer, obconical, club oval.

Head small, rounded, eyes round, lateral, sunken [margin impressed].

Mandibles strong, corneous, tridentate. Maxilla membranous, bilobed internally: the larger lobe ovate, ciliate, denticulate, the other small, ensiform, basal. Palpi four, equal, conical. Glossarium [labium] corneous, oblong, narrowed at base, intergerium [ligula] small, basal, ciliate. I have examined the mouth parts in *P. pini* and *P. notatus*.

Thorax transverse, convex, the apex slightly narrowed, coaretate, slightly emarginate below behind the gula, not provided with a canal for the reception of the rostrum.

Scutellum distinct.

Elytra slightly broader than the thorax at base, oblong, convex, posteriorly calloused, rounded at apex, not shorter than the abdomen, covering the wings.

Feet strong, subequal, approximate anteriorly. Femora clavate, frequently dentate,[a] tibiæ hardly compressed, angulate interiorly at the apex, exteriorly armed with a large hook flexed inward, tarsi short, broad, segments 1 and 2 triangular, the penultimate broader, bilobed, the last clavate, with two claws.

The indigenous species live in the trunks of resinous trees; they are able to hold on to the host by the curved hook of the tibia.

[No.] 456. Pissodes nemorensis: Femora shortened, piceous, thorax rugosely punctate, with two white spots, elytra subfasciate with yellow, a white spot below the middle. Lives in North America. (Kentucky.)

It is certainly similar to *P. notatus*, a little smaller, and the white spot of the elytra near the apex. Beak longer than the thorax, punctulate, piceous. Thorax with the sides somewhat rounded,

[a] Relates to *Hylobius* and *Hilipus*.

coarctate at apex, rugosely punctate, obsoletely carinate, piceous, with two disklike spots of white scales. Scutellum with white scales. Elytra slightly broader than thorax and half again longer than wide. Sides straight, obtusely rounded at apex, impressed at either side; convex, striato-punctate, the alternate interspaces broader, more elevated, piceous, lightly clothed with brown scales, each with two obsolescent fulvous bands, posteriorly close to the suture terminated with a white spot. Body piceous below, with gray scales. Feet piceous, the femora shortened, annulated with gray before the apex.

Following are the names of the other species described and the genera and species to which they were later referred.

No. 457. *Pissodes macellus* = *Hylobius pales* Boh., Sch. Curc., II, 340.

No. 458. *Pissodes choicus* = *Hilipus choicus* (Germar).

No. 459. *Pissodes onychinus* = *Hilipus onychinus* (Germar).

No. 460. *Pissodes flammiger* = *Hilipus flammiger* (Germar).

No. 461. *Pissodes picturatus* = *Hilipus picturatus* (Germar).

No. 462. *Pissodes polymitus* = *Hilipus polymitus* (Germar).

No. 463. *Pissodes erythrorhynchus* = *Hilipus erythrorhynchus* (Germar).

No. 464. *Pissodes prodigialis* = *Hilipus prodigialis* (Germar).

No. 465. *Pissodes trachypterus* = *Hilipus trachypterus* (Germar).

Schoenherr (1826, pp. 225–226) was the first to subdivide the genus and to designate *Pissodes pini* (L.) as the type and *P. piceæ* (Ill.), *P. harcynia* (Herbst), *P. notatus* (Fab.), *P. piniphilus* (Herbst), and *P. nemorensis* Germ. as cotypes. Therefore, according to the rules of nomenclature (Stiles, 1905, pp. 26–27), *Pissodes pini* (L.) must stand as the type of the genus.

It appears that up to 1909 the genus was represented by 21 authentically recognized species, 7 from North America, 9 from Europe, 3 from eastern Siberia, and 2 from Japan, as follows:

LIST OF SPECIES OF PISSODES DESCRIBED PREVIOUS TO 1909, WITH RECORDED DISTRIBUTION AND HOST TREES.

NORTH AMERICA.

Species of Pissodes.	Reference to original description in bibliography.	Distribution.	Host.
affinis Randall	1838, p. 24	North America	*Pinus.*
costatus Mannerheim	1852, p. 363	Sitka	Pine (?
dubius Randall	1838, p. 24	North America	*Abies.*
fasciatus Le Conte	1876, p. 143	Oregon.	
strobi Peck	1817, p. 205	Maine to North Carolina	*Pinus strobus.*
nemorensis Germar	1824, p. 318	Kentucky.	
rotundatus Le Conte	1876, p. 143	Lake Superior.	

EUROPE.

gyllenhali Gyllenhal, in Schoenherr	1836, p. 260	North Germany, Sweden, eastern Siberia.	
harcyniæ Gyllenhal	1813, p. 68	Sweden.	
harcyniæ Herbst	1795, Käf., vi, p. 294	Middle northern Europe	*Picea.*
interstitiosus Sahlberg		Finland.	
quadrinotatus Panzer	1801?	Germany.	
notatus Fabricius	1787, p. 103	Europe—Russia to Greece, Spain, Italy, Madeira, England	*Pinus sylvestris, Pinus strobus, Picea, Larix.*
var. *castaneus* De Geer	1775, p. 231	Germany	
var. *brunneus* Panzer	1801?	Germany.	
var. *palmes* Herbst	1795, Käf., vi, p. 169	Germany.	
fabricii Stephens	1829, p. 88	England.	
pini Olivier	1807, p. 116	France.	
strobili Redtenbacher	1874, p. 417?	Germany.	
piceæ Illiger	1807, p. 309	Mountains of middle Europe; Caucasus	*Abies pectinata.*
fabricii Leach, MSS., in litt		England.	
notatus Sturm	1826, Catalogue, p. 184	Germany.	
pini Panzer	1801?, 42, 1	Germany.	
piniphilus Megerle, MSS., in litt		Hungary.	

pini Linnæus	1798, p. 379	Europe	*Pinus sylvestris, Pinus strobus, Picea, Larix.*
a. ferrugineus Rey	1895.		
abietis Schrank	1798, p. 480	Germany.	
piniphilus Herbst	1797, VII, p. 21	Northern and middle Europe	*Pinus.*
rotundicollis Desbrochers	1810, p. 191	Russia.	
scabricollis Miller	1859, p. 364	Austria, Hungary, Bohemia	*Picea.*
validirostris Gyllenhal, in Schoenherr	1836, p. 259	Northern Europe, Germany, Austria	*Pinus sylvestris* (cones).
v. latatus Redtenbacher	1874, p. 418	Germany.	

ASIA (SIBERIA)

cembræ Motschulsky	1860, p. 158	Dauria (eastern Siberia) as far as the banks of the Amur River	*Pinus cembra*
insignatus Boheman		Irkutsk (eastern Siberia)	
Schoenherr	Gen. Curc., VII, p. 133.		
lor[illegible]us Motschulsky	1860, p. 159	Dauria (eastern Siberia)	*Pinus* and *Larix.*
irroratus Reitter	1899, p. 208	Kamtschatka (eastern Siberia).	

JAPAN

nitidus Roelofs	1874, p. 121	Japan.	
obscurus Roelofs	1874, p. 122	Japan.	

TAXONOMY.

CHARACTERS USED BY DIFFERENT AUTHORS.

Beginning with the second division of the Coleoptera or suborder Rhynchophora of most of the authors, the principal characters compiled from Lacordaire (1863), Le Conte and Horn (1876), Ganglbauer (1903), Kolbe (1903), and Bedel (1886–1888), which led up to the family Curculionidæ may be summarized as follows:

SUBORDINAL AND FAMILY CHARACTERS.

Head prolonged into a beak; maxillary palpi rigid, *4-jointed, without palparium* (see "Revisional notes," page 9); labial palpi 3-jointed; labrum absent; gular sutures wanting; prosternum with epimera extending across the base (see "Revisional notes," page 9); testicles globular; abdomen always with 5 (visible) ventral segments (see "Revisional notes," page 9); tibiæ without movable spines; *pygidium divided* (see "Revisional notes," page 9); elytra with strong fold toward inner edge; tarsi dilated, brushlike beneath, third joint bilobed, fourth obscure; mandibles without accessory pieces; antennæ geniculate, clubbed; beak more or less curved.

Continuing through the family Curculionidæ, the principal characters, adopted by one or more of the authors mentioned, which lead up to the subfamilies, tribes, or groups to which the genus Pissodes was referred, are as follows:

TRIBAL AND SUBFAMILY CHARACTERS.

Lacordaire (1863, pp. 442–464): Mentum leaving maxilla exposed; submentum forming a peduncle; anterior coxæ usually contiguous; pygidium covered by the elytra; metasternum more or less elongate; metepisternum at least moderately broad; antennal funiculus 7-jointed; beak variable, with antennal grooves; mesepimerum not ascending toward base of elytra; prothorax with anterior ventral margin usually emarginate. Tribe Hylobiides.

Tarsal claws free; elytra with elevations at base; mesepimerum usually large; body oblong, oval. Group Hylobiides.

Le Conte and Horn (1876, pp. 122, 137): Tibiæ with tooth of outer apical angle small; eyes not contiguous beneath; mandibles with 3 teeth; side pieces of metathorax distinct; lateral angles of first ventral segment not visible; mentum transverse; labial palpi large. Tribe Hylobiini.

Stierlin (1883, p. 403): Tibiæ compressed; inner edge bisinuate with apical hook. Subfamily Hylobiini.

Bedel (1888, p. 65): Tibiæ without distinct groove on the inner edge, but with an incurved apical tooth; ventral segments 2 and 4

with straight sutures; anterior coxæ separated, but without groove for beak; tarsal claws small. Tribe Pissodini.

Nüsslin (1905, p. 110): Beak with antennal insertion near the middle. Subfamily Pissodini.

REVISIONAL NOTES.

GENERIC CHARACTERS.

The anterior ventral margin of the prothorax is not slightly emarginate in any of the species examined by the writer. The reference to a dentate femur was based on the species of *Hylobius* and *Hilipus*. With these exceptions, the original description applies very well to all of the known species.

SUBORDINAL AND FAMILY CHARACTERS.

There has been considerable difference of opinion among systematists as to whether the palpus should be referred to as 4-jointed or 3-jointed.

It is evident to the writer that the lateral segment of the maxilla, which has been mistaken for the basal joint of the palpus, is homologous with the palpifer in other Coleoptera and orders of insects, and it would seem, therefore, that the rigid, 3-jointed palpi should be recognized as one of the important characters to distinguish the true Rhynchophora from the other Coleoptera. It would remove the Anthribidæ and some other groups which, on account of the absence of gular sutures, have been placed with the Rhynchophora, but the writer is inclined to agree with some recent authors that these really do not belong in the Rhynchophora. In representatives of the Curculionidæ, Scolytidæ, and several other families examined by the writer, the maxillary palpus is distinctly 3-jointed. In some, as in *Pissodes*, the palpifer closely resembles a basal joint of the palpus, but it joins the stipes and the apex does not extend beyond the base of the galea. Therefore it can not belong to the palpus, but is the part of the body of the maxilla to which the palpus is attached, designated as the palpifer.

ABDOMINAL SEGMENTS.

The abdominal tergites 7 and 8 have been referred to by various authors as the pygidium, propygidium, divided pygidium, etc. Indeed, the terms "pygidium" and "propygidium" have been extensively used in systematic entomology, and there is a very general lack of uniformity in their application to the apical or subapical tergite without regard to their numerical relation. There seems to be serious objection to this general application of these terms in classification, from the fact that in comparative anatomy

they have no meaning. Therefore in the use of the terms "pygidium" or "propygidium" it is important that the numerical position of the tergite should be mentioned.

In the Curculionidæ, for instance, tergite 7 of the female occupies the pygal position, while tergite 7 of the male occupies the propygal position, and tergite 8 the pygal. In the Curculionidæ, Scolytidæ, and many other Coleoptera abdominal tergite 7 is by far the most important of the series, owing to the fact that it presents important characters of structure, sculpture, stridulating accessories, sex, etc. (see Plate VI).

There is also some confusion with reference to the abdominal sternites, or ventral segments. The 5 segments often referred to as the first to fifth are the sternites of the third to seventh abdominal segments, the first and second being obscured by the coxal cavity (Hopkins, 1909, fig. 38). Therefore they should be referred to either in their proper numerical order or as the 5 visible abdominal sternites.

REVISED CLASSIFICATION.

It appears to the writer that it would contribute to a more convenient and natural arrangement if we would give the Curculionidæ of most authors the rank of superfamily, and thus promote the old subfamilies and tribes to families and subfamilies. Thus the genus Pissodes would fall in the superfamily Curculionoidea, family Curculionidæ, and subfamily Pissodinæ.

The subfamily Pissodinæ would come next to the group of genera comprising the subfamily Hylobiinæ. The two subfamilies are characterized as follows:

SUBFAMILY HYLOBIINÆ.

Anterior coxæ contiguous; prothorax with anterior ventral margin emarginate and produced toward the sides; beak stout, with antennal insertion in front of middle or toward the tip; eyes oval; tibiæ without tooth on inner apical angle. The North American genera of this subfamily are distinguished as follows:

I. Metasternum very short..... *Paraplinthus.*
II. Metasternum long.
  A. Tibiæ with outer apical angle dilated..... *Pachylobius.*
  B. Tibiæ with outer apical angle not dilated.
    a1. Tibiæ commonly narrowed toward tip..... *Hilipus.*
    a2. Tibiæ not narrowed toward tip.
      b1. Femora not toothed..... *Hypomolyx.*
      Eudocimus.
      b2. Femora toothed..... *Hylobius.*

SUBFAMILY PISSODINÆ.

Anterior coxæ slightly separated; prothorax with anterior ventral margin not emarginate or produced toward sides; beak usually slender, with antennal insertion at or toward middle; eyes rounded; tibiæ with tooth on inner apical angle.

Metasternum long, femora not toothed ..... *Pissodes.*

SUBORDINAL TO SUBFAMILY CHARACTERS.

Head behind the eyes without gular space; maxillary and labial palpi rigid, 3-jointed; labrum wanting or obscure. Suborder Rhynchophora.

Beak or rostrum prominent; elytra with lateral fold or groove; abdomen of sexes with different number of tergites (8 in the males, 7 in the females); tarsi with fourth joint obscure, third bilobed, ventral surface of first to third densely clothed with fine velvety hairs, fifth joint with simple claws ..... Superfamily Curculionoidea.

Gular peduncle (submentum) usually long; antennæ 11-jointed, geniculate ..... Family Curculionidæ.

Prothorax with anterior ventral margin not distinctly emarginate; tibiæ with incurved apical tooth; femora unarmed; anterior coxæ not widely separated; abdominal tergites covered by the elytra; sternites 3 and 4 (1st and 2nd visible) very long, 5 and 6 short, 7 as long as 5 and 6 together; eyes rounded, widely separated. Subfamily Pissodinæ.

GENERIC CHARACTERS.

Length, ranging from 3.7 to 10 mm.; body oblong, reddish brown to black, sparsely to thickly clothed with slender to broad scales, the latter often forming spots on the pronotum, elytra, and femora.

Pronotum variable; broader than long, rarely as long as broad, narrowed in front of middle and usually constricted toward head; posterior angles rounded, rectangular or acute; punctures of dorsal surface with intervening flat or elevated contiguous spaces which sometimes obscure the punctures.

Elytra variable, more than as long again, with the base as broad or slightly broader than the pronotum, the sides parallel or slightly narrowed posteriorly, and slightly constricted on each side of the declivity; interspaces convex to flat, the alternating ones often broader and more elevated; punctures of striæ regular or irregular in size. Declivity oblique, the third and ninth interspaces joined around a distinct impression at the apex of the fourth, seventh, and eighth interspaces; fifth strongly elevated at the vertex. Apex of each elytron rounded or subacute; striæ distinctly punctured.

Head (figs. 1, 2) behind the eyes globular, about one-half maximum width of prothorax, smooth, punctured, slightly impressed between the eyes and with a few scales on the front toward the margins of the eyes.

Beak slender, cylindrical, punctured, as long as prothorax or longer, with sides parallel or slightly narrowed toward middle, or slightly broader toward base of mandibles. Antennal insertion at or toward middle and the antennal groove beginning just in front of insertion and extending almost parallel with ventral margin to near eyes.

Antennæ (fig. 1).—Scape shorter than funicle, which is 7-jointed; first joint about as long as second and third together; second to seventh of about equal length, but slightly increasing in width toward club; first joint of club large, much longer on one side, and sparsely clothed with short hairs and long bristles; other joints of club slightly more flattened on one side, more densely clothed with fine hairs, and the sutures as shown in figures 1 and 2.

ANATOMICAL DETAILS OF THE ADULT.[a]

THE HEAD.

The generic characters and anatomical details of the external skeleton and appendages of the head are shown in figures 1 and 2. When compared with the head of a scolytid beetle (figs. 3, 4), it is plain that the subordinal characters are common to both, but further than this there are certain features which at once refer them not only to different families but, in the writer's opinion, to different divisions of at least superfamily rank.

Mouth parts.—The *labrum* and *clypeus* are not represented, and the *epistoma* is only represented externally by a smoother area faintly defined by an obscure line and lateral bristles. As usual, the lateral angles, or area, support the dorsal articulation of the mandibles. The *hypostoma* also is obscurely defined externally, but is represented by the thickened declivous anterior margin of the ventral wall of the beak, by the sides of the submentum, and by a somewhat irregular apodeme, the anterior angles of which support the ventral articulation of the mandibles, the middle supporting the maxillary cardo, the inner anterior angle produced along the lateral area of the submentum, and the posterior angle ending just beneath the large hypostomal puncture. Thus the hypostomal area is that part of the ventral wall of the rostrum which lies anterior to the indistinct limit of the *pregula*. The *pleurostoma* is represented by the convex area surrounding the large mandibular scrobe. The solid *submentum*, or "gular peduncle" of authors, is evidently homologous with the bifid

[a] For anatomical nomenclature, see Technical Series 17, Part I, Bureau of Entomology, U. S. Dept. of Agriculture, 1909.

submentum in *Dendroctonus*. Its apex is truncate or rounded, and supports the *labium*, the *mentum* of which is about as long as the

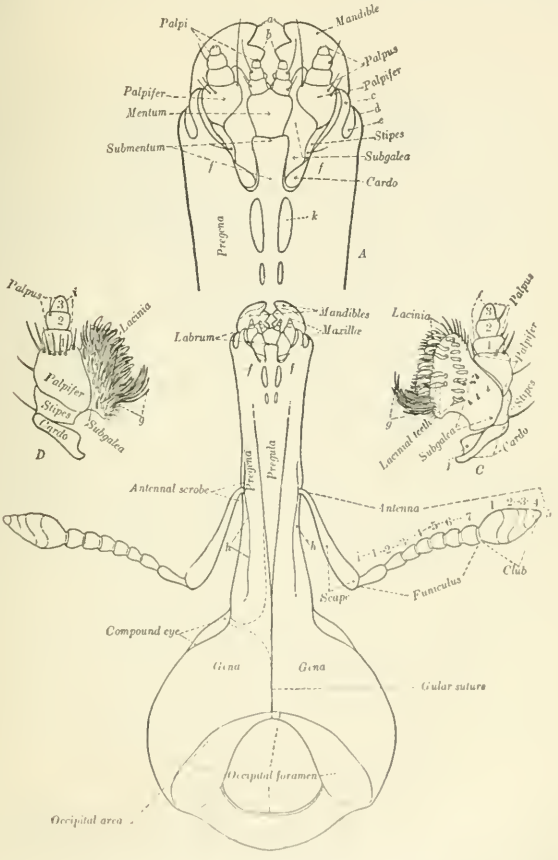


FIG. 1.—*Pissodes strobi*: Head, ventral aspect, and mouth parts. *A*, Ventral aspect of apical region of beak; *B*, ventral aspect of head; *C*, interno-lateral aspect of maxilla; *D*, externo-lateral aspect of maxilla; *a*, apical tooth; *b*, submedial tooth; *c*, lateral arm of hypostoma; *d*, pleurostoma; *e*, mandibular scrobe; *f*, hypostomal area; *g*, lacinial bristles; *h*, antennal groove; *i*, joints; *j*, fossa of cardo; *k*, hypostomal puncture (Author's illustration.)

submentum and a little broader. The *labial palpifer* is not defined, but is represented by the anterior third of the mentum. The *labial*

palpi are stout, conical, and 3-jointed, and not so long as the mentum, the first and second joints of about equal length and the third short.

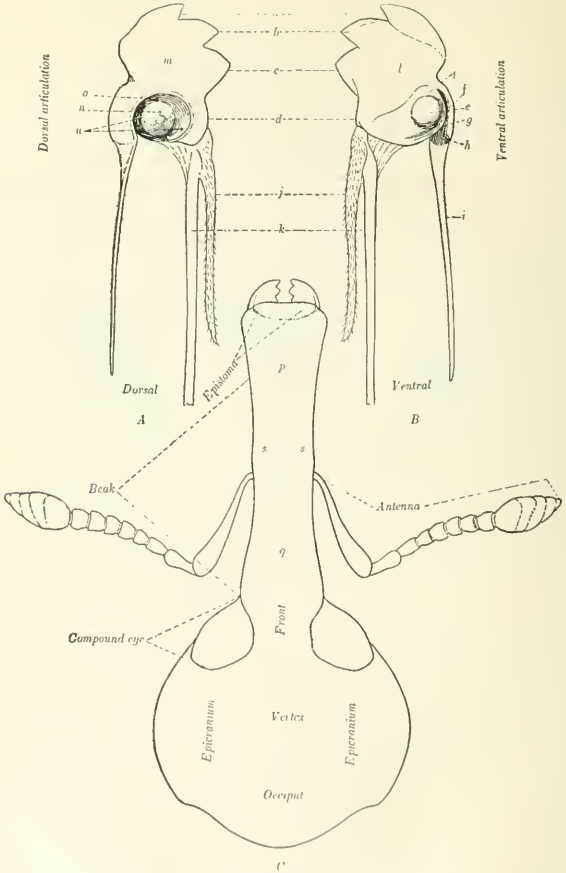


FIG. 2.—*Pissodes strobi*: Head, dorsal aspect, and mandibles. *A*, Dorsal aspect of left mandible; *B*, ventral aspect of left mandible. *C*, dorsal aspect of head; *a*, apical tooth; *b*, subapical tooth; *c*, median tooth; *d*, molar; *e*, median condyle; *f*, lateral muscle process; *g*, lateral condyle; *h*, lateral fossa; *i*, extensor tendon; *j*, pharyngeal bracon; *k*, retractor tendon; *l*, ventral area; *m*, dorsal area; *n*, median condyle; *o*, anterior fossa; *p*, anterior section of beak; *q*, posterior section of beak; *s*, dorsal area; *t*, anterior condyle; *u*, lateral fossa. (Author's illustration.)

The *ligula* is narrow and clothed with long bristles rising from the inner anterior margin of the mentum.

The form and relative proportions of the *maxilla* are shown in figure 1, *C, D,* and in place in *A*. The *cardo* is short and stout, and articulates with the hypostomal apodeme. The *extensor*, *flexor*, and other *muscles* of the cardo, maxilla, and labium are attached to the

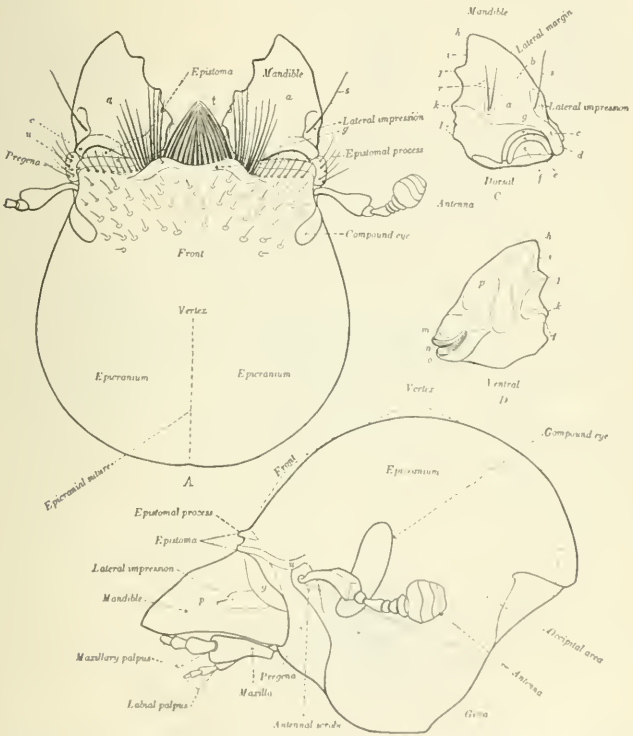


FIG. 3.—*Dendroctonus valens*: Head, dorsal and lateral aspects. *A*, Dorsal aspect of head. *B*, lateral aspect of head; *C*, dorsal aspect of right mandible, *D*, ventral aspect of right mandible. *a*, dorsal area; *b*, dorsal impression; *c*, anterior condyle; *d*, median fossa; *e*, median condyle; *f*, posterior fossa; *g*, basal ridge; *h*, apical tooth; *i*, acute margin; *j*, subapical tooth; *k*, median fossa; *l*, [illegible]; *m*, anterior condyle; *n*, median fossa; *o*, posterior condyle; *p*, lateral area; *r*, dorsal bristles of mandible; *s*, lateral bristles of mandible; *t*, epistomal bristles; *u*, lateral angle of epistoma. (Author's illustration)

inner ventral wall of the beak in a median triangular space between the hypostomal punctures and converging to a point near the anterior limit of the pregula. The *stipes* is clearly defined as a subbasal piece articulating with the cardo and joined to the palpifer and subgulea

by distinct sutures, and in this respect is very different from that in *Dendroctonus,* in which it is fused with the palpifer and subgalea. The *maxillary palpifer* is large and stout and from an interno-lateral

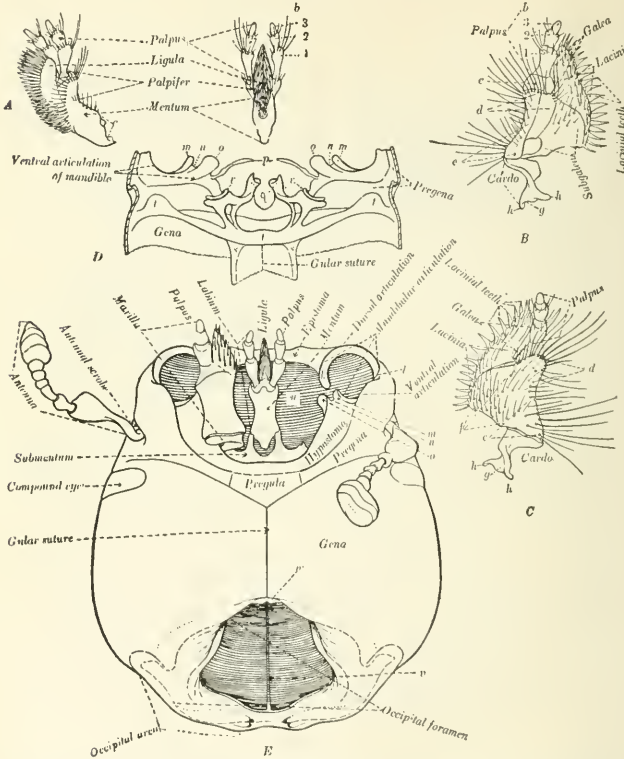


FIG. 4. *Dendroctonus valens:* Head, ventral aspect, and mouth parts. *A*, Labium; *B*, maxilla, interno-lateral aspect; *C*, same, externo-lateral aspect; *D*, hypostomal region, dorsal aspect; *E*, head, ventral aspect. *a*, basal fossa of mentum; *b*, joints; *c*, basal membrane; *d*, palpiferal area; *e*, stipal area; *f*, subgaleal area; *g*, fossa; *h*, muscle processes; *k*, median condyle; *l*, lateral fossa; *m*, anterior condyle; *n*, median fossa; *o*, posterior condyle; *p*, hypopharyngeal bracon; *q*, submental process; *r*, maxillary condyle; *s*, gular apodeme; *u*, oral foramen; *v*, occipital apodeme; *w*, postgular piece. (Author's Illustration.)

aspect is longer than the stipes and cardo together and much longer than the palpus. It is separated from the subgalea and stipes by distinct sutures, and resembles a very large first joint of the palpus.

The *subgalea*, *galea*, and *lacinia* are represented by one broad lobe without even the indication of sutures separating the lacinia from the subgalea as in *Dendroctonus*. The interno-lateral face and internal margin of the lobe are armed with stout lacinial teeth, while the externo-lateral face is clothed with bristles and hairs, those of the posterior angle being very long and curved. The palpus is stout, conical, 3-jointed, shorter than the palpifer, joints 1 and 2 of about equal length and 3 shorter.

The character of the *mandibles* is shown in figure 2, *A* and *B*. They are stout, subrectangular, and without a scar on the "outer surface." The inner edge has 3 prominent teeth; the apical, subapical, and median teeth are stout, triangular, and about equal in size, the molar not represented. The outer lateral area is deeply impressed at the base of the lateral muscle process, which is long and broad. The ventral articulation has a simple median "ball" condyle, while the dorsal articulation has a median "ball" condyle surrounded by a deep fossa. The *extensor* and *retractor muscles* are attached to the inner wall of the cranium, and are connected to the mandibles by long, very slender, subchitinous tendons (fig. 2, *i,k*). The *pharyngeal bracon* is also long and slender, and apparently subchitinous, thus serving as a rigid support or brace to the lateral wall of the *pharynx*.

The characters of the *antenna* are shown in figures 1 and 2. The *scape* is slightly shorter than the *funiculus*, and the *club* is about half as long as either one. The funiculus is 7-jointed; joint 1 is about as long as joints 2 and 3 together; joints 2 to 7 are of about equal length and increase slightly in width toward the club. The club is subcylindrical, ovate, acuminate, with apex subacute and with 5 obscurely defined joints. Joint 1 is much longer on one side than on the other and sparsely clothed with short hairs and long bristles; the remaining 4 are about equal in length, slightly more impressed on the anterior face, and densely clothed with fine hairs which obscure the sutures; the sutures, according to the point of view, may be oblique, transverse, recurved, or procurved.

The *pregula* is clearly defined in the ventral area of the rostrum. The sutures diverge anteriorly from their junction with the median gular suture near the base of the rostrum. The *pregena* is represented by the longitudinal area between the pregular suture and the antennal groove.

THE THORAX.

The thorax, as is usual, consists of 3 distinct segments (fig. 9, p. 28). The prothorax articulates freely with the mesothorax, but the mesothorax and metathorax are firmly connected. The combined length of the sternal areas of the three thoracic segments is slightly greater than that of the sternal area of the abdomen, while the com-

bined length of the dorsal or tergal areas of the thoracic segments is also slightly greater than the tergal area of the abdomen. The pronotum is slightly longer than the mesotergum and metatergum together. The prosternal area is much longer than the mesosternal and about equal to that of the metasternal area. The metapleura show the same relative proportions as the sterna, and together are much longer than the abdominal pleura. The anterior dorsal margin of the pronotum is not greatly extended beyond that of the sternum, as it is in *Dendroctonus;* the posterior margin of the metatergum is but slightly extended anteriorly beyond the posterior ventral margin of the same segment, but it is much in advance of the posterior margin of the metapleura. (For a discussion of the divisions of the thoracic segments of insects and of the nomenclature, see Hopkins, 1909, pp. 23–35.)

The Prothorax.

As is usual in the rhynchophorous beetles, the tergal, pleural, and sternal areas are fused into a continuous band. In addition to the preceding description of the *pronotum* there is usually a median elevated line extending from the anterior impression to the posterior margin, and each side of this line toward the middle there are two distinct impressions filled with whitish or yellowish scales, thus forming distinct subdorsal spots. There is also a broad, posterior, dorsal impression near the posterior margin. The lateral areas are usually marked with spots of scales, which are more or less distinct and variable in size and form. The anterior margin is usually evenly curved, but is sometimes slightly emarginate. The anterior ventral margin is never emarginate or distinctly produced toward the sides. The posterior dorsal margin is slightly bisinuate, and the posterior and lateral declivities of the notum are vertical. The posterior ventral margin is elevated and uniformly curved. The *episternal* and *epimeral areas* are not indicated by surface sculpture, but the *precpisternal area* is plainly indicated by a transverse elevation anterior to a distinct transverse pleural groove. This groove also extends across the *sternal area* and thus defines the *presternal area,* which is strongly convex. The *sternum* is flat to subconvex, subdeclivous, the posterior section terminating in an acute point between the coxæ. The *sternellum* is represented by a small but distinct intercoxal piece and the *poststernellum* ("epimerum" of authors) by the narrow posterior area which incloses the coxæ. The coxal cavities are large, with the inner margins but slightly separated.

The Mesothorax.

The mesothorax is short and partially hidden from view by the prothorax, which covers the anterior third of the sternites, pleurites, and tergites, while the base of the elytra normally covers the posterior

areas of the tergites, leaving only the scutellar process or scutellum exposed between the basal angles. This process is densely clothed with white or yellow scales.

When the prothorax and elytra are removed the *mesotergum* is found to be rectangular in form; the *prescutum* is clearly defined as a convex strongly chitinized notal plate, occupying about two-thirds of the tergal area. The anterior margin is acutely emarginate and the anterior angles strongly produced. The *prephragma* is strongly flexed beneath the posterior dorsal area. The *scutum* appears to be represented by a narrow dorsal area between the median process of the scutellum and the posterior limit of the prescutum, and by the lateral submembranous areas between the oblique lateral margin of the prescutum and the scutellum. The *scutellum* is represented by the prominent median process and laterally by the chitinous piece just posterior to the scutal area. The *postscutellum* is represented by the subventral and flexed margin of the scutellum and by a slender lateral arm.

Mesopleura.—The episternum, precpisternum, epimerum, and postepimerum are all clearly defined. The *precpisternum* is similar to that of *Dendroctonus*. It is nearly as large as the episternum, narrowed toward the sternum, and very broad toward the opposite extremity, where it projects over the anterior dorsal angles of the episternum and epimerum. The surface is testaceous and opaque. Its posterior margin is clearly defined by a distinct but narrow lateral impression, which is densely clothed with fine whitish scales. The anterior is strongly declivous, concave, shining, and the *precpisternal process* is prominent and broad, but not stout as it is in *Dendroctonus*. The oblique ventral margin is thickened, but the posterior dorsal section is very thin and without a distinct arm connecting it with the articulating condyles. In this respect and in the strongly dilated dorsal section the precpisternum is very different from that in Dendroctonus. The *episternum* forms an isosceles triangle with the anterior dorsal margin narrowly produced and disappearing beneath the dilated end of the precpisternum. The ventral and posterior angles are equal and acute. The surface is coarsely punctured and, as is common over the entire ventral area of the body, each puncture bears a broad scale. The *epimerum* is narrow, oblique, and broad at its junction with the anterior dorsal angle of the metepisternal plate. The ventral end is truncate, while the dorsal end is strongly narrowed and produced forward beneath the precpisternum, where it joins with the angle of the episternum to form the articulating processes. The *postepimerum* is narrow, declivous, and shining.

The *mesosternal area* is short, with the anterior margin bisinuate, the intercoxal piece elevated and truncate at apex, and the exocoxal pieces distinct. The *precpisternum* is represented by a narrow shining

area, but the *sternellum* and *poststernellum* are not represented by external areas. The coxal cavities are not widely separated. The mesothoracic spiracle is large and situated near the ventral edge of the preepisternal process where it is covered by the prothorax.

The Metathorax.

The *metatergum* is quite similar in general character to that in *Dendroctonus* (Hopkins, 1909, fig. 20); it is shorter and broad, and the *postscutellum* is very short and declivous. The membranous area of the *prescutum* is broad. The dorsal band is narrower. The scutellar groove is broad but less produced anteriorly. The metatergal costæ are not elevated above the scutum. The prescutal lobes are less prominent and the pleural hooks of the postscutellum are long and slender. Internally the median apodeme is more oblique and more acutely joined to the anterior apodeme. The longitudinal ridges formed by the deep lateral impressions of the scutellar groove are much more prominent and continuous from the anterior apodeme to near the posterior margin. The basal area of the wing and the articulating accessories are similar to those in *Dendroctonus*, differing only in minor details.

The *metapleura* are also similar to those in *Dendroctonus*, except that the *episternum* is narrower, the anterior ventral angle more produced and acute, the posterior end narrowed, and the exposed triangular plate of the *postepimerum* longer. The chitinous area of the *epimerum* is narrow, while the submembranous area or postepimeral area is correspondingly broad. The pleural clavicula is very long and the clavicle and coracoid processes are distinctly separated.

The *metasternal area* is a third longer than the mesosternal and twice as broad as long, without a median longitudinal groove, but with a median impression toward the posterior margin of the *sternum* proper. The *sternellum* is represented by an intercoxal piece covered by the median process of the abdominal sternite, and flexed beneath this is a plate which evidently represents the *poststernellum*. The coxal cavities are very large, widely separated, and suppress the first and second abdominal sternites. The metathoracic spiracle is situated in an open space between the metapleural clavicula and the mesepimerum.

The Abdomen.

Tergites.—The abdominal tergites increase slightly in length from tergite 1 to tergite 4, inclusive, and also become more uniformly subchitinous; 5 and 6 are shorter than 4, and 6 is more membranous and has a pair of membranous lobes which are absent in the five preceding tergites; 7 and 8 are chitinous and clothed with short hairs. The epipleurites are membranous and quite clearly defined in living examples. The spiracle of segment 1 is very large, as usual, and the

others diminish slightly in size to and including the seventh. Spiracle 8 is evidently not represented. The character of abdominal tergites 7 and 8 in the males and females of different species is clearly shown in Plate VI. It will be noted that they are quite different from the corresponding tergites in *Dendroctonus*, both in form and vestiture. In those of *Pissodes* two or three hairs rise from each puncture instead of one, as in *Dendroctonus*, and in tergite 7 of the male the middle section of the posterior margin is broadly retuse, with the principal stridulating scrapers on the subacute lateral angles. In the female the posterior margin of tergite 7 is broadly rounded. The sensory tubercles in tergite 7 of both sexes appear to be of considerable taxonomic importance, especially in their number and arrangement.

Sternites.—The characteristic form and relative proportions of the abdominal sternites are shown in fig. 9 (p. 28). The intercoxal process of sternite 3 (first visible sternite) is broad, with a slightly produced acute apex. In addition to the description of the abdominal sternites on page 10, suture 3 (or the first visible suture) is bisinuate, with the middle section strongly curved forward. Sutures 4, 5, and 6 continue straight to the lateral margin. The apex of sternite 7 in the males is variously sculptured, as described in the synopsis of secondary sexual characters. Sternite 8 in the males (Plate IX, *f*) is small, separated in two sections, and forms the so-called genital plate, while in the females (Plate VII, *c*) it is solid and evidently fused with tergite 9, which is evidently represented by the chitinous rod on apodeme *d*, and the fork *j*.

The *hypopleurites* are completely covered by the elytra; 1 and 2 are fused with the anterior end of 3. The sides of 3 and 4 are nearly vertical and have the dorsal edges acute, to fit into the posterior lateral groove of the elytra; 5, 6, and 7 are oblique and increase in width to and including 7, the posterior margin of which is obliquely curved to fit around the lateral section of tergite 8 in the male or 7 in the female.

THE WINGS.

Mesothoracic wings (elytra). In addition to the description on page 11, the mesothoracic wings, or elytra, have each 10 striæ and 11 interspaces, the latter including the costal and anal margins. The costal edge is deeply grooved for the reception of the produced dorsal edge of the metepisternum in the anterior section and of hypopleurites 3 and 4 in the posterior section. Beginning near the posterior end of this groove and extending obliquely to the apex there is a triangular area on the inner face of both elytra, which in the male is finely sulcate and serves as the stridulating rasp, while in the female the surface is roughened, with irregular elevations, apparently not available for producing sound. The subacute lateral angles of abdominal tergite 7 of the male evidently serve as the stridulatory scrapers.

Metathoracic wings.—The metathoracic wings are similar to those of *Dendroctonus*, but are at once distinguished by the two branches faintly connected with an evident cross-vein between the media and cubitus. The writer has not made a sufficient study of the modification of the veins in coleopterous wings to warrant anything more than the provisional interpretations indicated in the recently published figure (Hopkins, 1909, fig. 1).

INTERNAL ANATOMY.

The only parts of the internal anatomy that have been studied in detail by the writer are the reproductive organs of both sexes, which are of special interest, both from a systematic and from an economic point of view. These present taxonomic characters of last resort in the determination of the species. Those of the female are of interest from the fact that it is claimed that individuals must attain an age of several months before the ovaries are sufficiently matured for the development of eggs; also, that a single copulation may suffice for a long period; therefore it is important in our economic studies to be able to readily recognize the sexes and the approximate age of specimens collected at different times. The details of the male reproductive organs are shown in Plates VIII to XI, and require little explanation in addition to that given in the legends and synopsis. It will be seen that there are specific differences in the main body or stem (Plate XI), as well as in the fork (Plate X). The organs of reproduction in a very young female are shown in Plates VII and VIII, the parts of which are fully explained in the legends.

The profile of the abdomen (Plates VII and IX, A), with the parts *in situ*, shows the relation of the ventral and dorsal segments and genital plates to the different parts of the reproductive organs, certain parts of which are evidently direct modifications of the ninth and tenth dorsal and ventral segments. The figures are intended to illustrate the main features and are in some respects subdiagrammatical.

SECONDARY SEXUAL CHARACTERS.

Females.—In the females there are but 7 visible abdominal tergites, the eighth being completely covered by the seventh, which forms the pygidium. The beak is longer, smoother, and more slender than in the males. The apical or seventh abdominal sternite is usually shorter than the two preceding sternites together, which are usually less convex and more evenly punctured. The inner apical tooth of the tibiæ is also smaller.

Males.—In the males there are 8 visible abdominal tergites; the seventh is distinguished by the broadly retuse posterior margin, while the eighth is prominent with the apex broadly rounded, and forms the pygidium. The abdominal sternites 3 and 4 are more con-

vex than in the female, less evenly punctured and more shining toward the middle. The beak is stout, shorter, less shining, and more distinctly punctured. The inner apical tooth of the tibiæ is usually more prominent.

THE EGGS.

The eggs are pearly white, slightly oblong, and equally rounded at both ends.

THE LARVA.[a]

The larva (Plate V, A) is yellowish-white, cylindrical, footless, with 3 thoracic and 9 distinct abdominal segments, the anal lobes representing the tenth; the thoracic segments not distinctly larger than the first abdominal. The hairs of the second prothoracic segment to the seventh abdominal segment are small and obscure; those of the head, first prothoracic, and eighth and ninth abdominal are longer and more conspicuous. The first thoracic segment has a shining dorsal plate and sometimes a distinct sternal plate. The ventral lobes of the three thoracic segments have inconspicuous foot calli, each with fine, erect hairs. The first thoracic segment has a distinct spiracle; the second and third segments are without spiracles, but the spiracles are distinct in the first to the eighth abdominal, and are round and not oblong or oval, as in Hylobiinæ.

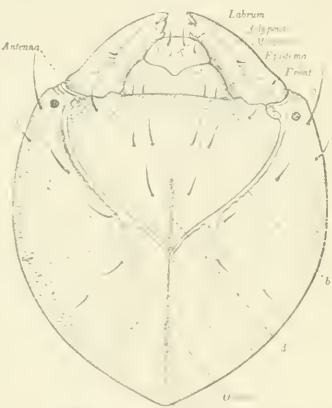


FIG. 5. *Pissodes strobi*: Head of larva, dorsal aspect. *a*, Eye spot; *b*, frontal suture; *c*, coronal suture; *d*, median line; *e*, epicranial suture. (Original.)

The head (figs. 5–8 and Plate V, A).—The head is light brown, the anterior margin and mandibles much darker. When removed it is as broad as long (not including the mandibles), narrower in front than at middle, the sides broadly rounded from middle to apex, which is somewhat angular. The sides are nearly straight from the middle to the anterior angles, and the lateral area has an oblique longitudinal, lighter area or stripe; the epicranial and frontal sutures are distinct and much lighter in color in fresh specimens. There are also 2 short, narrow, longitudinal stripes rising from the

[a] For anatomical nomenclature, see Hopkins, 1909, pp. 5, 6.

frontal suture. The anatomical details are very similar to those of *Dendroctonus*. The *frontal area* is triangular, with a distinct median line from the apex to or beyond the middle. The sutural margins are irregular or sinuate. The normal arrangement of the hairs is shown in figure 8. The *antennæ* are very small, conical, 1-jointed, and situated at the anterior extremity of the frontal suture. The *epistoma* is represented by the thickened anterior margin of the front, with which it is fused. It is usually darker in color, with the anterior margin declivous and nearly straight, and the lateral angles slightly produced and elevated where they support the dorsal articulation of the mandibles. The pleurostoma is represented by the thickened declivous area surrounding the mandibular foramen.

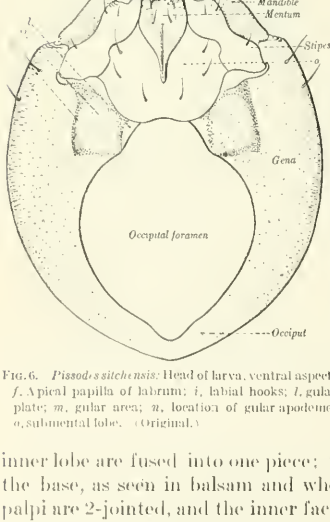


FIG. 6. *Pissodes sitchensis:* Head of larva, ventral aspect. *f*, Apical papilla of labrum; *i*, labial hooks; *l*, gular plate; *m*, gular area; *n*, location of gular apodeme; *o*, submental lobe. (Original.)

The *mandibles* are rather stout, triangular, with 3 teeth on the anterior half of the inner edge. The apical tooth is usually acute, the subapical acute and near the apex, and the third or median tooth obtuse, emarginate, or triangular; usually the basal or molar tooth is not represented. The articulation is quite similar to that in larvæ of *Dendroctonus*. The dorsolateral area of the mandible has a small impression and short bristle. The *eyes* are represented in some species by minute black spots beneath the exoskeleton, but apparently without lenses. The *maxillæ* (fig. 6) are much longer than broad, with a distinct cardo, and the stipes, palpiger, and inner lobe are fused into one piece; the lateral area is elevated toward the base, as seen in balsam and when removed from the head. The palpi are 2-jointed, and the inner face of the lobes is armed with stout lacinial teeth. The *labium* (fig. 6), ventral aspect, has a large, membranous submental lobe (*o*) attached to and contiguous with the integument of the prothoracic sterna and laterally to that of the maxilla; it is also attached by ligaments to the intergular plate. The mentum is represented by a median triangular chitinous plate near the middle of the submentum. The mentum, palpifer, and ligula are fused, and the palpi are short, conical, and 2-jointed; the inner part of the ligula is membranous and contiguous with the pharynx. The arrangement of

the hairs on both the maxillæ and labium, as shown in figure 6, is characteristic and quite constant. The clypeus (fig. 5) is broad at base, the sides narrowed to the apical angles, and slightly to distinctly longer than the labrum. The *labrum* (fig. 5) is more chitinous, about three times as broad as long from apex of clypeus, the ventral posterior margin angular, and extending beyond the margin of the clypeus. The labral hooks are distinct (in balsam mounts), only slightly longer than the labrum, and, as usual, support the anterior portion of the epipharynx. An examination of the larvæ of 14 species showed that there is considerable specific variation in the form and proportion of the frontal area, clypeus, labrum, and mandibles. The last have characters of some divisional and subdivisional value, but the characters have not been sufficiently studied to present them in tabular form for the identification of the species. Certain characters common to one or more species of a division are given in a provisional synopsis on page 39.

FIG. 7. *Pissodes sitchensis*. Head of larva, lateral aspect. *b*, Frontal suture; *c*, subdorsal stripe; *o*, submental lobe; *p*, lateral stripe. (Original.)

THE PUPA.

(Plate V, *B*.)

An examination of the pupæ of 6 species of the first division and 3 species of the second division shows that the following characters are common to all: The apex of the posterior tarsus is even with the apex of the wing pad; the apex of the antenna extends toward the middle and in front of the anterior femur, but does not rest against it or touch the wing pad; the anterior, middle, and posterior femora have each 2 minute subapical spines; the head has 2 prominent spines toward the vertex, 2 smaller ones on the sides toward the eyes, and 2 small ones each side of the front between the eyes, and usually 3 pairs of smaller ones on the beak between the frontal ones and the base of the antennæ; the prothorax has 3 pairs of dorsal spines, one pair moderately closely placed on or toward the anterior margin, one widely separated pair on the median area, and the other pair situated toward the base and still more widely separated; the lateral area has 2 closely placed spines near the middle, and the basal angle has an oblique row of 3 spines; the mesoscutum and metascutum have each 2 rather closely placed spines on each side of the median space; the abdomen has 8 distinct dorsal tergites, and the dorsal area of each is armed with 2 spines, which slightly increase in prominence from the first segment to the sixth or seventh. In

some species there are alternating smaller, less regular spines between the dorsal and lateral ones. The lateral area of each tergite is armed with two spines and the epipleural lobes are each also distinctly or obscurely armed with one or two spines, and the ninth segment, as usual, is armed with two prominent pleural spines. (See Hopkins, 1909, figs. 37, 38, for anatomical nomenclature.)

HOST TREES.

The host trees of Pissodes are, so far as known, restricted to the conifers, and include *Pinus, Picea, Abies, Larix. Pseudotsuga,* and *Cedrus.* Some of the species infest both living and dying or newly felled trees, while others appear to confine their attack to those which are sickly, dying, or felled. Some of them infest the living terminals and upper branches, others the upper or middle, stem, or base; some prefer to infest the thick bark of large trees, while others show a preference for the thinner bark of saplings and poles. (See table, pp. 41–42.)

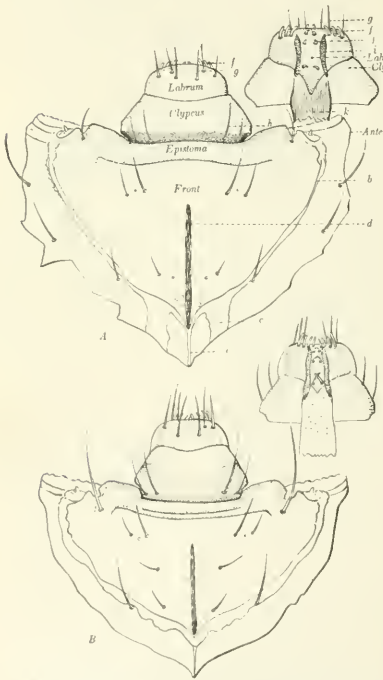


FIG. 8. *A: Pissodes piperi,* front of head of larva. *b,* Frontal suture; *c,* subdorsal stripe; *d,* median line; *e,* epicranial suture; *f,* apical papilla; *g,* labral bristles; *h,* clypeal bristles; *i,* labral hooks or epipharyngeal bracons, *j,* epipharyngeal papilla; *k,* œsophagus. *B: Pissodes nemorensis,* front of head of larva. Nomenclature same as in *A.* (Original.)

GENERAL HABITS.

The eggs are deposited in cavities excavated by means of the beak in the outer or inner portion of the inner bark. Some species deposit one or two eggs in a single cavity, while others deposit many. The larvæ obtain their food from the inner bark through which they extend their irregular mines (Plates XII to XVIII), and when they have completed their development

they excavate transformation cells, or pupal cases, in the outer portion of the wood, or, rarely, in the inner bark. These cells are inclosed by a thick covering of excelsior-like wood fiber, forming the so-called "chip cocoons," which are perhaps a more characteristic feature of the species of this genus than of any other.

GENERAL LIFE HISTORY.

The characteristic features in the life history of the species are the long life of the adult, the slow sexual maturity, the long period in which eggs may be deposited by a single female, and a single generation annually. In some species the broods develop within two or three months after the eggs are deposited, while in others it requires a longer period. The adults of some of the species emerge from the bark and hibernate in the ground, while others pass the winter in the bark.

GENERAL DISTRIBUTION.

The genus is represented in all sections of the United States characterized by natural growth of their host trees, and in other sections where such trees have been introduced to a sufficient extent to support them. (See table, pp. 40–41.)

THE NORTH AMERICAN SPECIES OF PISSODES.

NATURAL CLASSIFICATION OF THE SPECIES.

In the following key and synopses (pp. 30–38) an attempt is made toward a natural classification of the species of *Pissodes* into primary and secondary divisions, sections, series, etc., according to characters which indicate lines of specialization and natural affinities. It will be noted that the general modification, as in most Curculionidæ, is from a short or stout beak to a longer or more slender one, and in general from small to larger forms.

The characters of the pronotum, as commonly used to indicate species and groups of species, are found to be of little value in separating primary, or even secondary, divisions, but are of more importance in separating the subsections, series, and species. The specialization is plainly from a rounded, obtuse, to a rectangular and acute basal angle, but this specialization is confined to the smaller groups, and is therefore represented in the several sections as parallel developments. The pronotum is, in fact, quite variable in the individuals of the same species. In some reared specimens of the same species there is a wide range from a rounded to an acute basal angle, while in one specimen of *Pissodes nemorensis* the angle of one side is rectangular, while that of the other is acute. These radical departures from the normal may, however, be considered as deformities.

The length of the beak also varies; thus, in some of the females it is shorter than in some males of the same species. The elytra are more or less variable in form, but appear to be more constant than the other parts, and show little or no sexual difference.

The character and position of the spots of densely placed scales appear to be of special value in the classification of the genus, but these are sometimes rendered obscure in old, rubbed, and dirty specimens. The scales are so firmly attached, however, that they are often sufficiently retained in old specimens to be of value. Dirty specimens can be easily cleaned with chloroform or xylol, the latter being especially valuable for the removal of resin.

STATISTICAL TAXONOMY.

In a comparative study of the characters which distinguish the major and minor divisions and species of a genus or a larger group of organisms, a progressive modification of certain parts of the body structure is usually found to serve (*together with other characters*) as an index to a natural classification. Therefore the importance of having some clear and definite method of indicating the range and limit of such lines of modification or specialization is apparent.

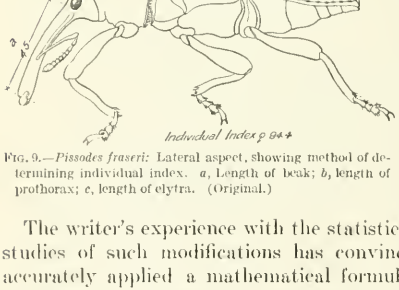


FIG. 9.—*Pissodes fraseri:* Lateral aspect, showing method of determining individual index. *a*, Length of beak; *b*, length of prothorax; *c*, length of elytra. (Original.)

The writer's experience with the statistical method in comparative studies of such modifications has convinced him that when it is accurately applied a mathematical formula may be determined to express the limit and relative taxonomic importance of a given modification in one or more structural characters, to indicate specific differences, and to show the relative position and rank the species occupy in a natural classification. Thus we may adopt for certain groups of insects a statistical taxonomy as a guide toward the classification of the species into natural divisions.

In the bark-weevils of the genus *Pissodes* we have a good example for the application of this method. One of the principal lines of modification available for statistical study is the progressive elongation of the beak. Therefore when we compare the average ratio or mode of the length of the beak to both the length of the prothorax and length of the elytra (fig. 9) in a number of individuals of one species with that of an equal number of individuals of another species,

no matter what differences there may be in the length of the body of the individuals, we get a mathematical expression, or index, of the difference in their relative proportions.

The following examples will serve to illustrate the application of the method:[a]

Example 1.

Female individual of *Pissodes strobi*.

a, Length of beak, 29 micrometer divisions.
b, Length of prothorax, 31 micrometer divisions.
c, Length of elytra, 73 micrometer divisions.

$a \div b = .935$.

$a \div c = .397$, $+ .935 = 1.332$, $\div 2 = .666$ = Index of relative proportions of an individual. Now, if 50 male individuals of this species show a range in the individual index of 61 to 64, with an average or mode of 63, and 50 females show a range of 65 to 69, with a mode of 68, the relative proportions for each sex and for the species are expressed by the formula, ♂ 63–♀ 68.

Example 2.

Female individual of *Pissodes fraseri* (fig. 9).

a, Length of beak, 45 micrometer divisions.
b, Length of prothorax, 33 micrometer divisions.
c, Length of elytra, 85 micrometer divisions.

$a \div b = 1.366$.

$a \div c = .529$, $+ 1.366 = 1.895$, $\div 2 = .947+$. If 50 male individuals show an index range of 72 to 73 and a mode of 72, and 50 females show a range of 91 to 111, with a mode of 100, the formula would be ♂ 72 – ♀ 100.

P. strobi, formula ♂ 63 – ♀ 68.
P. fraseri, formula ♂ 72 – ♀ 100.

According to other characters, these two species fall in the same division of the genus, but in different subdivisions. The formulas for the species of the first division range from ♂ 57 – ♀ 62 to ♂ 72 – ♀ 100. Those of the first subdivision range from ♂ 57 – ♀ 62 to ♂ 74 – ♀ 79, while those of the second subdivision range from ♂ 64 – ♀ 70 to ♂ 72 – ♀ 100.

Thus the formulas for *P. strobi* and *P. fraseri*, together with the characters which refer them to their respective primary and minor divisions, indicate the natural position and rank they should occupy in the classification. (See Plate II.)

It is interesting to note that the Hylobiinæ, which are plainly less modified in respect to the length of the beak than the Pissodinæ, show their relative lower position in the determined formulas for representatives of the 4 principal genera (*Paraplinthus*, ♂ 47, ♀ 58; *Hilipus*, ♂ 35, ♀ 68; *Eudocimus*, ♂ 38, ♀ 49; *Hylobius*, ♂ 48, ♀ 56). It will be noted that the females of only two of the genera fall within the range of the Pissodinæ, while *Hylobius*, which has some affinities

[a] Measurements up to 10 mm. may be made by means of a microscope with a micrometer eyepiece and a 2-inch objective, the tube adjusted so that each division in the micrometer scale equals five one hundredths of a millimeter.

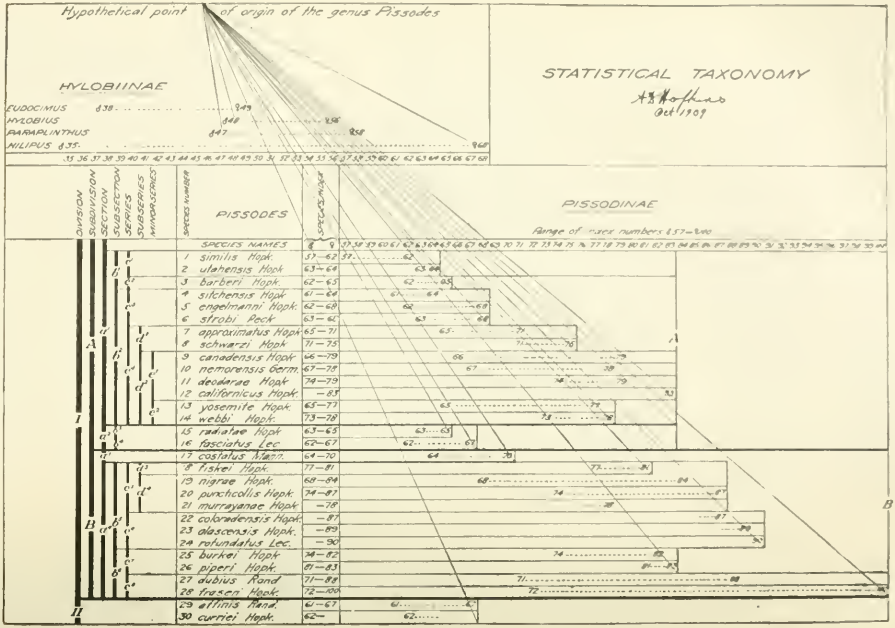
with *P. affinis* of the second division of the genus *Pissodes*, does not come within the range, but occupies the position probably held by the more primitive forms of the *affinis* division. (See Plate II.)

MORPHOLOGICAL AND PHYSIOLOGICAL CHARACTERS AND CHARACTERISTICS.

The plan of combining morphological characters and physiological characteristics as a basis for specific distinction, as discussed by the writer in the technical contribution on *Dendroctonus* (Hopkins, 1909, p. 64), has been followed in the study and classification of the species of *Pissodes*. The close resemblance of the adults of allied species and the wide range of specific variation render it very difficult and often practically impossible to refer some of the individuals to the species by external characters of the adults alone, but with information on the distribution, host, habit, seasonal history, etc., they can often be referred to their species without a moment's hesitation. Specimens without locality labels and some additional information are therefore of no value to the economic investigator, and will evidently become of less and less value to the systematists. The importance of utilizing bionomic data as guides to the identification of species will doubtless become more popular in the future and contribute to a more rapid advancement of the essential knowledge required by the systematic and economic entomologist in research work.

KEY TO THE SPECIES.

1. Elytral interspaces 3 and 5 broader or more elevated than 2 and 4.
   A. Elytra always with anterior and posterior spots.
      a1. Elytra with distinct spots near vertex of declivity.
         b1. Beak moderately stout, always shorter than prothorax.
            c1. Elytra with distinct anterior spots and very large posterior ones.
               Posterior spot with distinct dark border ..... 1. *similis.*
               Posterior spot without distinct dark border..... 2. *utahensis.*
            c2. Elytra with indistinct anterior spots and small posterior ones. 3. *barberi.*
         b2. Beak slender, shorter or longer than prothorax.
            c3. Elytra with anterior and posterior spots large.
               Posterior spots of elytra without dark border. Pacific Coast. 4. *sitchensis.*
               Posterior spots of elytra usually with dark border. Rocky Mountains..... 5. *engelmanni.*
               Posterior spots of elytra with or without dark border. Eastern U. S..... 6. *strobi.*
            c4. Elytra with small to moderately large anterior and posterior spots.
               d1. Posterior brown spots moderately large.
                  Posterior brown and white spots usually separated. Eastern and northern U. S..... 7. *approximatus.*
                  Posterior brown and white spots fused. Central and northern Rocky Mountains..... 8. *schwarzi.*



STATISTICAL TAXONOMY OF PISSODES. (ORIGINAL.)

Tech. Series 20, Part I, Bureau of Entomology, U. S. Dept. of Agriculture.

d2. Posterior brown spots small.

c1. Elytral interspaces 3 and 5 elevated and broad.

Posterior spots fused, the yellow one larger. Manitoba ..... 9. *canadensis.*

Posterior spots usually separated, yellow one small.

Elytra noticeably narrowed posteriorly from base. 10. *nemorensis.*

Elytra not noticeably narrowed posteriorly from base. South Atlantic States ..... 11. *dodarae.*

Elytra noticeably narrowed posteriorly; white and brown spots separated, the latter very small. 12. *californicus.*

c2. Elytral interspaces 3 and 5 narrow, strongly elevated.

Pronotal punctures coarse but not dense.. 13. *yosemite.*

Pronotal punctures coarse and dense..... 14. *webbi.*

a2. Elytra with transverse band of white and yellow scales near vertex.

b3. Pronotum with posterior angles acute..... 15. *radiatæ.*

b4. Pronotum with posterior angles subrectangular..... 16. *fasciatus.*

B. Elytra usually without distinct anterior spots, and with posterior spot anterior to vertex of declivity.

a3. Pronotum with basal angles subrectangular..... 17. *costatus.*

a4. Pronotum with basal angles rounded.

b5. Pronotal punctures distinctly separated.

c5. Pronotum not distinctly narrower than elytra.

d3. Pronotum stout, deeply constricted anteriorly.. 18. *fiskei.*

d4. Pronotum subelongate, not deeply constricted anteriorly.

Pronotum moderately stout; elytral interspaces 3 and 5 scarcely elevated; with anterior spot..... 19. *nigræ.*

Pronotum elongate

Elytral interspaces 3 and 5 slightly elevated, flattened; with anterior spot..... 20. *punctcollis.*

Elytral interspaces 3 broader and more elevated; without anterior spot ..... 21 *murrayanæ.*

c6. Pronotum distinctly narrower than elytra.

Pronotal punctures irregular, not dense; punctures of striæ irregular.. .. .. 22. *coloradensis.*

Pronotal punctures regular, moderately dense; punctures of striæ coarse, irregular..... 23. *alascensis*

Pronotal punctures dense, regular; punctures of striæ irregular. 24 *rotundatus*

b6. Pronotal punctures irregular, not distinctly separated.

c. Elytral striæ with punctures very irregular.

Gray, densely clothed with scales; spots prominent; 25. *barkeri*

Black, not densely clothed with scales; spots obscure. 26. *piperi*

c8. Elytral striæ with punctures moderately irregular; spots obscure

Pronotum convex, without dorsal impressions and elevations 27 *dubius*

Pronotum moderately convex and usually with dorsal impressions and elevations .. . 28 *fraseri*

II. Elytral interspaces 3 and 5 not broader or more elevated than 2 and 4

Elytra with distinct posterior spot . .. .. 29 *affinis*

Elytra with small posterior spot .... 30 *carrieri*

SYNOPSIS OF ADULT CHARACTERS, WITH DESCRIPTIONS OF NEW SPECIES.[a]

Elytral interspaces 3 and 5 broader or more elevated than 2 and 4.
Division I, pages 32, 43.
Elytral interspaces 3 and 5 not broader or more elevated than 2 and 4.
Division II, pages 36, 64.

DIVISION I.

Elytra always with distinct spots of densely placed scales on the anterior lateral area and always with spots or bands of scales situated near the vertex of the declivity.
Subdivision A, pages 32, 44.
Elytra usually without distinct spots on the anterior lateral area and with small spots situated between the vertex of the declivity and middle of elytra.
Subdivision B, pages 35, 56.

SUBDIVISION A.

Elytra with distinct spots near vertex of declivity.....Section a1, pages 32, 44.
Elytra with transverse band of white and yellow scales near vertex of declivity.
Section a2, pages 34, 55.

Section a1.

Beak moderately stout, shorter than prothorax; pronotum with basal angles subobtuse; elytra with interspaces 3 and 5 strongly elevated and rugose.
Subsection b1, pages 32, 44.
Beak slender, shorter or longer than prothorax; pronotum with basal angles rectangular; elytral interspaces 3 and 5 moderately to strongly elevated.
Subsection b2, pages 33, 46.

Subsection b1.

Elytra with distinct anterior spots and very large posterior ones; pronotum distinctly narrower than elytra, punctures indistinct, irregular .....Series c1, page 32.
Elytra with indistinct anterior spots and small transverse posterior ones; pronotum not distinctly narrower than elytra, punctures distinct and regular.
Series c2, page 32.

Series c1.

Length 3.7 to 4 mm.; brown; pronotal and elytral punctures moderately coarse; posterior spot of elytra with distinct dark border. Maine and high mountains of North Carolina, probably in *Abies fraseri*, and New Hampshire in *Abies balsamea*. Species index, ♂57–♀62.....1. *similis* n. sp., page 44.
Length 3.9 mm.; dark brown; pronotal and elytral punctures coarse; posterior spot of elytra without distinct dark border, third and fifth interspaces with acute rugosities, spots prominent. Park City, Utah, and Bear Lake, British Columbia. Species index, ♂63–♀64.....2. *utahensis* n. sp., page 45.

Series c2.

Length 5 to 5.5 mm.; black; pronotal and elytral punctures very coarse; elytra with interspaces 3 and 5 broad and prominent. Humboldt, Cal., Astoria, Oregon, and Tenino, Wash. Species index, ♂62 ♀65.....3. *barberi* n. sp., page 45.

[a] The divisional, subdivisional, sectional, subsectional, serial, and species characters constitute a complete description of each species; *e. g.*, 1, A, *a1*, *b1*, *c1*, and *species 1*.

Subsection b2.

Elytra with large anterior and posterior spots; sides parallel; beak never longer than prothorax.....Series c3, page 33.

Elytra with small to moderately large anterior and posterior spots; sides usually slightly narrowed posteriorly; beak sometimes longer than prothorax.

Series c4, page 33.

Series c3.

Length 4.2 to 5 mm.; brown; pronotum distinctly narrower than elytra, not distinctly shining, and the punctures moderately coarse and dense; posterior spots of elytra without dark border; punctures of striæ coarse, distinct. Hoquiam and Pialschie, Wash., in tops of *Picea sitchensis*. Species index, ♂61–♀64.

4. *sitchensis* n. sp., page 47.

Length 5 to 5.3 mm.; brown; pronotum not distinctly narrower than elytra, shining, and the punctures coarse; posterior spots of elytra usually with faint dark border; punctures of striæ indistinct, especially on lateral area. Smith's Ferry, Idaho, and Pikes Peak, Colo., in tops of *Picea engelmanni*. Species index, ♂62–♀68.....5. *engelmanni* n. sp., page 47.

Length 4.5 to 6 mm.; brown; pronotum slightly narrower than elytra, moderately shining, and the punctures dense; posterior spot of elytra with or without faint dark border. Eastern United States, in terminals of *Pinus strobus*, rarely in terminals of *Pinus resinosa* and terminals of *Picea*. Species index, ♂63–♀68

6. *strobi* Peck, page 48.

Series c4.

Posterior brown spots of elytra moderately large; fork of male genitalia very stout.

Subseries d1, page 33.

Posterior brown spots of elytra small; fork of male genitalia long and slender.

Subseries d2, page 33.

Subseries d1.

Length 4.3 to 6.7 mm.; brown; pronotum not distinctly narrower than elytra, punctures moderately coarse; elytral interspace 3 broad, flattened, moderately rugose, and posterior white and yellow spots usually separated, the brown one smaller but not very small as in species 10, and the white one extending over the second interspace. Mountains of North Carolina northward to New Hampshire, and west to Lake Superior region, in *Pinus* under bark on stumps and logs and trunks of dying trees, and base of saplings. Species index, ♂65–♀71.

7. *approximatus* n. sp., page 49.

Length 5.2 to 6.7 mm.; brown; pronotum slightly narrower than elytra, punctures coarse; elytral interspaces 3 and 5 distinctly elevated and rugose, the punctures of striæ coarse, and the posterior white and yellow spots fused, not extending over the second interspace. Colorado, in *Pinus scopulorum*, thick bark on base, stems, tops, and terminals of saplings. Species index, ♂71–♀75.

8. *schwarzi* n. sp., page 50.

Subseries d2.

Elytral interspaces 3 and 5 distinctly elevated and broader than 2 and 4; pronotal punctures moderately coarse and densely placed. ... Minor series e1, page 34

Elytral interspaces 3 and 5 but slightly broader than 2 and 4, strongly elevated and acutely rugose; pronotum narrower than elytra, punctures very coarse

Minor series e2, page 34.

Minor series e1.

Length 6.2 to 7 mm.; brown; pronotum as broad as elytra, with sides rounded; elytra with sides scarcely narrowed posteriorly, interspaces 3 and 5 broad, elevated, rugose, the posterior spots fused, and the yellow one large; beak not longer than the prothorax in the males. Winnipeg, Manitoba, in *Pinus?* Species index, ♂66–♀79.....9. *canadensis* n. sp., page 51.

Length 4.9 to 7.7 mm.; brown; pronotum with sides not strongly rounded; elytra with sides narrowed posteriorly from base, posterior spots usually separated, the yellow one very small and the white one extending to first interspace; beak usually longer than prothorax in both sexes. Boardman, N. C., and mountains of North Carolina, to Florida and Texas, in bark of *Pinus* logs, stumps, trunks of dying trees, and rarely in base of saplings. Species index, ♂67–♀78.
10. *nemorensis* Germar, page 51.

Length 4.2 to 5.8 mm.; light brown; body slender; pronotum slightly narrower than elytra; elytra with sides nearly parallel, interspaces 3 and 5 but slightly elevated, posterior brown spot very small; beak longer than prothorax in both sexes. Experiment, Ga., in stems, branches, and tops of *Cedrus deodaræ*. Species index, ♂74–♀79.....11. *deodaræ* n. sp., page 52.

Length 8.6 mm.; brown; pronotum broad, with sides broadly rounded; elytra with sides distinctly narrowed posteriorly, interspace 3 very broad, not coarsely rugose as in *yosemite;* posterior spots separated, the brown one very small; beak distinctly longer than prothorax. Yosemite Valley, Cal., in bark of living pine with *P. yosemite*. Species index, ♀83.....12. *californicus* n. sp., page 53.

Minor series e2.

Length 5.1 to 7.7 mm.; brown; pronotal punctures very coarse, not dense; elytra with sides nearly parallel, interspaces 3 and 5 strongly elevated, acutely rugose, punctures of striæ rather coarse, and posterior spots fused on lateral area. Yosemite Valley, Siskiyou County, and Lake Tahoe, Cal., in *Pinus ponderosa* and *Pinus lambertiana*. Species index, ♂65–♀77.....13. *yosemite* n. sp., page 53.

Length 4.8 to 6.8 mm.; brown; pronotal punctures very coarse and dense; elytra with sides nearly parallel, interspaces 3 and 5 elevated and rugose, punctures of striæ rather coarse, and posterior spots prominent and fused on the sides. Mountains of southern New Mexico and Arizona, in *Pinus strobiformis* and *Pinus ponderosa*. Species index, ♂73 ♀78.....14. *webbi* n. sp., page 54.

Section a2.

Pronotum with posterior angles acute.....Subsection b3, pages 34, 55.
Pronotum with posterior angles subrectangular.....Subsection b4, pages 34, 55.

Subsection b3.

Length 5.1 to 7.1 mm.; brown; pronotum broader toward base, angles acute, sides converging anteriorly, slightly constricted toward head, punctures coarse, distinct; elytra with anterior spots small, yellow, and the posterior band principally of white scales. Monterey, Cal., in bark of logs and trunks of *Pinus radiata;* also one specimen from Easton, Wash. Species index, ♂63–♀65.
15. *radiatæ* n. sp., page 55.

Subsection b4.

Length 5.1 to 8.3 mm.; brown; pronotum narrower than elytra, sides rounded and slightly narrowed anteriorly but not distinctly constricted toward head; elytra with anterior spots prominent, oblique, yellow, the posterior indistinct band composed of scattering white and yellow scales. Oregon, Washington, Idaho, and British Columbia, in *Pseudotsuga mucronata*. Species index, ♂62–♀67.
16. *fasciatus* Le Conte, page 56.

Subdivision B.

Pronotum with basal angles subrectangular; beak rather stout, moderately long.
Section a3, pages 35, 57.

Pronotum with basal angles rounded; beak slender, moderately to very long.
Section a4, pages 35, 58.

Section a3.

Length 5.5 to 7.1 mm.; dark brown; pronotal punctures not distinctly separated; elytra with faint anterior spot toward the middle and indistinct spots of reddish brown and white scales behind the middle, interspaces with many minute white spots toward sides and on declivity. Hoquiam, Wash., in thick bark on trunks of dying trees and stumps of *Picea sitchensis*. Species index, ♂64–♀70.
17. *costatus* Mannerheim, page 57.

Section a4.

Pronotal punctures distinctly separated; punctures of elytral striæ small to coarse.
Subsection b5, pages 35, 59.

Pronotal punctures irregular, not distinctly separated; punctures of elytral striæ very coarse and irregular ..... Subsection b6, pages 36, 62.

Subsection b5.

Pronotum not distinctly narrower than elytra..... Series c5, page 35.

Pronotum distinctly narrower than elytra..... Series c6, page 36.

Series c5.

Pronotum short, stout, sides strongly rounded and constricted toward the anterior margin; elytral interspaces strongly elevated with rather coarse rugosities.
Subseries d3, page 35.

Pronotum elongate, sides rounded, but not deeply constricted toward head; elytral interspaces with fine rugosities..... Subseries d4, page 35.

Subseries d3.

Length 4.2 to 5.2 mm.; dark brown; elytra without anterior spot but with broad posterior one, interspaces 3 and 5 strongly elevated, convex, rugose; punctures of striæ small. New Hampshire, in thin bark on dying *Picea mariana* and *Picea rubens*. Species index, ♂77–♀81..... 18. *fiskei* n. sp., page 59.

Subseries d4.

Length 4.4 to 5.6 mm.; dark brown; pronotum short, broad; elytra with small obscure anterior spots and distinct posterior ones situated toward the middle, interspaces 3 and 5 flattened, scarcely elevated, rugosities fine; punctures of striæ coarse. Webster, N. H., in *Picea mariana*, bark of small tree. Species index, ♂68–♀84.
19. *nigrae* n. sp., page 59.

Length 4.2 to 6.1 mm.; light brown; pronotum elongate, punctures coarse, irregular; elytra with small anterior spots and more distinct posterior ones just behind the middle, interspaces 3 and 5 slightly elevated and flattened; punctures of striæ moderately coarse. Mountains of West Virginia, in *Picea rubens*, thick bark on logs. Species index, ♂74–♀87..... 20. *puncticollis* n. sp., page 60.

Length 4.1 mm.; dark brown; pronotum elongate, punctures moderately coarse, regular; elytra without anterior spots and with very small posterior ones each side behind the middle, interspace 3 distinctly broader, elevated, striæ coarser toward the base. Wallowa, Oregon, in *Pinus murrayana*; reared from bark. Species index, ♀78.
21. *murrayanae* n. sp., page 60.

Series c6.

Length 6.9 to 7 mm.; dark brown; pronotal punctures irregular, elytra without distinct anterior spots, but with distinct spots of yellow scales behind the middle, interspaces 3 and 5 strongly elevated, and punctures of striæ irregular. Leadville, Colo., National Park, Wyo., and Black Hills, S. Dak., in *Picea canadensis* thick bark on base of trees. Species index, ♀87.

22. *coloradensis* n. sp., page 60.

Length 6.5 mm.; black; protonal punctures coarse, regular, closely placed and rather deep; elytra without anterior spots, but with small, rather distinct, posterior ones, punctures of striæ coarse, irregular, and smaller on the lateral area, interspaces 3 and 5 reddish, strongly elevated, and broad. Arctic Circle, Alaska, and Montana in *Picea engelmanni*. Species index, ♀89.

23. *alascensis* n. sp., page 61.

Length 6 to 7.3 mm.; black; pronotal punctures dense, regular; elytra rarely with small anterior white spots, but with small white spots behind the middle, interspace 3 very broad, interspacial rugosities not coarse, punctures of striæ irregular and not smaller on the lateral area. Marquette, Mich., Lake Superior region, probably in *Picea*. Species index, ♀90.....24. *rotundatus* Le Conte, page 61.

Subsection b6.

Punctures of elytral striæ very irregular, spots of scales moderately distinct; pronotum not distinctly narrower than elytra.....Series c7, page 36.

Punctures of elytral striæ moderately irregular, spots of scales evident but small and obscured by scattering white or yellow scales; pronotum distinctly narrower than elytra.....Series c8, page 36.

Series c7.

Length 6 to 7.7 mm.; gray; elytra and pronotum rather densely clothed with whitish scales; elytra with rather distinct anterior and posterior spots, and punctures of striæ not very closely placed. Ouray, Colo., Alta and Park City, Utah, probably in *Abies?* Species index, ♂74–♀82.....25. *burkei* n. sp., page 62.

Length 7.4 to 10 mm.; black; elytra and pronotum sparsely clothed with whitish scales; elytra with anterior and posterior spots evident but small, and punctures of striæ very deep and closely placed. Mount Rainier, Wash., and Centerville, Idaho, in *Abies lasiocarpa* and *Abies concolor;* also at Glacier, B. C. Species index, ♂81–♀83.....26. *piperi* n. sp., page 62.

Series c8.

Length 4.8 to 5.7 mm.; black; beak moderately long; pronotum convex, without dorsal irregularities. Maine to Lake Superior, in *Abies balsamea*. Species index, ♂72–♀88.....27. *dubius* Le Conte, page 63.

Length 4.6 to 9.1 mm.; black; beak very long, even in the male; pronotum somewhat flattened, and usually with dorsal irregularities, sometimes distinctly impressed towards base. High mountains of North Carolina in *Abies fraseri*. Species index, ♂72–♀100.....28. *fraseri* n. sp., page 63.

DIVISION II.

Elytral interspaces 3 and 5 not more elevated or broader than 2 and 4; beak short, slender; pronotum broad, with sides behind the middle nearly parallel, and the basal angles rectangular; punctures of elytral striæ moderately coarse, regular; posterior tibia of male fringed with long bristles.

Length 5.5 to 8 mm.; black, elytra with or without faint anterior spots but with distinct transverse spots of white or yellow scales near vertex, and the punctures of striæ moderately coarse. Wisconsin to New Hampshire, in *Pinus strobus*. Species index, ♂ 61–♀ 67 ..... 29. *affinis* Randall, page 64.

Length 5.6 to 7.7 mm.; black, elytra with obscure anterior spots and small posterior ones, the punctures of striæ coarse and deep. Kaslo, B. C. Species index, ♂ 62, 30. *carcici* n. sp., page 65.

SYNOPSIS OF PRIMARY SEXUAL CHARACTERS.

Male Genitalia.

Stem with apex *uniformly rounded* ..... Division I
Stem with apex *not uniformly rounded* ..... Division II

DIVISION I.

Section a1.

Fork slender ..... Species 4, 5, 6
Fork short ..... Species 4
Fork long ..... Species 5
Fork moderately stout ..... Species 6
Fork long and stout ..... Species 7, 8
Fork long and slender ..... Species 9, 10, 11, 13

Section a2.

Stem narrowed toward apex, but not constricted ..... Species 15
Stem broad toward apex, slightly constricted anteriorly ..... Species 16

Section a4.

Fork long and slender ..... Species 27, 28

DIVISION II

Fork very stout ..... Species 29, 30

SYNOPSIS OF SECONDARY SEXUAL CHARACTERS.

Beak longer and more slender in females than in males ..... The Genus
Hind tibia of male *without* long fringe of hairs ..... Division I
Hind tibia of male *with* long fringe of hairs ..... Division II

DIVISION I.

Beak in both sexes usually shorter than prothorax, rarely longer ..... Subdivision A
Beak in both sexes rarely shorter than prothorax, commonly much longer ..... Subdivision B

Subdivision A

Apical margin of abdominal sternite 7 sinuate or not in male ..... Section a1
Apical margin of abdominal sternite 7 not sinuate in male ..... Section a2

Section a1.

Apical margin of abdominal sternite 7 not sinuate in male ..... Subsection b1 Species 1, 2, 3
Apical margin of abdominal sternite 7 faintly sinuate in male ..... Subsection b2

Subsection b2.

Beak shorter than prothorax in males, rarely longer in females.
Series c3, Species 4, 5, 6
Beak as long as prothorax or longer in males, usually longer and often distinctly so, in females.....Series c4, Species 7, 8, 9, 10, 11, 12, 13, 14

Section a2.

Beak in both sexes shorter than prothorax.....Species 15, 16

SUBDIVISION B.

Apical margin of abdominal sternite 7 faintly sinuate, but without apical process in females.....Section a3, Species 17
Apical margin of abdominal sternite 7 without or with process in males....Section a4

Section a4, Subsection b5.

Apical margin of abdominal sternite 7 sinuate, but without median process in males.....Species 18
Apical margin with median process in males.....Species 20

Subsection b6.

Apical margin of abdominal sternite 7 with apex uniformly rounded in males.
Species 25, 26, 27, 28

DIVISION II.

Beak shorter than prothorax in both sexes, apical margin of abdominal sternite 7 with truncate process rising from deep emargination in males.....Species 29, 30

SYNOPSIS OF PUPAL CHARACTERS.

DIVISION I.

Head *with* one or more minute spines on posterior margin of eyes.....Subdivision A
Head *without* minute spines on posterior margin of eyes.....Subdivision B

SUBDIVISION A.

Abdominal tergites with small spines alternating with larger ones, especially on tergites 3 to 6.....Section a1
Abdominal tergites without small spines alternating with larger ones.....Section a2

Section a1, Series c3.

Abdominal tergites 5 and 6 *with* small spines between the more prominent dorsal ones.....Species 4, 6
Abdominal tergites 5 and 6 *without* small spines between the more prominent dorsal ones.....Species 5

Series c4.

Abdominal tergites 5 to 6 without small spines between the more prominent dorsal ones.....Species 7-14

Section a2.

Abdomen with prominent epipleural spines.....Series c5, Species 15
Abdomen with small epipleural spines.....Series c6, Species 16

Subdivision B.

Abdominal tergites with small spines alternating with the larger ones and with small spines between the more prominent dorsal ones.
Epipleurite 9 with bristles.....Section a3
Epipleurite 9 without bristles.....Section a4

Section a3.

Abdominal tergites 4 to 5 with two small spines between the more prominent dorsal ones.....Species 17

Section a4.

Abdominal tergites 4 to 5 with four small spines between the more prominent dorsal ones.
Beak without pair of spines between middle and apex.....Species 25, 26
Beak with pair of small spines between middle and apex.....Species 27

DIVISION II.

Abdominal tergites 4 and 5 with two small spines between the more prominent dorsal ones; beak with pair of small spines between apex and middle.....Species 29

SYNOPSIS OF LARVAL CHARACTERS.

DIVISION I, Subdivision A.

Mandibles with middle tooth emarginate.....Section a1
Mandibles with middle tooth triangular.....Sections a2, a3
Mandibles with middle tooth emarginate or triangular.....Section a4

Section a1.

Apical tooth acute.....Subsection b2
Abdominal spiracles distinct.
Head without distinct eye-spots.....Species 4, 5
Head with distinct eye-spots.....Species 6

Series c4.

Abdominal spiracles distinct.
Head without distinct eye-spots.....Species 7, 10
Head with distinct eye-spots.....Species 14

Section a2.

Apical tooth obtuse; head with distinct eye-spots.....Species 15
Apical tooth acute; head with distinct eye-spots.....Species 16

Subdivision B

Section a3

Abdominal spiracles obscure; apical tooth acute; median tooth triangular; head with distinct eye-spots.....Species 17

Section a4

Series c5

Abdominal spiracles moderately distinct
Apical tooth obtuse, middle tooth triangular, head without eye-spots.....Species 18
Apical tooth acute, middle tooth emarginate, head without distinct eye-spots.....Species 20

Series c7.

Abdominal spiracles moderately distinct; apical, subapical, and median teeth obtuse; head with distinct eye-spots.....Species 25
Abdominal spiracles obscure; apical tooth acute; middle tooth triangular; head without distinct eye-spots.....Species 26

Series c8.

Abdominal spiracles obscure; apical tooth acute; median tooth emarginate. Species 27
Apical tooth obtuse; median tooth emarginate.....Species 28

TABLE OF DISTRIBUTION.

THE WORLD.

In *Europe and Asia*, from Spain and England into eastern Siberia and Japan and northward into Sweden and Russia, probably to the Arctic Circle; in *North America*, from Mexico and Florida to the Arctic Circle in Alaska and eastward to the Atlantic.....The genus

NORTH AMERICA DIVISION 1.

Subdivision A.

Section a1.

Maine to higher mountains of North Carolina.....Species 1
Mountains of Utah to Bear Lake, British Columbia.....Species 2
Coast of northwestern California to western Washington.....Species 3
Coast of northwestern Oregon and western Washington.....Species 4
Smiths Ferry, Idaho, to Pikes Peak, Colorado.....Species 5
New Brunswick, southwest through mountains to Biltmore, N. C. (distribution of white pine).....Species 6
Eastern United States, south through mountains to North Carolina and eastward to Maine.....Species 7
Eastern Washington to Leadville, Colo., and Black Hills of South Dakota..Species 8
Winnipeg, Manitoba, to Michigan.....Species 9
Atlantic coast region and Lower Austral life zone, northward probably to Long Island, New York, and westward through the Gulf States into Texas.....Species 10
Georgia.....Species 11
Yosemite Valley, California.....Species 12
Mountains of northern California.....Species 13
Southern New Mexico and Arizona, and probably mountains of western Texas, into Mexico.....Species 14

Section a2.

Monterey and Palo Alto, Cal., Easton, Wash.....Species 15
Northwestern California, into British Columbia.....Species 16

Subdivision B.

Section a1.

Coast of western Washington to Sitka.....Species 17

Section a?.

New Hampshire ..... Species 18
New Hampshire ..... Species 19
High mountains of West Virginia ..... Species 20
Northeastern Oregon ..... Species 21
Black Hills, South Dakota, and central Colorado ..... Species 22
Koyukuk River, Alaska, lat. 67° 69′, long. 151° ..... Species 23
Northern Michigan ..... Species 24
Colorado and Utah ..... Species 25
Mount Rainier, Washington ..... Species 26
Maine to Northern Michigan ..... Species 27
Higher mountains of North Carolina ..... Species 28

DIVISION II.

New Hampshire to northern Pennsylvania, westward into Minnesota ..... Species 29
Kaslo, British Columbia ..... Species 30

TABLE SHOWING RELATIONS OF SPECIES TO HOST TREES.

Pissodes species numbers — Hosts, etc.

1. *Abies balsamea* and *A. fraseri*. Dying bark on branches and witch's broom.
2. *Abies*? (Not observed.)
3. *Picea sitchensis*? (Not observed.)
4. *Picea sitchensis*. Living bark of terminals and tops of young trees, causing serious injury.
5. *Picea engelmanni*. Living bark of terminals and tops of young trees, causing serious injury.
6. *Pinus strobus*, common; *Pinus rigida*, rare; *Pinus divaricata*, rare; *Picea rubens*, frequent; *Picea excelsa*, frequent. Living terminals of saplings and small trees, causing serious damage to white pine.
7. *Pinus strobus*, *Pinus rigida*, *Pinus echinata*, *Pinus resinosa*, *Pinus virginiana*, and *Pinus pungens*. Living and dying thick and thin bark on base and trunks of standing and felled trees, stumps, and base and stems of saplings. Injurious to the last.
8. *Pinus ponderosa* and *Pinus scopulorum*. Living and dying bark on base, stems, tops (?), and terminals of saplings.
9. *Pinus*? (Not observed.)
10. *Pinus palustris*, *Pinus taeda*, *Pinus virginiana*, and *Pinus echinata*. Living and dying thick bark on standing and felled trees, stumps, and base and stems of saplings.
11. *Cedrus deodara*. Living branches, tops, and terminals, causing serious injury.
12. *Pinus ponderosa*. Living thick bark on trunks of small trees, evidently causing scars.
13. *Pinus ponderosa* and *Pinus lambertiana*. Living and dying thick bark on standing and felled trees and stumps and on base and stems of saplings.
14. *Pinus strobiformis*, *Pinus scopulorum*, and *Pinus contorta* [*murrayana*]. Living (?) and dying bark on base and stems of saplings and of standing and felled trees.
15. *Pinus radiata* and *Pinus sylvestris*. Thick and dying bark on standing and felled trees and stumps and on base, stems, tops, and tops of saplings.
16. *Pseudotsuga taxifolia*. Living and dying thick bark on standing and felled trees and stumps and on base and terminals of saplings, causing serious injury to saplings.
17. *Picea sitchensis*. Living and dying thick bark on standing girdled trees and stumps of felled ones.

Pissodes species numbers.	Hosts, etc.
18.	*Picea rubens* and *Picea mariana*. Dying (?) thick bark on logs, stumps, and trunks of small standing trees.
19.	*Picea mariana*. Dying bark on trunk of small tree.
20.	*Picea rubens*. Dying bark on felled and standing trees.
21.	*Pinus contorta* (*murrayana*). Thin bark on standing tree.
22.	*Picea canadensis* and *Picea engelmanni*? Dying thick bark on base of standing trees.
23.	*Picea*. Thick bark on living trees. (Brunner's notes.)
24.	Probably in *Picea rubens*? and *Picea canadensis*? (Not observed.)
25.	*Abies lasiocarpa* and *Abies concolor*? Living thick bark on trunks and base of living and dying trees. Injurious.
26.	*Abies lasiocarpa* and *Abies concolor*. Living and dying thick bark on living and dying trees.
27.	*Abies balsamea*. Living and dying bark on trunks of living and dying trees and snags of storm-broken trees; also in trunks of felled trees.
28.	*Abies fraseri*. Living and dying bark on trunks of living and dying trees.
29.	*Pinus strobus*. Thick bark on stump.
30.	Host not observed; probably pine.

TABLE OF HOST TREES.

Tree species. (Britton classification, 1908.)	Common name.	*Pissodes* species number
Pinus strobus	White pine	6, 7, 29.
lambertiana	Sugar pine	13.
strobiformis	Mexican white pine	14.
resinosa	Red pine	7.
ponderosa	Western yellow pine	8, 12, 13.
scopulorum	Rock pine	8, 14.
murrayana	Lodgepole pine	14, 21.
palustris	Longleaf pine	10.
rigida	Pitch pine	6, 7.
echinata	Shortleaf pine	7, 10.
taeda	Loblolly pine	10.
radiata	Monterey pine	15.
banksiana (*divaricata*)	Gray pine	6.
virginiana	Virginia or scrub pine	7, 10.
pungens	Table mountain pine	7.
sylvestris (introduced)	Silver pine	15.
Picea canadensis	White spruce	22, 24?.
rubens	Red spruce	6, 18, 20.
mariana	Black spruce	19.
excelsa (introduced)	Norway spruce	6.
engelmanni	Engelmann spruce	5, 22?, 23.
sitchensis	Sitka spruce	3?, 4, 17.
Pseudotsuga mucronata (*taxifolia*)	Douglas spruce	16.
Abies balsamea	Balsam fir	1, 27.
fraseri	Fraser's balsam fir	1, 28.
lasiocarpa	White fir	25, 26.
concolor	Silver fir	25?, 26?.
Cedrus deodara (introduced)	Deodar cedar	11.

CHARACTERS COMMON TO THE SPECIES OF THE GENUS.

Adults.—Prothorax with anterior ventral margin not distinctly emarginate; tibiæ with incurved apical tooth; femora unarmed; anterior coxæ not widely separated; abdominal tergites covered by elytra; sternites 3 and 4 (first and second visible) very long; 5 and 6 short; 7 as long as 5 and 6 together; eyes rounded, widely separated; body oblong, reddish brown to black, sparsely to thickly clothed with slender to broad scales, the latter often forming spots on the pronotum, elytra, and femora.

Sexes.—Females with but 7 visible abdominal tergites; beak longer, smoother, and more slender than in the males. Males with 8 visible abdominal tergites; beak shorter, stouter, less shining, and more distinctly punctured.

Eggs.—Pearly white, slightly oblong, and equally rounded at both ends.

Larvæ.—Elongate, cylindrical, yellowish white, footless; body with 12 closely wrinkled segments, those of the thorax not larger or more permanent than the first abdominal.

Pupæ.—Of the general size and form of the adults, with the beak folded on the mesosterna and metasterna; tips of the posterior tarsi even with tips of wing-pads; head, beak, and abdominal segments armed with spines, the ninth abdominal having 2 rather prominent epipleural spines.

Larval galleries.—Excavated in the inner bark and sometimes marking or grooving the surface of the wood; elongate, winding, and either in the bark or outer wood, ending in pupal cells which are lined with excelsior-like borings.

Host trees.—*Pinus*, *Picea*, *Abies*, *Cedrus*, and *Pseudotsuga*.

Distribution.—Spain and England into eastern Siberia and Japan; America north of Mexico.

CHARACTERS COMMON TO THE SPECIES OF THE MAJOR AND MINOR DIVISIONS.

DIVISION I

(Species Nos. 1 to 28.)

Adults.—Elytral interspaces 3 and 5 broader and more elevated than 2 and 4.

Sexes.—Hind tibiæ of the males without long fringe of hairs.

Pupæ and larvæ.—Apparently without distinctive divisional characters, so far as observed.

Subdivision A.

(Species Nos. 1 to 16.)

Adults.—Elytra always with a distinct spot of densely placed scales on the anterior lateral area, and always with a spot or band of scales near the vertex of the declivity.

Sexes.—Beak of both sexes usually shorter than the prothorax, rarely longer.

Pupæ.—Eyes with one or more minute spines on the posterior margin.

Larvæ.—The subdivisional characters of the larva have not been recognized.

Section a1.

(Species Nos. 1 to 14.)

Adults.—Elytra with distinct spots (instead of a continuous band) near the vertex of the declivity.

Sexes.—Apical margin of the seventh abdominal sternite of the male not sinuate, or rarely so.

Pupæ.—Abdominal tergites with small scutellar spines, alternating with larger ones.

Larvæ.—Median tooth of mandible emarginate.

Host trees.—*Abies, Picea, Pinus,* and *Cedrus.*

Distribution.—Eastern and western United States, from the Gulf States and Mexico into Canada and British Columbia.

Subsection b1.

(Species Nos. 1 to 3.)

Adults.—Beak moderately stout, shorter than the prothorax; basal angles of pronotum subobtuse; third and fifth elytral interspaces strongly elevated and rugose. In species 1 and 2 the anterior spots on the elytra are distinct, the posterior ones are very large, and the pronotum is distinctly narrower than the elytra, while in species 3 the anterior and posterior spots are indistinct and the pronotum is not distinctly narrower than the elytra.

Sexes. Apical margin of seventh abdominal sternite of male *not* emarginate.

Host trees. *Abies,* so far as observed.

Distribution. Species 1, North Carolina; species 2, British Columbia; species 3, California into Washington.

1. Pissodes similis n. sp.

(Plate III, fig. 1.)

The type specimen is labeled "Type No. 7424, U.S.N.M.;" name; "type of drawing; Black Mts., N. C., VI. 27–30; ♀." It was collected by Dr. William Beutenmuller in the spruce forest on

Black Mountain, North Carolina, in 1905. The type and one male are in the type collection of the U. S. National Museum. Three females and one male from the same locality, labeled, respectively, "VI-17," "VI-17," "VI-19," and "VI-30," were returned to the American Museum of Natural History, New York City. A dead specimen was collected by the writer at Camp Caribou, Maine, June 7, 1900, on dead branch of "witch's broom," on balsam fir. Larval mines and pupal cells were observed in adjoining twigs, and another dead specimen was taken at Waterville, N. H., May 4, 1906, from a pupal cell in dead branch of "witch's broom," on balsam fir. Several specimens had emerged from the same branch.

Distinctive characters.—This species is closely allied to *P. utahensis*, from which it is distinguished by the moderately coarse pronotal punctures and the very large posterior spot which extends anteriorly to the middle of the elytra, and is surrounded by a distinct dark border.

Variations.—The specimens vary in length from 3.7 to 4 mm., and in color from light brown to dark brown, with but slight variation in the spots. Eight adult specimens were examined.

Host trees.—Abies balsamea; Abies fraseri.

Distribution (Plate XIX, fig. 1).—(Hopk.U.S.) *Maine:* Camp Caribou, Parmachene Lake. *New Hampshire:* Waterville. (A.M.N.H.) *North Carolina:* Black Mountains.

2. Pissodes utahensis n. sp.

The type specimen is labeled "Type No. 7425, U.S.N.M.;" name; "type of drawing; Park City, Ut., 6.17; Coll. Hubbard & Schwarz; 952; ♂ 1."

Distinctive characters.—This species is closely allied to the preceding, from which it is distinguished by the coarser pronotal punctures and the smaller posterior spots, which do not extend forward to the middle of the elytra and do not have a distinct darker border.

Variation.—There is very little variation in size, but the scales vary from white to a yellowish brown. Five adult specimens, 4 males and 1 female, have been examined.

Host tree.—Unknown, probably *Abies.*

Distribution (Plate XIX, fig. 2).—(U.S.N.M.) *British Columbia:* Bear Lake (London Hill Mine). *Utah:* Alta, Park City.

3. Pissodes barberi n. sp.

The type specimen is labeled "Type No. 7426, U.S.N.M.;" name; "Bair's R[an]ch, Redw[oo]d Cr[ee]k; Humboldt Co., Cal., 13.6 [June 13, 1903]; H. S. Barber, collector; 327; ♂ 1."

Distinctive characters.—This species is at once distinguished from all of the other species of the first subdivision by its darker color, the very coarse punctures of the pronotum and elytral striæ, the

strongly elevated and acutely rugose third and fifth interspaces of the elytra, and the small posterior spot. The pronotal punctures are also more distinctly separated than in the other species.

Variations.—There is some variation in size—the length ranging from 5 mm. to 5.5 mm.—and in the elytral spots, color of scales, etc. Three adult specimens, 1 female and 2 males, have been examined.

Host tree.—Unknown, probably *Picea.*

Distribution (Plate XIX, fig. 3).—(U.S.N.M.) *California:* Humboldt County. *Oregon:* Astoria. *Washington:* Tenino.

SUBSECTION b2.

(Species Nos. 4 to 14.)

Adults.—The beak is slender and shorter than the prothorax in some species and longer in others. The basal angles of the pronotum are rectangular but not acute. The third and fifth elytral interspaces are moderately to strongly elevated and rugose. Species 4 to 6 have large anterior and posterior spots on the elytra. The sides of the elytra are parallel and the beak is never longer than the prothorax. Species 7 to 14 have small anterior and posterior spots on the elytra; the elytra are slightly narrowed anteriorly and the beak in some of the species is longer than the prothorax. Species 9 to 12 have the third and fifth interspaces of the elytra distinctly elevated and broader than the second and fourth, and the punctures of the pronotum are moderately coarse and densely placed. Species 13 and 14 have the third and fifth interspaces of the elytra only slightly broader than the second and fourth, but strongly elevated and acutely rugose. The pronotum is distinctly narrower than the elytra and the pronotal punctures are very coarse.

Sexes.—In species 4 to 6 the beak of the males is shorter than the thorax and that of the females is rarely longer, while in species 7 to 14 the beak of the males is as long as the prothorax, and in a few cases longer; that of the females is usually longer and often distinctly so.

Pupæ.—The fifth and sixth abdominal tergites of species 4 and 6 have small spines between the prominent dorsal ones, while in species 5 and 7 to 14 they are obscure or absent.

Larvæ.—The apical tooth of the mandibles is acute and the abdominal spiracles are distinct. In species 4, 5, and 7 to 10 the eye spots are distinct, while in species 6 and 14 they are not.

Hosts.—Species 4 and 5, *Picea:* species 6, *Pinus* and *Picea;* species 7, 8, 10, and 12 to 14, *Pinus;* species 11, *Cedrus.*

Distribution.—Species 4, Rocky Mountains; species 5, Pacific coast; species 6 and 7, eastern United States; species 8, northern Rocky Mountains; species 9, Canada; species 10, 11, Southern States; species 12, 13, California; species 14, southern Rocky Mountains.

4. Pissodes sitchensis n. sp.

(Plate V, fig. *B*; Plate XIII; text figs. 5–7.)

The type specimen is labeled "Type No. 7428, U.S.N.M.;" name; "Hoquiam, Wash.; H. E. Burke, collector; ♀; Hopk. U. S. 2289c." The species was described from a large series, including all stages, work, and parasites, collected and reared from terminals.

Distinctive characters.—This species is closely allied to *P. engelmanni* and *P. strobi*, from the first of which it is distinguished by the subopaque pronotum, the absence of dark band on the posterior spot of the elytra, and the rather coarse punctures of the elytral striæ; from the latter it is distinguished by its average smaller size and narrower prothorax, as well as by its distribution and habits.

Variations.—There is not very much variation in size—length 5 to 5.3 mm. The color ranges from light to dark brown. The spots of scales vary in size, color, and density, and there is some variation in the relative width of the prothorax and in the size of the punctures of the elytral striæ. More than 200 specimens have been examined, including both sexes, larvæ, pupæ, and work.

Host tree.—*Picea sitchensis*, infesting tops and terminals of saplings and small trees; quite injurious.

Extensive observations have been made by Mr. Burke on the habits and seasonal history of this species.

Distribution (Plate XIX, fig. 4). (Hopk. U. S.) *Oregon:* Astoria. *Washington:* Hoquiam, North Bend, Pialschie, Satsop.

5. Pissodes engelmanni n. sp.

(Plate VI, fig. 5.)

The type specimen is labeled "Type No. 7427, U.S.N.M.;" name; "type of drawing; *Picea engelmanni;* Smith's Ferry, Idaho, Aug. 10, '05; J. L. Webb, collector; ♀ 3; Hopk. U. S. 5314." From a series of 50 adults reared August 23 to November 14 from section of top of spruce containing larvæ and pupæ collected August 10, 1905.

Distinctive characters.—This species is distinguished from the preceding in that the pronotum is shining, the posterior spot of the elytra has a dark border, and the punctures of the elytral striæ are indistinct, especially on the lateral area. From *P. strobi* it is distinguished by its generally smaller size, coarse punctures of the pronotum, and more obscure punctures of the elytral striæ, as also by its distribution, habits, and host.

Variations.—There is very little variation in size. The color ranges from light to dark brown, the spots of scales vary in size, color, and density, and the dark border of the posterior spot from distinct to obscure. The punctures of the pronotum and elytra vary considerably in size and distinctness. More than 150 specimens were examined, including both sexes, larvæ, pupæ, and work.

Host tree.—Picea engelmanni, infesting tops and terminals of saplings and small trees; quite injurious.

Extensive observations on the habits and seasonal history of this species have been made by Messrs. Burke and Webb.

Distribution (Plate XIX, fig. 5).—(Hopk. U. S.) *Colorado:* Manitou Park. *Idaho:* Smiths Ferry. *Montana:* Little Belt National Forest.

6. Pissodes strobi Peck.

(Plate III, fig. 6; Plate VI, fig. 6; Plate XIV; text figs. 1, 2.)

This species is represented in the collection by a typical specimen labeled with name, "type of drawing; *Pinus strobus;* Webster, N. H.; W. F. Fiske, collector; ♀ 6; Hopk. U. S. 3215b;" by 2 specimens labeled "*Pinus strobus;* Milford, Pa.; A. D. Hopkins, Nov. 14–25, bred; Hopk. U. S. 6077," and by one small specimen labeled "Edsallville, Pa."

Distinctive characters.—This species is most closely allied to *P. engelmanni,* from which it is distinguished by its average larger size, dense punctures of the pronotum and distinct punctures of the elytral striæ, as well as by its distribution and habits.

Variations.—There is considerable variation in size—4.5 to 6 mm. in length—but the average is nearer the latter extreme. The color ranges from dark to light brown. The spots of scales vary considerably in size, density, and color and in the presence or absence of a dark border to posterior lateral spot of the elytra. There is also considerable variation in the form of the pronotum and in the punctures of the pronotum and elytral striæ. More than 500 specimens were examined, including all stages and work.

Host trees.—Pinus strobus, Pinus rigida, Pinus divaricata, Picea rubens, and *Picea excelsa;* infesting terminals. Very injurious to white pine, much less so to the other species.

Distribution (Plate XIX, fig. 6).—(Hopk. U. S.) *Connecticut:* Hartford, Pomfret Center. *Maine:* Alfred, Bangor, Portland. *Massachusetts:* Framingham. *Michigan:* Grand Rapids. *New Hampshire:* Colebrook, Dover, Franconia, Keene, Monadnock, Newport, Penacook, Pike, Rochester, Tamworth, Webster, Wiers. *New York:* Kiamesha, Kidders. *North Carolina:* Biltmore (Davidsons River). *Pennsylvania:* Cisuarun, Milford, Mount Airy (Franklin County), Trucksville, Wilkesbarre. *West Virginia:* Kanawha Station, Cairo. *Wisconsin:* Ashland. *Canada:* Ontario—Guelph, Ottawa; New Brunswick—Chatham, Fredericton. (Hopk. W. Va.) *Massachusetts:* Middlesex Falls. *West Virginia:* St. George, Tucker County. (U.S.N.M.) *Massachusetts:* Boston. *Pennsylvania:* Edsallville. *Michigan:* Grand Ledge. *New Hampshire:* Contoocook. *New York:* New Baltimore.

Bibliography and Synonymy.

Rhynchænus strobi Peck, 1817, p. 2, pl. 2. Harris, 1841, pp. 63–64.

Pissodes strobi (Peck) Say, 1831, p. 14 (in part). Fitch, 1858, pp. 732–736, pl. 3, fig. 1. Say, 1859, p. 277 (in part). Walsh and Riley, 1869, p. 26, fig. 22. Gemminger and Harold, 1871, p. 2432. Le Baron, 1874, p. 139, fig. 63. Thomas, 1876, pp. 133–134 (in part). Le Conte, 1876, pp. 142–143 (in part). Fuller, 1880, pp. 5–6, fig. 2. Saunders, 1883, p. 55, fig. 23 (in part). Packard, 1886, pp. 322–325, pl. 9 (in part). Lintner, 1888, p. 24, figs. 6, 7. Packard, 1890, pp. 734–741 (in part). Riley and Howard, 1890, p. 348 (parasite); 1891, p. 468 (in part). Lintner, 1893, pp. 344–345, fig. 22 (in part). Hopkins, 1893, p. 205, No. 219 (in part); 1899, pp. 259–260, 345, 441 (in part). Chittenden, 1899, pp. 58–59, figs. 11, 12 (in part). Felt, 1906, pp. 397–401 (in part). Hopkins, 1906, pp. 252–253, figs. 61, 62; 1907, pp. 1–7, figs. 1–6; 1909, pp. 11, 16, 17, figs. 8, 9.

7. Pissodes approximatus n. sp.

(Plate VI, fig. 7; Plate XV, figs. *A*, *B*.)

The type specimen is labeled "Type No. 7430, U.S.N.M.;" name; "*Pinus strobus;* Lynn Woods, Mass.; A. D. Hopkins, June 11, '06, bred; ♀; Hopk. U. S. 6332." This specimen was reared from larvæ in bark from base of white pine sapling defoliated by the gipsy moth. The type series is represented by a male labeled the same as the type, one labeled "Camb.; Coll. Hubbard & Schwarz; ♂," and 2 males labeled "Marquette, Mich., 27.6; Coll. Hubbard & Schwarz."

Distinctive characters.—This species has been commonly confused with *P. strobi* in collections and literature, but is distinguished from it by the average large size, elongate body, the sides of the elytra more distinctly narrowed posteriorly. The beak is longer, and the spots of the elytra are uniformly smaller, the posterior ones rarely connected. It is also definitely separated by its marked difference in habits. It is distinguished from *P. nemorensis*, to which it is more closely allied, by its average smaller size, shorter beak, and larger posterior brown spot of the elytra, and, except in regions where the two species may overlap, it may be at once distinguished by its distribution. It is distinguished from its closest ally, *P. schwarzi*, by the moderately coarse pronotal punctures.

Variations.—There is much variation in size, the length ranging from 4.3 to 6.7 mm., but extremes are rare. The color ranges from dark brown, nearly black, to brown, but the prevailing color is dark. There is considerable variation in the structure of the pronotum and elytra and in the punctures, spots, etc., but the spots of scales, while variable in size and color, are commonly small, and never as large as in the average *P. strobi*. More than 100 specimens were examined, including all stages and work.

Host trees.—*Pinus strobus*, *Pinus rigida*, *Pinus echinata*, *Pinus resinosa*, *Pinus virginiana*, and *Pinus pungens*, occurring in thick bark on trunks of trees and base of saplings; sometimes injurious to the saplings.

Distribution (Plate XIX, fig. 7).—(Hopk. U. S.). *Maine:* Lake Moxie. *Massachusetts:* Lynn Woods, Springfield. *Michigan:* Grand Island, Munising. *New Hampshire:* Penacook, Waterville, Webster. *North Carolina:* Biltmore, Hendersonville, Pink Beds. *Pennsylvania:* Milford. *Virginia:* Rock Springs. *Wisconsin:* Lac du Flambeau. *Canada:* Guelph.

(Hopk. W. Va.) *West Virginia:* Deckers Creek, Greenbrier County, Greene Spring, Hampshire County, Harpers Ferry, Morgantown, Pendleton County, Romney, Tibbs Run, Tucker County. (U.S. N.M.) *Massachusetts:* Cambridge, Marion, Springfield. *Michigan:* Eagle Harbor, Marquette, Whitefish Point. *New Hampshire:* Durham, Hanover. *New York:* New York City and vicinity. *Wisconsin:* Bayfield.

8. Pissodes schwarzi n. sp.

(Plate III, fig. 8; Plate XVI, fig. *B*.)

The type specimen is labeled "Type No. 7455, U.S.N.M.;" name; "Veta Pass, Col., 24.6; Coll. Hubbard & Schwarz; ♀." This, together with another specimen, a male from the same locality, was evidently collected by Mr. E. A. Schwarz, for whom the species is named. The specimens were found in the United States National Museum under *P. costatus*.

Distinctive characters.—This species is evidently confused in collections under the name *P. costatus*. Specimens of *P. schwarzi* and *P. yosemite* had been referred to *P. costatus* by the writer until the specimens from Sitka spruce were recognized as representing the latter. With possibly a single exception, the specimens referred to by Le Conte under *P. costatus* evidently belonged to *P. yosemite*. *P. schwarzi* is not allied to the specimens I have referred to *P. costatus*. In general appearance it comes nearer *P. yosemite* and *P. webbi*, but according to the character of the fork of the male genitalia it falls in the series with *P. approximatus*, from which it is distinguished by the narrow pronotum with coarse punctures and by the larger posterior spots of the elytra. It is distinguished from *P. webbi* by its relatively broader pronotum, the punctures of which are less coarse and more densely placed, and from *P. yosemite* by the same character; also it is distinguished from both by its distribution.

Variations.—There is quite a wide range of variation in size, the length ranging from 5.2 to 6.7 mm., and in the density of the pronotal punctures, size and density of spots of scales, and relative elevation of elytral interspaces 3 and 5, so that some specimens may be found which appear to connect it with the other species, but it is the writer's opinion that when we know more of the habits and seasonal history of the northern Rocky Mountain *Pissodes* some of the species here included will be found to represent one or more undescribed species, and especially Hopk. U. S. 2386a, which was found ovipos-

iting in the terminal of a pine sapling. Forty-nine specimens have been examined, including all stages and work.

Host tree.—Pinus ponderosa scopulorum, in thick bark on trunks of trees, in base of saplings, and possibly in tops and terminals.

Distribution (Plate XIX, fig. 8).—(Hopk. U. S.). *Colorado:* Estes Park. *Idaho:* Centerville. *South Dakota:* Black Hills, Custer, Lead. *Washington:* Buckeye (U.S.N.M.) *Colorado:* Breckenridge, Estes Park, La Veta Pass, Leadville. *Montana:* Helena. *South Dakota:* Custer. *Washington:* Buckeye. *Canada:* Alberta, Banff Springs.

Bibliography and Synonymy.

Pissodes costatus (not of Mann.) Hopkins, 1906, p. 254, fig. 63.

9. Pissodes canadensis n. sp.

The type specimen is labeled "Type No. 7431, U.S.N.M.;" name; "Winnipeg, Man[itoba], Hanham; ♀ 1." This, with two other specimens, a male and a female, were found in the Wickham collection in the United States National Museum under *P. strobi*.

Distinctive characters.—This species may be easily confused with *P. approximatus* by its general external appearance, but the difference in the fork of the male genitalia indicates that it is distinct and more nearly related to *P. nemorensis*. It is distinguished from *P. approximatus* by the somewhat stouter body and prothorax. The alternate interspaces of the elytra are acutely rugose, the posterior spots are more completely fused on the lateral area, and the beak is longer. It is easily separated from *P. nemorensis* by the relatively shorter beak and stouter body and fused posterior spots of the elytra, as also by its distribution.

Variations.—There is not much variation in the three specimens except that the alternating elevated interspaces are less acutely rugose in one specimen than in the other two specimens. Three adult specimens were examined.

Host tree.—Not known, but it is evidently pine.

Distribution (Plate XX, fig. 9).—(U.S.N.M.). (Wickham Collection) *Canada:* Manitoba (Winnipeg).

10. Pissodes nemorensis Germar

Plate XV, fig. *C*, text fig. 8, *B*

The species is represented in the collection by a typical specimen labeled with rectangular red label; name; "*Pinus;* Calhoun, Ala.; A. D. Hopkins, Apr. 25, '05, bred; ♂ 1: Hopk. U. S. 11761."

Distinctive characters.—There seems to be little doubt that this is the long unrecognized species described by Germar in connection with the description of the genus and commonly referred to as synonymous with *P. strobi*, with which it has been confused in col-

lections and literature. The reference in the description to the beak being longer than the prothorax is sufficient to distinguish it from *P. strobi*, and the type locality, "Kentucky," is sufficient to place it within the range of this common southern form. This species is very readily distinguished from *P. strobi* by its average larger size, much longer beak, smaller spots of scales on elytra, and by its habits and general distribution, although the ranges of the two species may overlap in some places. It is distinguished from *P. approximatus* (with which it may occur in the Transition zone around the Appalachian Mountain ranges) by its average larger size, longer beak, the elytra more distinctly narrowed posteriorly, and much smaller posterior brown spot. It is also distinguished from its closest ally (*P. deodaræ*), the only other species known to occupy the Gulf States region, by its average larger size and shorter beak, and by the posteriorly narrowed elytra and more distinctly elevated third and fifth elytral interspaces.

Variations.—There is much variation in size, the length ranging from 4.9 to 7.7 mm., and in color from nearly black to light brown, the darker areas predominating. There is also much variation in all of the structural and sculptural characters and in the size, density, and color of the spots. More than 250 specimens have been examined, including all stages and work.

Host trees.—*Pinus palustris Pinus tæda*, *Pinus virginiana*, and *Pinus echinata*, in thick bark on trunks of dying and felled trees, stumps, stems, and base of saplings, etc. Apparently it is not especially injurious.

Distribution (Plate XX, fig. 10).—(Hopk. U.S.) *Alabama:* Calhoun. *District of Columbia:* Langdon, Rock Creek Park. *Georgia:* Demorest, Macon, Thomasville. *Maryland:* Silver Spring. *North Carolina:* Boardman, Tryon. *South Carolina:* Lumber. *Texas:* Deweyville, Houston. *Virginia:* Hawlin, Princess Anne County, Virginia Beach. *West Virginia:* Kanawha Station. (Hopk. W. Va.) *West Virginia:* Lockheart's Run, Roosevelt. (U. S. N. M., under *P. strobi*.) *Alabama:* Prattville. *Florida:* Tallahassee. *Maryland:* Piney Point. *North Carolina:* Retreat, Graybeard Mountains.

Bibliography and Synonymy.

Pissodes nemorensis Germar, 1824, p. 318. Gemminger and Harold, 1871, p. 2431.
Pissodes strobi (not of Peck) Say, 1831, p. 14 (in part). Harris, 1841, p. 63 (in part). Say, 1859, p. 277 (in part). Le Conte, 1876, p. 142 (in part). Thomas, 1877, p. 134 (in part). Hopkins, 1893, p. 205, No. 219 (in part); 1899, p. 429 (parasite); 1899, p. 441 (in part).

11. Pissodes deodaræ n. sp.

The type specimen is labeled "Type No. 7433, U.S.N.M.;" name; "deodar; Experiment, Ga., Apr. 25, '03; Fiske, Col[lecto]r; ♀; Hopk. U. S. 1641e."

Distinctive characters.—This species is distinguished from *P. nemorensis* by its average smaller size, longer beak, less distinctly elevated elytral interspaces, and the sides of the elytra more distinctly parallel, but it is more distinctly separated by its habit and host. It is not improbable that this is an example of the origin of species through mutation and change of habit and host.

Variations.—There is considerable variation in size, the length ranging from 4.2 to 5.8 mm., but there is not very much variation in the grayish-brown color or in form, sculpture, and vestiture. In fact, it appears to be more constant in general character than almost any of the other species.

Host tree.—*Cedrus deodara*, in living branches, tops, and terminals, causing serious injury.

Distribution (Plate XX, fig. 11).—(Hopk. U. S.) *Georgia:* Experiment.

12. Pissodes californicus n. sp.

The type specimen is labeled "Type No. 7456, U. S. N. M.;" name; "*Pinus ponderosa;* Yosemite Val., Cal., June 13, '04; Hopkins, Col[lecto]r; ♀ 4; Hopk. U. S. 2808a." This specimen was collected by the writer at the same time and place as those referred to *P. yosemite*, and was not recognized at the time as distinct.

Distinctive characters.—This species is closely related to *P. nemorensis*, from which it is at once distinguished by the deeply emarginate anterior margin of the pronotum and by its very different habit and distribution. It is also readily distinguished from *P. yosemite* by the broad, closely punctured pronotum with its emarginate anterior margin and by the broad, flattened, third and fifth elytral interspaces. Indeed, it is so markedly different from any of the other western forms that we feel justified in basing our conclusion as to its distinctness on the single specimen.

Host tree.—*Pinus ponderosa*, in thick bark on living trees, causing serious scars.

Distribution (Plate XX, fig. 12). (Hopk. U. S.) *California:* Yosemite Valley.

13. Pissodes yosemite n. sp.

Plate XVI, fig. 4.[1]

The type specimen is labeled "Type No. 7434, U. S. N. M.;" name; "*Pinus ponderosa;* Yosemite Val., Cal., June 13, '04; Hopkins, Col[lecto]r; ♂ 4; Hopk. U. S. 2808b." The specimen was collected near Mirror Lake in the thick bark of a tree which was apparently dying from injuries by this and possibly the preceding species.

Distinctive characters.—This species is more closely allied to *P. webbi*, from which it is distinguished by the narrower pronotum with the punctures less densely placed, and by its distribution.

Variations.—There is considerable variation in size, the length ranging from 5.1 to 7 mm., but not much in its reddish-brown color. The spots of whitish scales are usually conspicuous on the sides of the pronotum and near the declivity of the elytra, but there is considerable variation in their size, density, and color. The very coarse punctures of the pronotum and the strongly elevated third and fifth elytral interspaces are quite constant and characteristic. Fifty-one specimens were examined, including adults, larvæ, and work.

Host trees.—*Pinus ponderosa* and *Pinus lambertiana*, in living and dying thick bark on standing and felled trees, stumps, and base and stems of saplings. It is evidently quite injurious.

Distribution (Plate XX, fig. 13).—(Hopk. U. S.) *California:* Summerdale and Yosemite. (U. S. N. M.) *California:* Lake Tahoe, Placer County, Siskiyou County, under *P. costatus*. *Washington:* Easton, under *P. fasciatus*.

Bibliography and Synonymy.

Pissodes costatus (not of Mannerheim) Hopkins, 1906, p. 254, fig. 64.

14. Pissodes webbi n. sp.

The type specimen is labeled "Type No. 7459, U. S. N. M.;" name; "*Pinus strobiformis;* bred Nov. 12–7; Sta. Catalina Mts., Ariz.; J. L. Webb, collector; ♀; Hopk. U. S. 5722." The specimen was reared with others from larvæ in thick bark on small felled tree, August 20, 1908. It is named for the collector.

Distinctive characters.—This species is more closely allied to *P. yosemite*, from which it is distinguished by the broader pronotum, with the punctures more closely placed.

Variations.—There is considerable variation in size, the length ranging from 4.8 to 6.8 mm., and in color from nearly black to dark reddish-brown. There is less variation in the spots than usual, which have less white and more of the yellow scales. Over 70 specimens were examined, including all stages and work.

Host trees.—*Pinus strobiformis, Pinus scopulorum,* and *Pinus murrayana* (*contorta*) in living(?) and dying bark on base and stems of saplings and standing and felled trees. It is probably injurious.

Distribution (Plate XX, fig. 14).—(Hopk. U. S.) *Arizona:* Santa Catalina Mountains. *New Mexico:* Capitan Mountains and Cloudcroft.

Bibliography and Synonymy.

Pissodes strobi (not of Peck) Champion, 1902, p. 119. (May be above species; can not be *P. strobi* Peck.—A. D. H.)

SECTION a2.

SUBSECTIONS b3 AND b4.

(Species Nos. 15 and 16.)

Adults.—Elytra with a transverse band of white and yellow scales instead of a distinct spot near the vertex of the declivity; beak shorter than the prothorax. Species 15 has a broad pronotum with the posterior angles acute, while in species 16 the pronotum is narrow and the angles subrectangular.

Sexes.—Apical margin of seventh abdominal sternite of males not sinuate; beak slightly longer and more slender in the females than in the males.

Pupæ.—Abdominal tergites without distinct small spines alternating with the longer ones. Species 15 has distinct epipleural spines, while species 16 does not.

Larvæ.—Eye spots distinct; apical tooth of mandible obtuse in species 15 and acute in species 16.

Hosts.—Species 15, *Pinus;* species 16, *Pseudotsuga.*

Distribution.—Species 15, coast of California and Washington; species 16, northern California into British Columbia.

15. Pissodes radiatæ n. sp.

(Plate VII, fig. 15.)

The type specimen is labeled "Type No. 7435, U. S. N. M.; name; *Pinus;* Del Monte, Cal., Sept. 4, '02; A. D. Hopkins, collector; ♀ 1; Hopk. U. S. 1089b." It was reared from a small branch of a transplanted small sapling of *Pinus sylvestris*, collected September 4, 1902, in the grounds of the Del Monte Hotel at Del Monte, Cal.; it was also found in *Pinus radiata*, for which the species is named.

Distinctive characters.—This is a very distinct species, separated from all other North American species by the acute posterior angles of the pronotum. It comes nearer to *P. notatus* of Europe than to any other foreign species, but from this species it is at once distinguished by the strongly elevated third and fifth elytral interspaces.

Variations.—There is considerable variation in size, the length being from 5.1 to 7.4 mm., but not much in color, markings, etc., of the specimens from Monterey and Palo Alto, but the single specimen from Easton, Wash., is small, dark brown, the punctures of the elytra coarser, and the posterior angles of the pronotum very acute. Further specimens from this northern locality and more information relating to their habit and host may show that the northern individuals represent a distinct species. More than 90 specimens have been examined, including all stages and work.

Host trees.—*Pinus radiata* (common) and *Pinus sylvestris* (rare), infesting the thick bark on standing and felled trees and stumps, and the base, stems, and tops of saplings.

Distribution (Plate XX, fig. 15).—(Hopk. U. S.) *California*; Del Monte, Monterey, Palo Alto. (U. S. N. M.) *Washington:* Easton, under *P. fasciatus*.

16. Pissodes fasciatus Le Conte.

(Plate III, fig. 16; Plate XVII.)

The species is represented in the collection by a typical specimen labeled with the name "type of drawing; *Pseudotsuga taxifolia;* Hoquiam, Wash.; Burke, col[lecto]r; ♀; Hopk. U. S. 2064b."

Distinctive characters.—This species is readily distinguished from *P. radiatæ*, to which it is somewhat remotely allied, by the posterior angles being rectangular instead of acute, the third and fifth interspaces less elevated, and also by its habit and host.

Variations.—There is considerable variation in size, from 5.1 to 8.3 mm. in length, and in color from nearly black to reddish and brown; there is also much variation in the size, density, and color of the spots of scales. More than 200 specimens have been examined, including all stages and work.

Host tree.—*Pseudotsuga taxifolia*, living and dying thick bark on standing and felled trees and stumps, and on the base of saplings.

Distribution (Plate XX, fig. 16).—(Hopk. U. S.) *Washington:* Ashford, Keyport, Hoquiam, Meredith, Pialschie. (Webb's collection) *Washington:* Sequim. (U. S. N. M.) *Washington:* Tenino, Easton. *Oregon:* Corvallis, Portland. *British Columbia:* Kaslo, North Bend, Victoria.

Bibliography.

Pissodes fasciatus Le Conte, 1876, pp. 142–143. Hopkins, 1905, p. 253, figs. 65, 66.

Subdivision B.

(Species Nos. 17 to 28.)

Adults. Elytra usually without distinct spots on anterior lateral area and with small spots situated between the vertex of the declivity and the median area.

Sexes. Beak in both sexes rarely shorter than prothorax, commonly much longer, and always distinctly longer in females than in males.

Pupæ.—Eyes without minute spines on posterior margin (so far as observed).

Larvæ. Without distinctive divisional characters (so far as observed).

Hosts. *Picea* and *Abies*.

Distribution.—*Section a3*, coast of western Washington to Sitka; *section a4*, Canadian zone, eastern United States from mountains of North Carolina to Canada, and northern Rocky Mountains and Pacific Coast region northward into Alaska.

SECTION a3.

(Species No. 17.)

Adults.—Basal angles of pronotum subrectangular and beak rather stout and moderately long; apical margin of the seventh abdominal sternite of male without apical process, but faintly sinuate.

Pupæ.—Small spines alternating with the longer ones on abdominal tergites and ninth epipleurites with a few bristles.

Larvæ.—Abdominal spiracles obscure; apical tooth of the mandibles acute, the median emarginate, and the eye spots distinct. The host is *Picea sitchensis* from the coast of western Washington to Sitka.

17. Pissodes costatus Mannerheim.

This species is represented in the collection by a typical specimen labeled with the name: "*Picea;* Hoquiam, Wash.; A. D. Hopkins, collector; ♀ 2; Hopk. U. S. 2361g." The specimen was reared from among larvæ and pupæ found May 26, 1903, under thick bark in chip cocoons in outer wood of stump of a tree of *Picea sitchensis* felled in 1902. This evidently comes nearer to Mannerheim's species than anything yet recognized, and the fact that it is found in the Sitka spruce is additional evidence.

Distinctive characters.—This is the only representative of the first section (a3) of subdivision B, and therefore is not closely allied to any of the other species of the subdivision. It is distinguished by the closely placed punctures of the pronotum, which become coarser and more distinctly separated toward the posterior lateral section, by the moderately rounded posterior angles of the pronotum, and by the indistinct spots of reddish brown and white scales.

Variations.—The three matured adults examined range in length from 5.5 to 7.1 mm., and in color from dark brown to black. The spots of scales vary in size, color, and density. Three adults and the larva and pupa have been examined.

Host tree.—*Picea sitchensis*, in thick bark on dying and felled trees and stumps.

Distribution (Plate XXI, fig. 17).—Hopk. U. S. *Washington:* Hoquiam. *Alaska:* Sitka (the type locality).

BIBLIOGRAPHY.

Pissodes costatus Mannerheim, 1853, p. [illegible] (reprint p. 71).

SECTION a4.

(Species Nos. 18 to 28.)

Adults.—Basal angles of pronotum rounded; beak slender and moderately to very long.

Species 18 to 24 have the punctures of the pronotum distinctly separated and the punctures of the elytral striæ small to coarse. In species 18 to 21 the pronotum is not distinctly narrower than the elytra. Species 18 has a short, stout pronotum with the sides strongly rounded and constricted toward the anterior margin, the elytral interspaces with rather coarse rugosities. Species 19 to 21 have a more elongate pronotum with rounded sides but not distinctly constricted toward the head, and the elytral interspaces have fine rugosities. In species 22 to 24 the pronotum is distinctly narrower than the elytra. Species 25 to 28 have the punctures of the pronotum irregular in size and not distinctly separated and the strial punctures are very coarse and irregular. In species 25 and 26 the strial punctures are very irregular in size, the elytral spots moderately distinct, and the pronotum not distinctly narrower than the elytra. In species 27 and 28 the strial punctures are moderately irregular, the elytral spots are evident but small, and the pronotum is distinctly narrower than the elytra.

Sexes.—In species 18 the apical margin of the seventh abdominal sternite of the males is sinuate but without median process, while in species 20 there is a distinct median process, and in species 25 to 28 the apex is uniformly rounded as in the females.

Pupæ.—The fourth and fifth abdominal tergites have two small spines between the more prominent dorsal ones. In species 26 the rostrum is without a pair of spines between the middle and apex, while in 27 they are present. Head without distinct eye spots (so far as observed).

Larvæ.—In species 18 the abdominal spiracles are moderately distinct, the apical tooth of the mandibles obtuse, and the median tooth triangular. In species 20 the apical tooth is acute, and the median tooth is emarginate. In species 26 to 28 the abdominal spiracles are obscure. In species 26 the apical tooth is acute and the middle tooth triangular. In species 27 the apical tooth is acute and the median one emarginate, while in species 28 the apical tooth is obtuse and the median one emarginate.

Hosts.—Species 18, 19, 20, *Picea;* species 21, *Pinus;* species 22, *Picea;* species 25, 26 and 27, *Abies.*

Distribution.—Species 18, 19, 20, and 28, Canadian zone, West Virginia and New Hampshire; species 21 and 26, Cascade Mountains, Oregon and Washington; species 22 and 25, central Rocky Mountains; species 23, Alaska (Arctic Circle); species 24, northern Michigan; species 27, Maine to northern Michigan.

SUBSECTION b5.

(Species Nos. 18 to 24.)

18. Pissodes fiskei n. sp.

(Plate III, fig. 18; Plate XII.)

The type specimen is labeled "Type No. 7438, U.S.N.M.;" name; "type of drawing; *Picea;* Franconia, N. H., Oct. 16, '07; W. F. Fiske, collector; ♀ 1; Hopk. U. S. 3309." It was reared with other specimens from a section of a small spruce tree scorched by fire, collected October 16, 1907.

Distinctive characters.—This is a very distinct species, and may be known from its nearest ally, *P. nigræ*, by the strongly elevated third and fifth elytral interspaces, and the larger yellow posterior spot of densely placed scales, with no trace of an anterior spot. It is at once distinguished from *P. similis*, which may be associated with both species in the bark of the same tree, by its large size, short pronotum, and long beak.

Variations.—There is not much variation in size, the length ranging from 4.2 to 5.2 mm., nor in other characters. Eight specimens of adults and work were examined.

Host trees.—*Picea rubens* and *Picea mariana*, in thick bark on logs and trunks of small standing trees.

Distribution (Plate XXI, fig. 18).—(Hopk. U. S.) *New Hampshire:* Rye.

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Pissodes strobi (not of Peck) Packard, 1890, pp. 829–830. (Probably *P. fiskei* Hopk.—A. D. H.)

19. Pissodes nigræ n. sp.

The type specimen is labeled "Type No. 7458, U.S.N.M.;" name; "*Picea nigra;* Webster, N. H.; W. F. Fiske, collector; Hopk. U. S. 3725a." It was taken from a section of the trunk of a small dead tree, collected May 3, 1906.

Distinctive characters.—This species is distinguished from *P. fiskei* by the much less elevated and less rugose interspaces, longer beak, and small to obscure anterior white spot on the elytra. From *P. puncticollis* it is distinguished by its darker color, stout pronotum, and less distinctly elevated elytral interspaces. It is at once distinguished from *P. similis* by its long beak.

Variations.—The length varies from 4.4 to 6.6 mm. There is very little variation in the color. The anterior spots are obscure in some specimens and the posterior ones vary from yellowish to white.

Host tree.—*Picea mariana.*

Distribution (Plate XXI, fig. 19).—(Hopk. U. S.) *New Hampshire:* Webster.

20. Pissodes puncticollis n. sp.

(Plate IV, fig. 20.)

The type is labeled "Type No. 7437, U.S.N.M.;" name; "type of drawing; *Picea;* Randolph Co., W. Va.; A. D. Hopkins, collector; ♀ 1; Hopk. W. Va. 70." It was taken from the dead bark of a spruce log collected August 25, 1890.

Distinctive characters.—Closely allied to *P. murrayanæ*, but distinguished by its light reddish-brown color, irregular and less dense pronotal punctures, and larger size, with the alternating interspaces less distinctly elevated, an anterior spot present, and the posterior spot distinct.

Variations.—The length varies from 4.2 to 6.1 mm.; there is very little variation in the color. The anterior white spot, which is small and situated on the fourth interspace, is obscure in two specimens and situated on the fifth stria in the others. Four adults and 1 larva were examined.

Host tree.—Picea rubens, in dying bark on felled and standing trees.

Distribution (Plate XXI, fig. 20).—(Hopk. W. Va.) *West Virginia:* Cheat Bridge, Randolph County, Bayard, Tucker County.

21. Pissodes murrayanæ n. sp.

The type specimen is labeled "Type No. 7436, U.S.N.M.;" name; "*Pinus murrayana;* Wallowa, Oreg.; A. D. Hopkins, Apr. 10, '07, bred; Hopk. U. S. 6560a." It was reared from the section of a small tree received from correspondent, H. K. O'Brien, February 14, 1907.

Distinctive characters.—The single imperfect specimen representing this species is closely allied to *P. puncticollis*, from the type of which it is distinguished by its dark brown color, very small posterior spot, absence of an anterior spot, regular pronotal punctures, and broad third elytral interspace. It is probable that more specimens will show a wider range of variation from those of *P. puncticollis*.

Host tree. —Pinus murrayana, in thin bark.

Distribution (Plate XXI, fig. 21).—(Hopk. U. S.) *Oregon:* Wallowa.

22. Pissodes coloradensis n. sp.

The type specimen is labeled "Type No. 7439, U.S.N.M.;" name; "Leadville, Colo., H. F. Wickham, July 7–14, '96, 10,000–11,000 ft.; ♀; C. L. 39." (Abdomen removed and mounted on separate pin. Labeled "C L 39 ♀.") Specimen from Wickham's collection in the United States National Museum.

Distinctive characters.—Pronotum distinctly narrower than elytra and punctures irregular, not dense. Elytral scales distinct, giving

the surface a grayish appearance. Posterior spot prominent, this readily distinguishing it from its nearest allies, *P. alascensis* and *P. rotundatus*.

Variations.—Length 7.4 to 9.4 mm. The color ranges from dark brown to black. The color and density of the scales vary as usual, as do also the elevation and rugosities of the alternating interspaces, strial punctures, etc. Twenty-seven specimens of adults were examined.

Host trees.—*Picea canadensis* in the Black Hills of South Dakota. It will evidently be found also in *Picea engelmanni*.

Distribution (Plate XXI, fig. 22).—Black Hills of South Dakota; central Colorado.

23. Pissodes alascensis n. sp.

The type specimen is labeled "Type No. 7459, U.S.N.M.;" name; "Koyukuk R., Alas., Lt. 67-69, Lg. 151, summer 1901; W. J. Peters, collector."

Distinctive characters.—The darker color and closely placed yet separated pronotal punctures, sparse elytral scales, and small posterior spot on the elytra serve to distinguish the single specimen of this species from *P. coloradensis*, and the distinctly elevated and rugose elytral punctures distinguish it from *P. rotundatus*. One specimen only was examined.

Host tree.—Probably *Picea*.

Distribution (Plate XXI, fig. 23).—(Hopk. U. S.) *Alaska:* Koyukuk River, Arctic Circle.

24. Pissodes rotundatus Le Conte.

(Plate IV, fig. 24.

This species is represented in the collection by a typical specimen labeled with name; "Marquette, Mich., 4, 7 (July 4); Coll. Hubbard & Schwarz; ♀ 4"

Distinctive characters.—This species is closely allied to *P. alascensis* from which it is distinguished by the densely placed punctures of the pronotum and the broad and not strongly elevated third and fifth elytral interspaces, which also serve to distinguish it from *P. coloradensis*.

Variations.—The length varies from 6 to 7.5 mm.; there is not much variation in color except as it may be modified by the more numerous white scales on some specimens. Seven specimens of adults were examined.

Host trees.—Probably *Picea rubens* (?) and *Picea canadensis* (?).

Distribution (Plate XXI, fig. 24).—U. S. N. M. H. & S. *Michigan:* White Fish Point, Marquette, June and July.

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Pissodes rotundatus Le Conte, 1876, pp. 142, 143–144. Hopkins, 1906, pp. 254, 256, fig. 69.

Subsection b6.

Species Nos. 25 to 28.)

25. Pissodes burkei n. sp.

(Plate IV, fig. 25.)

The type specimen is labeled "Type No. 7440 U.S.N.M.;" name; "above Ouray, Colo., 9,000–10,000 ft., Mineral Point Trail, VII, 1897, H. F. Wickham; ♀ 4." From Wickham's collection. Additional specimens collected and host tree determined by H. E. Burke.

Distinctive characters.—This species is quite distinct from *P. rotundatus* but is more closely allied to *P. piperi*, from which it is distinguished by its decidedly grayish appearance and the distinct posterior spot of the elytra.

Variations.—The length varies from 6 to 7.7 mm., but there is comparatively little variation in the color, except in rubbed specimens which are darker. Thirty-two specimens were examined, including all stages and work.

Host tree.—*Abies lasiocarpa*, in thick bark on living and dying trees.

Distribution (Plate XXII, fig. 25).—(Hopk. U. S.) *Utah:* Kamas (Burke, collector). (U.S.N.M.) (H. & S.) *Utah:* Alta and Park City, June (under *P. costatus*). *Colorado:* Ouray (Wickham).

26. Pissodes piperi n. sp.

(Plate IV, fig. 26; Plate V, fig. A; Plate XVIII; text fig. 8, *A*.)

The type specimen is labeled "Type No. 7441, U.S.N.M.;" name; "type of drawing; Mt. Rainier, Wash.; collector, C. V. Piper; ♀ 1." Additional specimens were collected and host trees determined by Messrs. H. E. Burke and J. L. Webb.

Distinctive characters.—This species is at once distinguished from *P. burkei* by its large size, dark color, sparsely placed elytral scales, small posterior spot, and very coarse and deep punctures of elytral striæ.

Variations.—The length varies from 7.4 to 10 mm. and the posterior spots of the elytra vary from obscure to distinct. Five adults and 128 specimens examined, including all stages and work.

Host trees.—*Abies lasiocarpa* and *Abies concolor*, in thick bark on trunks of living (?) and dying trees.

Distribution (Plate XXII, fig. 26).—(Hopk. U. S.) *Washington:* Paradise Valley. *Idaho:* Centerville. (U.S.N.M.) (H. & S.) *British Columbia:* Glacier. *Washington:* Mt. Rainier.

27. Pissodes dubius Randall.

(Plate IV, fig. 27.)

This species is represented in the collection by a typical specimen labeled with the name; "Marquette, Mich., 27.6 [June 27]; Coll. Hubbard & Schwarz; ♀ 1."

Distinctive characters.—This species is closely allied to *P. fraseri*, from which it is distinguished by its medium size, moderately long beak, and the regular convex pronotum without broad impressions.

Variations.—The length varies from 4.8 to 5.7 mm. and as usual there is considerable variation in color due to rubbed and immature specimens. Forty-one specimens were examined, including all stages and work.

Host tree.—*Abies balsamea*, in thick living and dying bark on trunks of living and dying trees and stumps of storm-broken trees.

Distribution (Plate XXII, fig. 27).—(Hopk. U. S.) *Maine:* Lake Parmachene, Beaver Pond (Boil Mountain). *New Hampshire:* Dartmouth College, Fabyan, Waterville. *Michigan:* Grand Island. (U.S.N.M.) (H. & S.) *Michigan:* Marquette and White Fish Point.

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Pissodes dubius Randall, 1838, pp. 24–25. Le Conte, 1876, pp. 142, 143. Hopkins, 1906, pp. 254, 256, fig. 67. Felt, 1906, p. 401.

28. Pissodes fraseri n. sp.

(Plate VI, fig. 28; text fig. 9.)

The type specimen is labeled "Type No. 7142, U.S.N.M.;" name; "Pisgah Mt., N. C., altitude 5,000 ft.; A. D. Hopkins, collector; ♀; Hopk. U. S. 2868." It was collected June 29, 1904. Adults were common, pupæ frequent, and larvæ rare in pupal cells in inner bark on trunk of large Fraser fir tree, which had evidently died from root disease.

Distinctive characters.—Closely allied to *P. dubius*, from which it is distinguished by its large size, very long beak, and the moderately convex pronotum with basal and oblique subdorsal impressions.

Variations.—The length varies from 4.6 to 9.1 mm. and there is considerable variation in color, size of spots and punctures, length of beak, and impressions of pronotum. One hundred and six specimens were examined, including all stages and work.

Host tree.—*Abies fraseri*, thick living and dying bark on trunks of living and dying trees.

Distribution (Plate XXII, fig. 28).—(Hopk. U. S.) *North Carolina:* Pisgah Mountains (Silver Mountain). (A.M.N.H.) *North Carolina:* Black Mountains (Beutenmuller).

DIVISION II.

(Species Nos. 29 and 30.)

Adults.—Third and fifth elytral interspaces not broader or more elevated than second and fourth. Beak shorter than prothorax, slender. Pronotum broad, with sides behind the middle nearly parallel with the basal angles, rectangular. Punctures of elytral striæ moderately coarse, regular.

Sexes.—Posterior tibiæ of the males fringed with long hairs. Apical margin of the seventh abdominal sternite of the males with a truncate process arising from a deep emargination.

Pupæ.—Fourth and fifth abdominal tergites with two small spines between the more prominent dorsal ones. Rostrum with a pair of small spines between the apex and the middle.

Larvæ.—Not known.

Host.—*Pinus.*

Distribution.—Species 29, New Hampshire to northern Pennsylvania, westward into Minnesota; species 30, British Columbia.

29. Pissodes affinis Randall.

(Plate IV, fig. 29; Plate VI, fig. 29.)

This species is represented in the collection by a typical specimen labeled with name; "Marquette, Mich., 26.6 [June 26]; Coll. Hubbard & Schwarz; ♀ 2."

Distinctive characters.—This species is at once distinguished from all of the preceding ones of the genus by the equal width of the elytral interspaces, the third and fifth of which are not elevated; and from its nearest ally (*P. curtici*) by the long posterior spot on the elytra and by the moderately coarse strial punctures.

Variations.—The length varies from 5.5 to 8 mm., and while the sculpture and color are quite constant there is considerable variation in the spots of scales, both in color and density. Twenty-nine adult specimens were examined.

Host tree.—*Pinus strobus,* in thick bark on stump. (As determined by W. F. Fiske.)

Distribution (Plate XXII, fig. 29).—(Hopk. U. S.) (Fiske collector) *New Hampshire:* Webster or Penacook. (U.S.N.M.) *Minnesota.* (H. & S.) *Michigan:* Marquette (June and July); Eagle Harbor (Wickham). *Wisconsin:* Bayfield. *New Hampshire:* Hampton. *New York:* Ithaca (Chittenden). *Pennsylvania; Massachusetts.*

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Pissodes affinis Randall, 1838, p. 24. Le Conte, 1876, pp. 142, 143. Schwarz, 1889, p. 176 (male character). Hopkins, 1906, pp. 254, 256, fig. 68. Felt, 1906, p. 402.

30. Pissodes curriei n. sp.

(Plate VI, fig. 30.)

The type specimen is labeled "Type No. 7443, U.S.N.M.;" name; "Kaslo, B. C., 2.7 [July 2, 1903]; R. P. Currie, collector; ♂ 1."

Distinctive characters. This species is distinguished from *P. affinis* by the very sparsely placed scales, the obscure anterior spots, the small posterior spot on the elytra, and the coarse and deep strial punctures.

Variations.—The length varies from 5.6 to 7.7 mm. There is very little variation in sculpture, spots of scales, etc. Seven adult specimens were examined.

Host tree.—Unknown, probably *Pinus*.

Distribution (Plate XXII, fig. 30).—(U.S.N.M.) *British Columbia:* Kaslo.

LIST OF DESCRIBED SPECIES OF PISSODES.[a]

Species No.	Name.	Habitat.	Host.
1.	*similis* Hopkins	North America	*Abies.*
2.	*utahensis* Hopkins	North America	*Abies.*
3.	*barberi* Hopkins	North America	*Picea.*
4.	*sitchensis* Hopkins	North America	*Picea.*
5.	*engelmanni* Hopkins	North America	*Picea.*
6.	*strobi* Peck	North America	*Pinus* and *Picea.*
	validirostris Gyllenhal	Europe	*Pinus* (cones).
7.	*approximatus* Hopkins	North America	*Pinus.*
8.	*schwarzi* Hopkins	North America	*Pinus.*
9.	*canadensis* Hopkins	North America	
10.	*nemorensis* Germar	North America	Pine.
11.	*deodaræ* Hopkins	North America	Pine.
12	*californicus* Hopkins	North America	*Pinus.*
13.	*yosemite* Hopkins	North America	*Pinus.*
14.	*webbi* Hopkins	North America	*Pinus.*
	notatus Fabricius	Europe	*Pinus, Picea, Larix* (trunk).
15.	*radiata* Hopkins	North America	*Pinus.*
16.	*fasciatus* Le Conte	North America	*Pseudotsuga.*
	scabricollis Miller	Austria; Hungary; Bohemia	*Picea* (tops).
17.	*costatus* Mannerheim	North America	*Picea*
18.	*fiskei* Hopkins	North America	*Picea*
	obscurus Roelofs	Japan	
19	*nigra* Hopkins	North America	*Picea*
20	*punctatellus* Hopkins	North America	*Picea*
21	*murrayana* Hopkins	North America	*Pinus*
22	*coloradensis* Hopkins	North America	*Picea*
23	*alascensis* Hopkins	North America	*Picea*
	harcyniæ Herbst	Europe	*Picea* (twigs)

[a] North American species are numbered, foreign species are without number.

Species No.	Name.	Habitat.	Host.
24.	*rotundatus* Le Conte	North America	*Picea.*
	rotundicollis Desbrochers	Russia	
25.	*burkei* Hopkins	North America	*Abies.*
26.	*piperi* Hopkins	North America	*Abies.*
	piceæ Illiger	Middle Europe	*Abies* (twigs and trunk).
27.	*dubius* Le Conte	North America	*Abies.*
28.	*fraseri* Hopkins	North America	*Abies.*
	insignatus Boheman	Siberia	*Pinus, Larix.*
	piniphilus Herbst	Europe	Pine (terminals and trunk).
	irrorotus Reitter	Siberia	
	cembræ Motschulsky	East Siberia	*Pinus.*
	gyllenhali Gyllenhal	Europe Siberia	
	pini Linnæus	Europe	*Pinus* (thick bark), *Picea, Larix.*
29.	*affinis* Randall	North America	*Pinus.*
30.	*curriei* Hopkins	North America	

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ADULTS OF PISSODES.

Fig. 1.—*P. [illegible]*. (Original.) Fig. [illegible].—*P. [illegible]*. (Author's illustration.) Fig. 8.—*P. schwarzi*. (Author's illustration.) Fig. 15.—*P. [illegible]*. (Original.) Fig. 16.—*P. fasciatus*. (Author's illustration.) Fig. 18.—*P. [illegible]*. (Original.)

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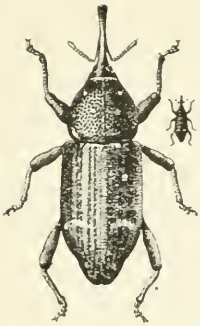

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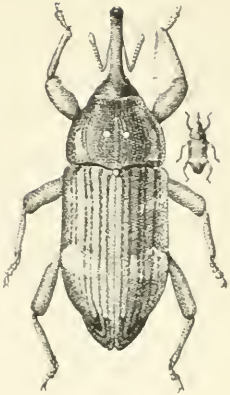

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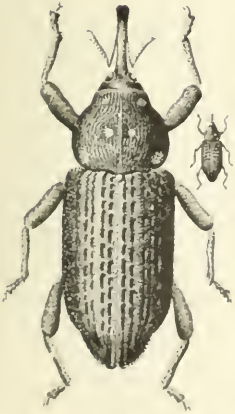

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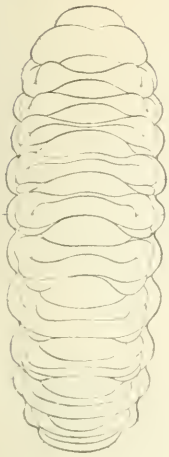
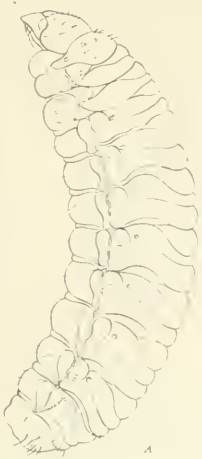
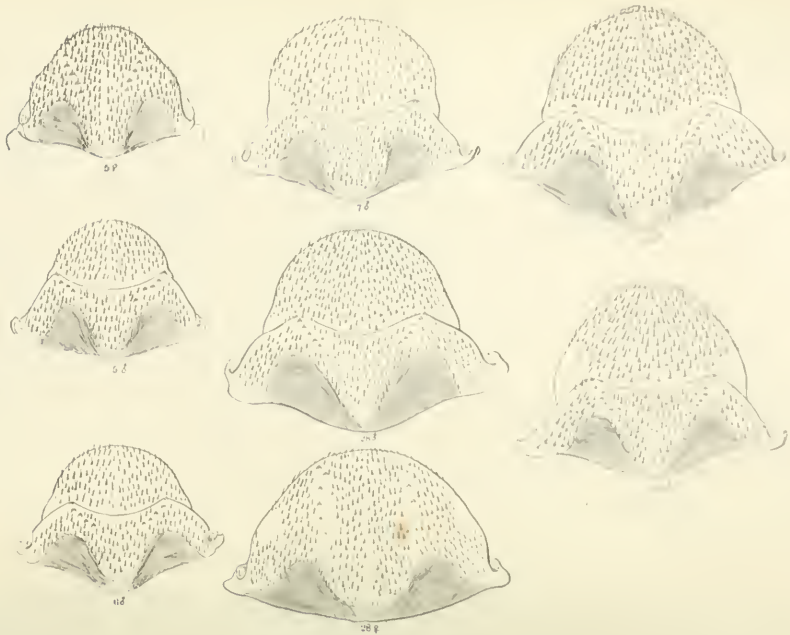
ADULTS OF PISSODES

Fig. 20.—*P. punctatus*. (Original.) Fig. 24.—*P. approximatus*. (Author's illustration.) Fig. 25.—*P. barberi*. (Original.) Fig. 26.—*P. piperi*. (Original.) Fig. 27.—*P. dubius*. (Author's illustration.) Fig. 29.—*P. affinis*. (Author's illustration.)



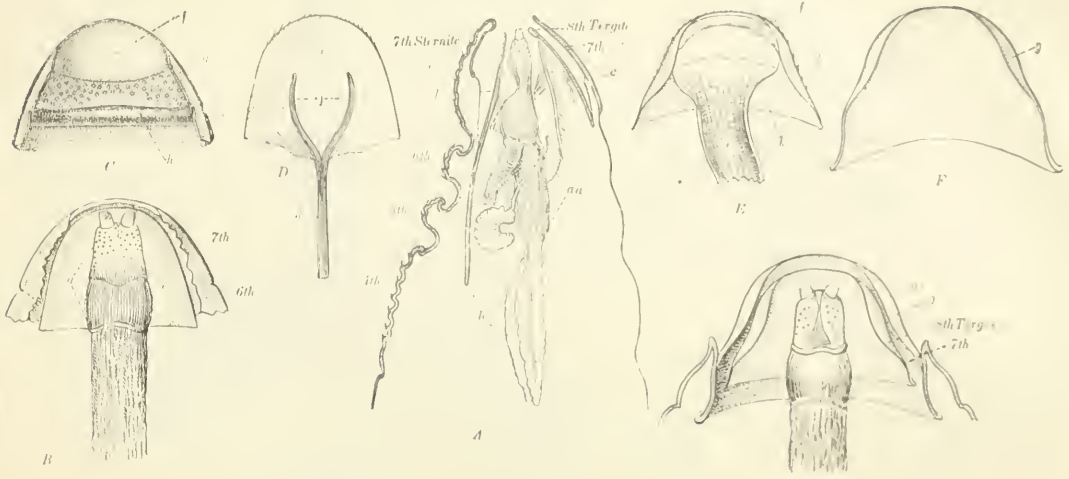


LARVA AND PUPA OF PSOCUS



PYGAL TERGITES OF THE ABDOMEN OF PISSODES.

Fig. 5, ♀.—Tergite 7 of *P. engelmanni*. Fig. 6, ♂.—Tergites 7 and 8 of *P. engelmanni*. Fig. 6, ♀.—Tergites 7 and 8 of *P. strobi*. Fig. 7, ♂.—Tergites 7 and 8 of *P. approximatus*. Fig. 28, ♂.—Tergites 7 and 8 of *P. fraseri*. Fig. 28, ♀.—Tergite 7 of *P. fraseri*. Fig. 29, ♂.—Tergites 7 and 8 of *P. affinis*. Fig. 30, ♂.—Tergites 7 and 8 of *P. carriei*. (Original.



FEMALE REPRODUCTIVE ORGANS OF PISSODES.

A.—Longitudinal section of abdomen showing relative positions of parts, and lateral aspect of the female organs: *a*, Posterior section of genitalia; *aa*, median section; *b*, posterior section and ovaries; *c*, genital plate or ninth sternite; *d*, apodeme of the ninth sternite; *e*, rectum. *B*.—Dorsal aspect of posterior part of organs showing relation to abdominal sternites. *C*.—Dorsal aspect of seventh sternite and junction with sixth sternite; *f*, Dorsal fold; *g*, hypopleurite 7. *h*, sutural fold; *i*, hypopleurite 6. *D*.—Dorsal aspect of eighth sternite; *c*, Genital plate; *d*, apodeme; *j*, fork. *E*.—Ventral aspect of eighth tergite; *e*, Rectum, *f*, ventral fold, *g*, epipleurites. *F*.—Ventral aspect of seventh tergite; *g*, Epipleurite 7. *G*. Ventral aspect of anterior section of organs and relations to seventh and eighth tergites. (Original.)

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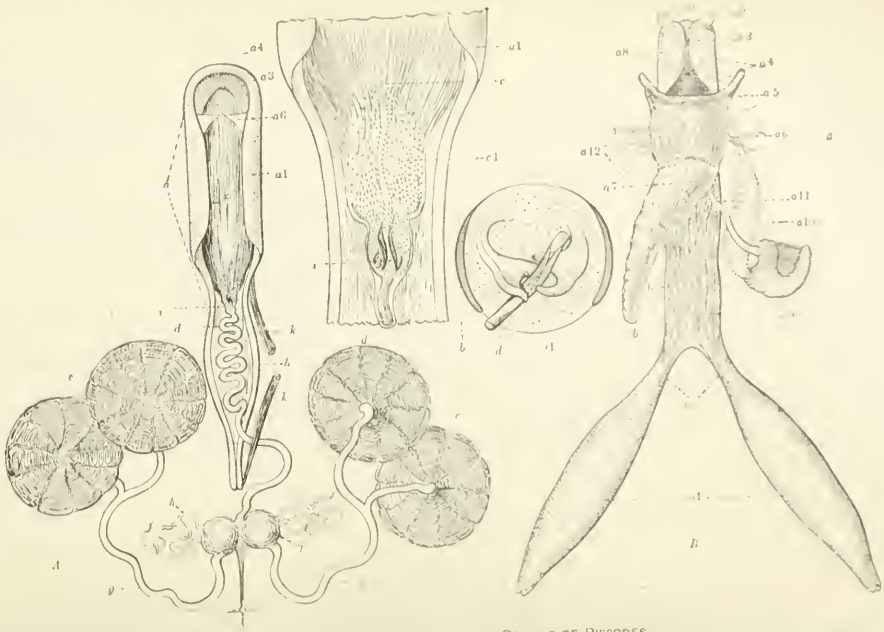
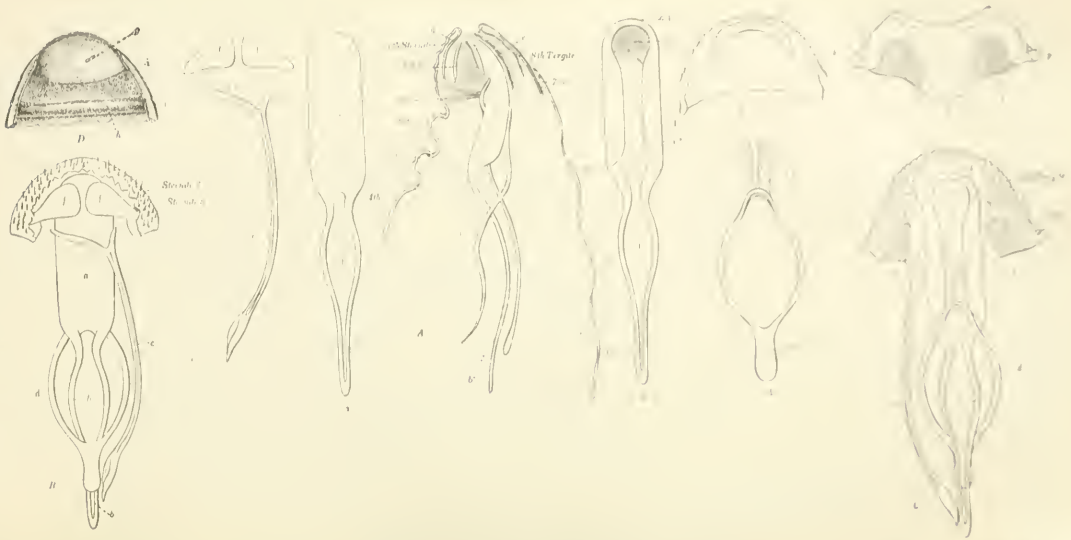


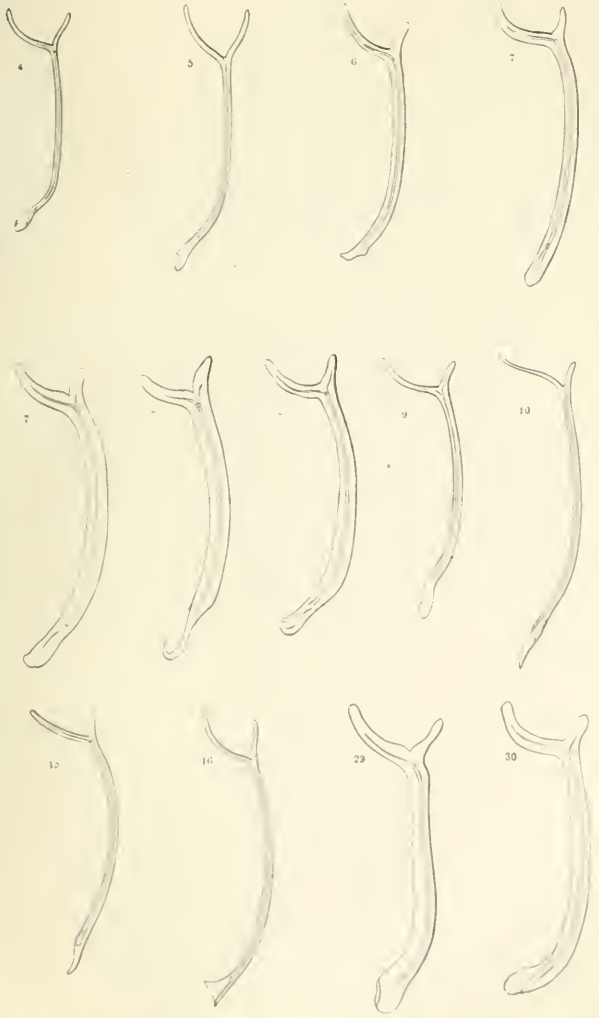
MALE AND FEMALE REPRODUCTIVE ORGANS OF PISSODES.

A. Male genitalia: *a*, Body; *a1*, lateral fold; *a3*, apical opening; *a4*, apex; *b*, femora or apodemes; *c*, ejaculatory duct; *c1*, denticulate area; *d*, seminal duct; *e*, testes; *f*, seminal vesicle; *g*, vas deferens; *h*, mucous glands; *i*, seminal valve; *i1*, transverse section greatly enlarged, showing approximate structure of valve. *B*. Female genitalia of young adult: *b1*, Ovaries (immature); *b2*, paired oviducts; *b3*, unpaired oviduct; *a1*, anal opening of ovipositor; *a2*, genital palpus; *a3*, ventral canal; *a5*, ovipositor; *a6*, vaginal opening; *a7*, vagina; *a8*, bursa copulatrix; *a9*, latero-ventral fold; *a9*, spermatheca; *a10*, spermatheeal gland; *a11*, seminal duct; *a12*, mucous glands. (Original.)



MALE REPRODUCTIVE ORGANS OF PISSODES.

1. Longitudinal section of abdomen showing relative position of segments and Lateral aspect of chitinous parts of genitalia; *B*, ventral aspect of chitinous parts in relation to seventh sternite and genital plates; *C*, dorsal aspect of chitinous parts in relation to seventh and eighth tergites; *D*, dorsal aspect of seventh sternite and genitalia with sixth; *E*, ventral aspect of eighth tergite; *F*, ventral aspect of seventh tergite. *a*, Body (representing the tenth sternite); *a 1*, lateral fold; *a 2*, ejaculatory canal, *a 3*, apical opening; *a 4*, apex; *b*, femora; *c*, rod or fork (representing the ninth sternite); *c 1*, major prong; *c 2*, minor prong; *d*, ring representing the apodemes of the ninth tergite); *d 1*, papillæ; *d 2*, posterior process; *e*, rectum, *f*, eighth sternite or genital plates; *g*, dorsal fold; *h*, sutural fold; *i*, hypopleurite 7, *j*, hypopleurite 8, *k*, epipleurite 8; *l*, apical or ventral fold; *m*, anterior margin; *n*, anterior margin; *o*, posterior margin; *p*, lateral angle and arthculating fold of lateral angle, also epipleurite, *q*, membranous lobe. (Original.)



FORKS OF MALE GENITALIA OF PISSODES

Fig. 4.—*P. schwarzi*. Fig. 5.—*P. engelmanni*. Fig. 6.—*P. strobi*. Fig. 7.—*P. approximatus*. Fig. 8.—*P. schwarzi*. Fig. 9.—*P. canadensis*. Fig. 10.—*P. nemorensis*. Fig. 15.—*P. radiatæ*. Fig. 16.—*P. fasciatus*. Fig. 29.—*P. affinis*. Fig. 30.—*P. curriei*. (Original.)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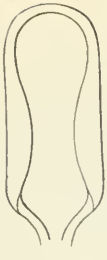
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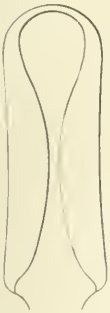
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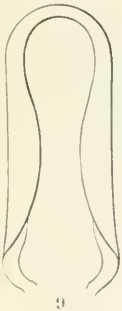
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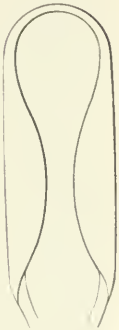
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STEMS OF MALE GENITALIA OF PISSODES

Fig. 4.—*P. eatchensis*. Fig. 5.—*P. engelmanni*. Fig. 6.—*P. strobi*. Fig. 7.—*P. approximatus*. Fig. 9.—*P. ennadensis*. Fig. 10.—*P. nemorensis*. Fig. 15.—*P. radiatae*. Fig. 16.—*P. fasciatus*. Fig. 29.—*P. affinis*. Fig. 30.—*P. curtisi*. Original.

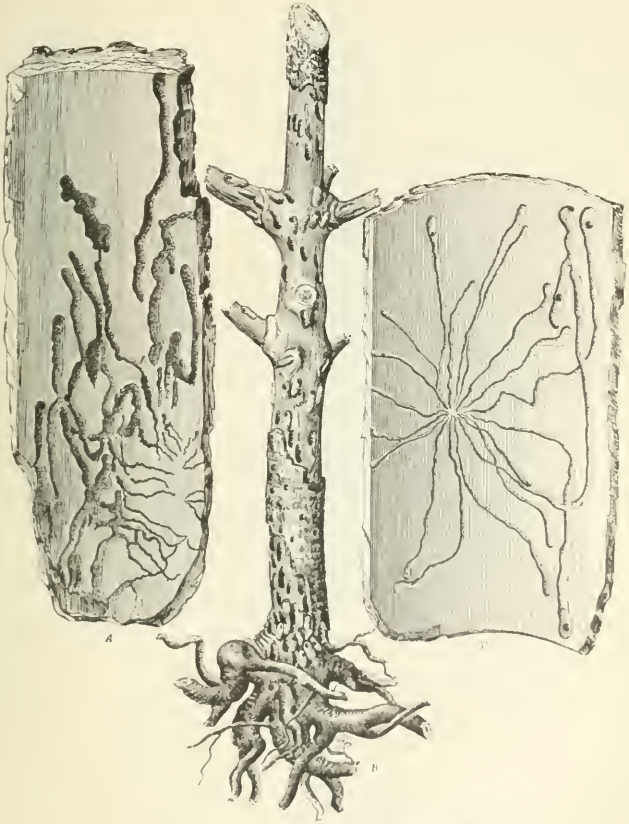
WORK OF PISSODES FISKEI IN INNER BARK AND OUTER WOOD (ORIGINAL.)

W[illegible] PI[illegible]OU[illegible]TCHEN[illegible] N BARK AND W[illegible] OF T[illegible]

[illegible] *B*.—Four-year-old top [illegible] one-year internode; [illegible] internode; [illegible] internode; *d*, 4-year internode. (Original.)

WORK OF PISSODES STROBI, SHOWING CHARACTER OF INJURY, CHIP COCOONS AND PUPAL CELLS.

[illegible]



WORK OF PISSODES APPROXIMATUS AND P. NEMORENSIS.

A.—Work of *P. approximatus* in bark. B.—Work of *P. approximatus* in bark and wood of apple. C.—Work of *P. nemorensis* in bark. Original.

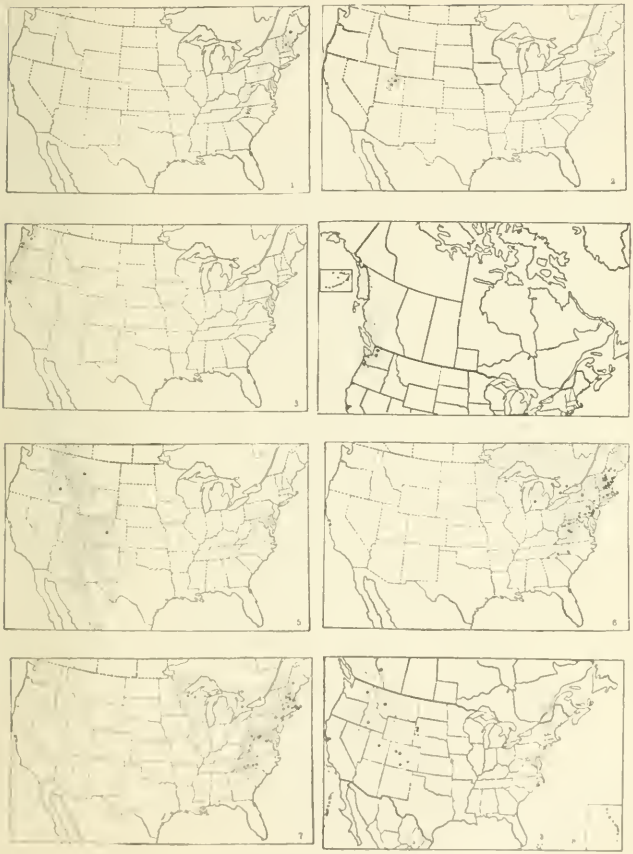
WORK OF PISSODES YOSEMITE AND P. SCHWARZI

A—P. [illegible] Work in wood and bark. (Author's illustration.) B—[illegible]. Work in wood and bark. (Original.)

WORK OF PISSODES FASCIATUS.

A.—Work in bark and wood of stem of sapling. (Author's illustration.) *B*.—Work in thick bark. (Original.)

WORK OF PISSODES PIPERI IN BARK. (ORIGINAL.)

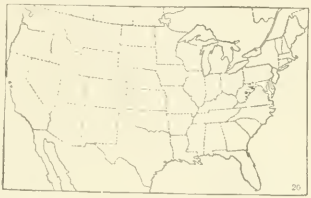


DISTRIBUTION MAPS OF PISSODES.

Fig. 1.—*P. similis*. Fig. 2.—*P. utahensis*. Fig. 3.—*P. barberi*. Fig. 4.—*P. sitchensis*. Fig. 5.—*P. engelmanni*. Fig. 6.—*P. strobi*. Fig. 7.—*P. approximatus*. Fig. 8.—*P. schwarzi*.

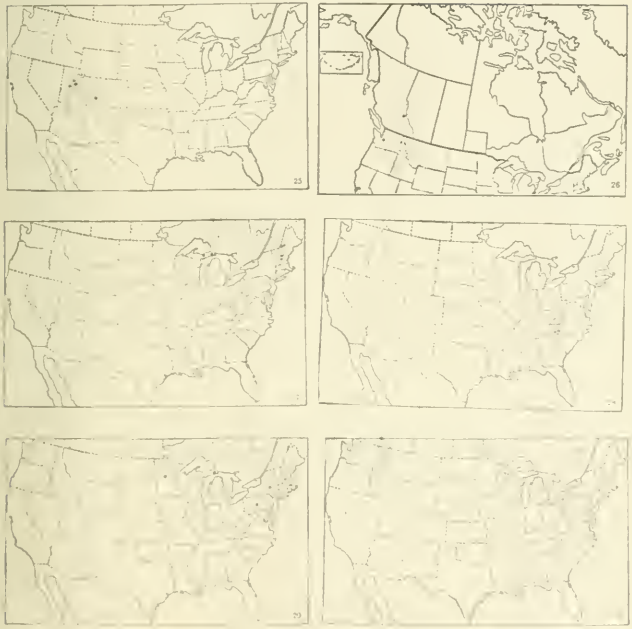
DISTRIBUTION MAPS OF PISSODES.

Fig. 9.—*P. canadensis*. Fig. 10.—*P. nemorensis*. Fig. 11.—*P. dentatus*. Fig. 12.—*P. strobiformicus*. Fig. 13.—*P. yosemite*. Fig. 14.—*P. webbi*. Fig. 15.—*P. radiatæ*. Fig. 16.—*P. fasciatus*.



DISTRIBUTION MAPS OF PISSODES.

Fig. 17.—*P. cubatus*. Fig. 18.—*P. [illegible]*. Fig. 19.—*P. nigra*. Fig. 20.—*P. punctatellus*. Fig. 21.—*P. murrayanæ*. Fig. 22.—*P. coloradensis*. Fig. 23.—*P. alascensis*. Fig. 24.—*P. rotundatus*.



DISTRIBUTION MAPS OF PISSODES.

Fig. 25.—*P. burkei*. Fig. 26.—*P. fasti*. Fig. 27.—*P. dubius*. Fig. 28.—*P. fraseri*. Fig. 29.—*P. affinis*. Fig. 30.—*P. curtis*.