

THESIS

REVISION OF THE NEW WORLD *HYLURGOPS* LECONTE (COLEOPTERA:
CURCULIONIDAE: SCOLYTINAE)

Submitted by

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ABSTRACT

REVISION OF THE NEW WORLD *HYLURGOPS* LECONTE (COLEOPTERA: CURCULIONIDAE: SCOLYTINAE)

The New World species of the genus *Hylurgops* LeConte are revised. *Hylurgops subcostulatus* Mannerheim is transferred to *Pachysquamus*, new genus. A revised key to the Hylastina is presented to include the new genus *Pachysquamus*. The Nearctic *H. knausi* Swaine is a valid taxon distinguishable from *H. planirostris* Chapuis of the high montane Neotropical region. The subspecies *H. r. rugipennis* Mannerheim and *H. r. pinifex* Fitch are considered full valid species. A key to the *Hylurgops* species of the New World is presented.

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INTRODUCTION

With over 6,000 described species worldwide (Wood 1982), the bark beetles of the subfamily Scolytinae represent a large and diverse subfamily within the Curculionidae. A few genera in the Scolytinae are particularly well-known due to their economic and ecological importance. These are considered primary bark beetles, which are species with the ability to overwhelm the defenses of a live and healthy tree and to reproduce successfully within it (Peirson 1923). Among these are species of the genus *Dendroctonus* Erichson, *Ips* DeGeer, and *Scolytus* Geoffroy. In contrast to those considered primary, secondary bark beetles (Peirson 1923) such as *Hylurgops* LeConte are generally poorly studied.

The subtribe Hylastina was erected by LeConte (1876) and it was considered by Wood (1978, 1982, 1986) to represent a primitive group within the subfamily Scolytinae. Genera in the Hylastina are characterized by having a seven segmented antennal funicle and an acutely raised precoxal ridge or costae. With the Hylastina, LeConte (1876) added two new genera to Erichson's (1836) genus *Hylastes* which represents the type genus. The first was *Hylurgops* where he placed the species in Erichson's (1836) second division of the genus *Hylastes* which had broad and bilobed third tarsomeres (Fig. 1a) and anteriorly protuberant intercoxal mesosternal processes (Fig. 2a). The second genus LeConte erected was *Scierus*, where he placed a single species with widely separated procoxae; differing from both *Hylastes* and *Hylurgops*, where the procoxae are subcontiguous.

The origins of the genus *Hylurgops* has been suggested to be Holarctic (Wood 1982) from where its earliest representatives were described from Baltic Amber (Schedl 1947) dating back to the late Eocene, around 38 million years ago. Presently, 22 species are included in the genus (see Wood & Bright 1992, Alonso-Zarazaga & Lyal 2009), which are distributed throughout the Holarctic and the high montane areas of the Neotropical region where the conifer hosts occur. Nine species have a Nearctic to high montane Neotropical distribution including the established exotic *H. palliatus* Gyllenhal (see Haack 2001, Hoebeke & Acciavatti 2006). The remaining 13 species are distributed throughout the Palearctic.

Various species of *Hylurgops* have been reviewed previously by Nüsslin (1912) who studied the genitalia; the morphology of the external and internal characters were treated by Munro (1917), Tsai & Huang (1964), Yin *et al.* (1984), and the morphology of the larva was presented in Munro (1917), and Thomas (1957). In addition, keys and descriptions are available for the Holarctic species (Reitter 1913, Pfeffer 1944), Europe and neighboring countries (Pfeffer 1995), eastern Russia (Krivolutskaya 1996), China (Tsai & Huang 1964, Yin *et al.* 1984), Japan (Murayama 1963), Canada and Alaska (Bright 1976), and North and Central America (Wood 1978, 1982). American species were described between 1843 and 1971 (Table 1).

In his monograph, Wood (1982) treated the genus *Hylurgops* where he included a key and descriptions to the species of the New World. The following revision reevaluates Wood's conclusions, as well as that of other workers and presents a treatment of the New World species in the genus *Hylurgops* and a new related genus.

Table 1. New World *Hylurgops* changes in this revision

Original designation	Wood (1982)	This study
<i>Hylesinus rugipennis</i> (Mann.)	<i>Hylurgops r. rugipennis</i>	<i>Hylurgops rugipennis</i>
<i>Hylastes subcostulatus</i> (Mann.)	<i>Hylurgops s. subcostulatus</i>	<i>Pachysquamus subcostulatus</i>
<i>Hylastes pinifex</i> (Fitch)	<i>Hylurgops r. pinifex</i>	<i>Hylurgops pinifex</i>
<i>Hylastes porosus</i> (LeC.)	<i>Hylurgops porosus</i>	<i>Hylurgops porosus</i>
<i>Hylastes planirostris</i> (Chapuis)	<i>Hylurgops planirostris</i>	<i>Hylurgops planirostris</i>
<i>Hylastes alternans</i> (Chapuis)	<i>Hylurgops s. alternans</i>	<i>Pachysquamus subcostulatus</i>
<i>Hylastes longipennis</i> (Blandf.)	<i>Hylurgops longipennis</i>	<i>Hylurgops longipennis</i>
<i>Hylastes incomptus</i> (Blandf.)	<i>Hylurgops incomptus</i>	<i>Hylurgops incomptus</i>
<i>Hylurgops knausi</i> Swaine	<i>Hylurgops planirostris</i>	<i>Hylurgops knausi</i>
<i>Hylurgops reticulatus</i> Wood	<i>Hylurgops reticulatus</i>	<i>Hylurgops reticulatus</i>

BIOLOGY

Adult *Hylurgops* are attracted by mixtures of ethanol (Byers 1992) and terpenes in the host's resin such as α -pinene (Byers 1992, Volz 1988) and β -pinene (Volz 1988), that are commonly released by dying or stressed conifers. The phloeophagous *Hylurgops* have been found in conifers of the genera *Abies*, *Larix*, *Picea*, *Pinus*, *Pseudotsuga* and *Tsuga* where they feed and breed from the lower bole to the root crown of the tree (Furniss & Carolin 1977). They can also live in the fallen trunks and branches (Wood 1982) of their hosts where they prefer the damp undersides (Oester *et al.* 1978), especially of those in cool and moist locations (Graham 1922, Grünwald 1986). The preference for hosts in cool and moist areas can be further inferred from studies showing higher densities of the species *H. palliatus* and *H. glabratus* occurring in bolts located in the forest's interior (Peltonen & Heliövaara 1999) or at the edge (Fossestøl &

Sverdrup-Thygeson 2009) and lower densities in bolts located at adjacent drier and warmer clear-cuts.

The reproduction of *Hylurgops* is barely known. The mating system has been described to be monogamous in *H. palliatus* (Benz *et al.* 1986), *H. pinifex* (Blackman 1919), and *H. rugipennis* (Oester *et al.* 1978). After completing maturation feeding in their birth host (Cameron 1940) females search for a new tree that has been recently killed or it is dying in response to an abiotic or biotic disturbance such as: severe drought, fire or the attack of a primary beetle or a fungal pathogen, among other factors. In these susceptible hosts the female initiates a new brood gallery (Blackman 1919, Kirkendall 1983).

Sex pheromones have not been found in *Hylurgops*, therefore the mechanisms of mate finding is not understood. It is known; however, that once it locates a female it stridulates the setae (Barr 1969, Lyal & King 1996, Oester *et al.* 1978) located on the plectral tubercles of the 7th abdominal tergite attracting the mining female. Mating occurs in a chamber built by the female proximate to the entrance hole (Blackman 1919). Males entering a couple's gallery are sometimes pushed out by the pair's male (Oester *et al.* 1978).

Females deposit their eggs in niches along the sides of the simple longitudinal and slightly sinuate (Bright 1976) gallery (Fig. 3b). The emerging larvae dig perpendicularly at both sides of the longitudinal gallery (Blackman 1919). As the larvae feed, they mine the phloem in random patterns (Swaine 1918) eventually making their galleries, as well as the brood gallery patterns indistinguishable (Blackman 1919). Four instars have been documented in *H. rugipennis* (Bright & Stark 1973) and *H. palliatus* (Davis *et al.* 2008, Lekander 1968). After completing the last instar, the pupae of *H. pinifex* develops on a chamber for a week (Blackman 1919) before emerging as an adult.

As described in *H. pinifex* (Blackman 1919), *H. palliatus* (Gillanders 1908, Davis *et al.* 2008), and for *H. rugipennis* (Bright & Stark 1973), *Hylurgops* overwinter both as fourth instar larvae and as adults. Voltinism varies with the temperature of the subcortical region of the host (Reid 1955) as well as the ecosystem's. The life cycle has been described to be univoltine in *H. palliatus* (Peltonen & Heliövaara 1999) and bivoltine in *H. rugipennis* (Keen 1929) and *H. pinifex* (Chamberlin 1939, Reid 1955).

Hylurgops have been associated with many species of fungi. Thirty-eight species of fungus that were inoculated by *H. palliatus* were collected from *Pinus sylvestris* (L.) in Poland (Jankowiak 2006) including *Leptographium lundbergii* Lagerb. & Melin, a blue stain causing fungi. Several Ophiostomatoid fungi were isolated from roots of *Pinus ponderosa* Douglas ex Lawson in New Mexico (Livingston *et al.* 1983) after an attack by *H. planirostris* Chapuis. *Hylurgops planirostris* has been found in living *P. ponderosa* and it could likely serve as a vector of pathogenic fungi into an uninfected host (Livingston *et al.* 1983).

Inoculations by *H. porosus* can be very extensive (Otrosina & Ferrel 1995). In northern California it was the most common bark beetle species found in experiments detecting *L. wagneri* Kendrick and the third most likely species to inoculate it into *P. ponderosa* in 2002 (Schweigkofler *et al.* 2005). It is possible that reports of suppressed seedling mortality (Keen 1938) in *Pinus contorta* Douglas ex Loudon, *P. monticola* Douglas ex D. Don, and *P. ponderosa* was in response of a combination of the girdling caused by *H. porosus* larvae and the inoculation of the pathogenic fungi it carries.

MATERIALS AND METHODS

The family and subfamily taxonomic treatment used in this review follow that of Crowson (1967) and Kuschel (1995). Tribe and subtribe taxonomic considerations follow the

organization of Wood (1982). Material was examined from the following museums, institutions and personal collections: (Codex information follows Arnett *et al.* 1993)

CNCI - Canadian National Collection of Insects, Ottawa, Canada

CSUC - C.P. Gillette Museum of Arthropod Diversity, Fort Collins, Colorado, USA

Donald E. Bright collection (DEBC), Fort Collins, Colorado, USA

ISNB - Royal Belgian Institute of Natural Sciences, Brussels, Belgium

NHMW - Museum of Natural History of Vienna, Austria

UIAC – University of Arizona Insect collection, Tucson, Arizona, USA

USDAFS Rocky Mountain Research Station collection (RMRS), Fort Collins, Colorado, USA

USNM - National Museum of Natural History, Washington, D.C., USA

Below is a list of additional abbreviations of institutions cited in this review:

BMNH - Natural History Museum, London

MCZC - Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, USA.

MZHF - Zoological Museum, University of Helsinki, Helsinki, Finland

UZIU - Uppsala University, Museum of Evolution, Sweden

Locality information of examined specimens with reliable reference information was approximated using Google Earth 6.0 (<http://www.google.com/earth>) and logged into a spreadsheet. Locations were imported into ArcMap 9.3 for producing distribution maps.

To observe morphological characters specimens were examined with a Wild M5 at 20–100X compound microscope and a Leica MZ16 stereoscopic microscope at 10–115X magnifications. The imagery was taken with the Leica MZ16 microphotography equipment and the multiple layers combined with the Leica Application Suite v. 2.8 or with the Helicon Focus v. 4.80 (<http://www.heliconsoft.com/>) for an increased depth of field. Images were post-processed with Adobe® Photoshop CS4® to highlight specific characters.

The aedeagus was examined for each species. The procedure involved removing dried specimens from points with a solvent and soaking them in warm water for 20 minutes or until the specimen relaxed. The abdominal sternites were removed from behind the metacoxae and cleared in a warm 7–10% potassium hydroxide solution for 20 minutes. The cleared aedeagus was carefully pulled from the abdomen and transferred to a watch glass where it was rinsed with distilled water for 10 minutes and subsequently mounted on slides with Euparal mounting medium. The corresponding sternites were also photographed to identify secondary sexual characters.

KEY TO THE HYLASTINA

1. Procoxae widely separated; elytral scale-like setae absent; striae 9 and 10 distinctly separated by the interstriae posterior to metacoxae; elytral sides broadening posteriorly *Scierus* LeConte
 — Procoxae subcontiguous; elytral scale-like setae usually present; striae 9 and 10 not separated by interstriae posterior to metacoxae; elytral sides nearly parallel..... **2**
2. Elytral disc surfaces thickly covered by round, recumbent scale-like setae; odd numbered interstriae distinctly costate, especially at declivity; pronotal disc spaces between large punctures densely, minutely punctate (Fig. 4a); anterior margin of intercoxal mesosternal process pointed, distinctly extending anteriorly (Fig. 2a)..... *Pachysquamus* new genus
 — Elytral disc surfaces loosely or thickly covered by recumbent, hair-like setae; odd numbered interstriae evenly convex; pronotal disc spaces between large punctures unpunctate or with medium sized punctures; anterior margin of intercoxal mesosternal process slightly rounded or straight, barely or not extending anteriorly (Fig. 2b, c)..... **3**
3. Third tarsal segment 1.3–1.7X broader than second, fifth broadening apically (Fig. 1a); spaces between large pronotal punctures with medium sized punctures (Fig. 4c); prothorax averaging 1.00X long as wide (0.92–1.09X); mid-frontal transverse impression usually distinct (Fig. 5a)..... *Hylurgops* LeConte
 — Third tarsal segment 1 to 1.1X broader than second, fifth not broadening apically (Fig. 1b); spaces between large pronotal punctures not punctate (Fig. 4b); prothorax averaging 1.16X longer than wide [1.05 (*H. salebrosus*)–1.30X]; mid-frontal transverse impression usually indistinct or absent (Fig. 5b)..... *Hylastes* Erichson

***PACHYSQUAMUS* NEW GENUS**

Distinguished by the typical characters of the Hylastina (Wood 1982), and by the following: **Size.** Length from 3.06–4.69 mm (mean 4.02 mm, n=25), length /width ratio 2.65X (n=25). **Color.** Reddish-brown to medium dark-brown. **Frons.** Down curving impression medially to eyes, carina from epistoma to frontal impression. **Eyes.** Oval, elongate. **Pronotum.** 0.93X wider than long, strongly constricted anteriorly; discal surface with large punctures, interpuncture area evenly, minutely punctate; interspaces narrower than small puncture diameter, glossy; pronotal longitudinal midline indistinct; dorsal vestiture consisting of abundant scale-like setae and scattered thick bristles. **Elytra.** Odd interstriae raised, vestiture consisting of rounded scale-like setae and erect thick bristles sparse on elevated interstriae. **Ventrally.** Procoxae subcontiguous; margin of intercoxal mesosternal process anteriorly extended and pointed (Fig. 2a); third tarsomere broader than second. **Male external genitalia.** The spiculum gastrale is slightly longer than the aedeagus. It resembles a desk lamp; proximally it is rounded at the tip from there it extends slightly arcuately ending distally in a bent base with two short stubs. The aedeagal apodemes are proportionally shorter than in the New World *Hylurgops* (Figs. 8b–i). The aedeagus is cylindrical, slightly longer than in *Hylurgops*. Ventrally it is straight (Fig. 6a) and less arcuate dorsally than in *Hylurgops*. The neck-like extension (Fig. 6c) between the aedeagus and the aedeagal apodemes present in some *Hylastes* (Grocholski *et al.* 1976) is absent (Fig. 6a). The tegmenal manubrium forms a very short tip.

Etymology: From the Greek “*pachy*”, meaning thick and “*squamus*”, meaning scale; for its distinct character of being thickly covered by scale-like setae.

Type species: *Hylastes subcostulatus* Mannerheim 1853, present designation.

Taxonomy: The genus *Pachysquamus* exhibits several unique characters within the subtribe Hylastina. A character separating it from the genus *Hylurgops* and previously mentioned by Swaine (1918) and Chamberlin (1939) is the raised, alternate elytral and declivital interstriae. The

only other occurrence of elevated interstriae in the Hylastina was described from *H. piger* (Wickham 1913); a fossil questionably placed in the genus *Hylurgops* from a Miocene shale impression from Colorado's Florissant fossil beds (Fig. 7).

The dorsal vestiture in the pronotum of *Pachysquamus* consists of a ground cover of round, scale-like setae and a few sparse and erect bristles. In the rest of the subtribe Hylastina this ground cover of setae is completely absent or replaced by short and recumbent hair which is long and erect in a few species only. As in the pronotum the entire dorsal surface of the elytra of *Pachysquamus* is covered by round, scale-like setae and erect interstitial bristles whereas in *Hylurgops* and in most *Hylastes* this ground cover consists of elongate or oval setae; in the interstriae the stiff bristles of *Pachysquamus* are replaced by erect and flexible hairs in all *Hylurgops* and some *Hylastes* and short and arcuate semi-recumbent hairs in most *Hylastes*. In *Scierus* the ground cover seta is totally absent and the interstitial vestiture consists of one or two rows of semi-erect and arcuate short bristles.

As in *Hylurgops* and *Hylastes* females of *Pachysquamus* have the 5th abdominal sternite longer than the combined lengths of the 3rd and 4th. The 5th abdominal sternite in females is also longer to that of males. Differently from that in *Hylastes* and *Hylurgops* the male genitalia in *Pachysquamus* is more elongate with the aedeagal apodemes proportionally shorter than the aedeagus (Fig. 6a, 8a).

Due to the uniqueness of a dorsal ground vestiture consisting of recumbent and round scale-like setae, the highly elevated odd numbered interstriae (Fig. 9b), and the anteriorly pointed margin of the intercoxal mesosternal process (Fig. 2a) this species is considered outside the generic limits of the other genera in the Hylastina and it is assigned to the new genus *Pachysquamus*. The subspecies previously treated by Wood (1982) are not recognized as such

since they represent population variation throughout the geographic distribution of *P.*

subcostulatus.

Pachysquamus subcostulatus (Mannerheim 1853)

(Figures 2a, 3a, 4a, 6a, 8a, 9a–b, 10)

Type specimen: Holotypes of *H. subcostulatus* Mannerheim and *H. cristatus* Mannerheim are considered lost (Wood & Bright 1992); *H. alternans* Chapuis, Syntypes in ISNB (not examined).

Type locality: *H. subcostulatus*, Kenai Peninsula, Alaska; *H. alternans* unspecified locality, Mexico.

Hylastes subcostulatus Mannerheim 1853:239; LeConte 1857:22; Lacordaire 1866:359; LeConte 1868:176; Gemminger & Harold 1872:2670; Crotch 1873:125; Blandford 1897:146; Wood 1969:116.

Hylastes cristatus Mannerheim 1853:239; LeConte 1857:22; Lacordaire 1866:359; LeConte 1868:177; Gemminger & Harold 1872:2669; Hamilton 1894a:36; Wood 1969:115.

Hylastes alternans Chapuis 1869:22; Gemminger & Harold 1872:2669; Chapuis 1873:230.

Hylurgops subcostulatus, LeConte 1876:389; Austin 1880:57; Henshaw 1885:149; Fall 1894:101; Hamilton 1894a:36; Wickham 1896a:170; Fall 1901:37; Hopkins 1902:13; Knaus 1903:179; Hopkins 1904:19; Swaine 1909:115; Kleine 1912:166, 1914:347, 389, 403; Chamberlin 1917:326; Swaine 1918:81; Hopping 1922:133; Keen 1928:57, 1929:24, 61; Chamberlin 1939:204; Schedl 1940:338; Ferrer 1942:21; Blackwelder 1947:785; Keen 1952:154; Chamberlin 1958:118; Wood 1971a:399; Kirk & Balsbaugh 1975:130; Bright 1976:44; Furniss & Carolin 1977:365; Evans 1983:33; Wood & Bright 1992:42; Cibrián-Tovar *et al.* 1995:338; Bright & Skidmore 1997:10, 2002:10.

Hylurgops cristatus, LeConte 1876:389; Austin 1880:57; Henshaw 1885:149; Swaine 1909:113.

Hylurgus subcostulatus, Eichhoff 1896:606.

Hylurgops alternans, Swaine 1909:116; Eggers 1929:54; Blackwelder 1947:785; Thomas 1967:77.

Hylastes (Hylastes) cristatus, Hagedorn 1910a:45, 1910b:9.

Hylastes (Hylurgops) subcostulatus, Hagedorn 1910a:46, 1910b:12.

Hylurgops subcostulatus subcostulatus, Wood 1982:91; Furniss & Johnson 1987:381, 1995:339; Gast *et al.* 1989:384, 385; McNamara 1991:356; Furniss *et al.* 1992:375; Romero *et al.* 1997:48; Furniss *et al.* 2002:87; Furniss & Johnson 2002:45, 47.

Hylurgops subcostulatus alternans, Wood 1982:91; Atkinson & Equihua-Martínez 1985a:69; Atkinson *et al.* 1986:15; Romero *et al.* 1997:48; Tkacz *et al.* 1998:18; Bright & Skidmore 2002:10.

Description: Length 3.06–4.69 mm (mean 4.02 mm, n=25), length to width ratio 2.65X (n=25);

mature color brownish red, ventral dark reddish-brown. **Frons.** Mid-frontal impression deep;

surface evenly punctate, inter-puncture space, shiny, 0.5X diameter of a puncture; slight vertical

impression across convex area below transverse impression; carina present or not, short, starting below vertical impression ending at epistoma, elevated, surface shiny; epistomal lobe narrow; vestiture consists of hair-like setae, longer below middle, 2–7X length a puncture's diameter; ovate club, first segment largest, three straight sutures indicated by setae; eye oval, entire, anterior margin straight. **Pronotum**. Broad, 0.93X (n=25) long as wide, distinctly constricted anteriorly (Fig. 9a), widest near basal fourth, sides of basal fifth slightly elevated forming narrow margin, sides rounded around middle, constricted on anterior fifth; dorsal median line present or not, extending from base up to four-fifths its length, surface shiny, slightly raised, concealed by scale-like setae; inter puncture space averaging 1X large puncture diameter wide; interspaces evenly, minutely punctate, 1/3 diameter of large puncture, margin smooth, shiny, and concealed by scale-like setae; additional vestiture sparse, erect bristles, 3X length of large discal punctures, longer at marginal areas; color reddish-brown. **Scutellum**. Round, small, flat, surface smooth, narrower than elytral interstriae. **Elytra**. Anterior margin distinctly procurved, crenulated marginal line distinct, and elevated; striae shallowly concave, narrower than interstriae near base, as wide as even numbered interstriae at middle and wider than interstriae at declivity, with deep, round punctures of shiny surface, separated less than 1X their diameter; interstriae, smooth, shiny, minutely punctate (seen at 100X or more), concealed by round scale-like setae, single line of erect bristles apart by distance of two strial punctures, rising behind interstitial granules, long as diameter of a discal puncture; color brownish red. **Declivity**. Convex, alternate interstriae highly elevated (Fig. 9b), with large tubercles as wide or wider than rest of interstitial costa; vestiture a bristle behind each granule 1–3X long as strial puncture diameter and a ground surface cover of recumbent, scale-like setae over each minute puncture. **Ventral areas**. Glossy, punctured; precoxal ridge rounded not acute; procoxae sub-contiguous; tarsi dark reddish-brown; protibia with two large spines before angle; meso and meta-tibia with one or two large spines before angle; third tarsomere slightly broader than second. **Male external genitalia**. Of typical

Pachysquamus type, lacking a ventral lobe (Fig. 8a) and dorsally less arcuate than New World *Hylurgops* (Figs. 8b–i).

Gallery: The maternal gallery is longitudinal, uniramous (Hopkins 1902), slightly sinuate (Fig. 3a). The larval galleries run perpendicular to only one side of the maternal gallery (Cibrián-Tovar *et al.* 1995).

Hosts: *Picea engelmannii* Parry ex Engelmann, *P. pungens* Engelmann, *Pinus arizonica* var. *cooperi* Engelmann, *P. ayacahuite* Ehrenberg ex Schlechtendahl, *P. contorta*, *P. duranguensis* Martínez, *P. engelmannii* Carrière, *P. hartwegii* Lindley, *P. jeffreyi* Balfour, *P. lambertiana* Douglass, *P. leiophylla* Schiede ex Schlechtendahl et Chamisso, *P. leiophylla* var. *chihuahuana*, *P. montezumae* Lambert, *P. ponderosa*, *P. pseudostrobus* Lindley, *P. strobiformis* Engelmann, *P. teocote* Schiede ex Schlechtendahl et Chamisso, *Pseudotsuga menziesii* (Mirbel) Franco, and *Tsuga heterophylla* (Rafinesque) Sargent.

Distribution: **NORTH AMERICA:** British Columbia, Canada to Chiapas, Mexico. There is only one record from the Kenai Peninsula in Alaska; the type's locality (Mannerheim 1853). It also occurs in the Black Hills of South Dakota (Fig. 10).

Material examined: 850 specimens from the CNCI, CSUC and the USNM collections were examined. **CANADA. British Columbia:** Midday Valley Merritt (CNCI), Peachland (CNCI), Summerland (CNCI), Vancouver (CNCI). **MEXICO. Chiapas:** San Cristobal (CNCI). **Chihuahua:** Mesa del Huracan (CNCI). **Durango:** 10 mi. SW El Salto (CNCI). **Nuevo Leon:** Cerro Potosi (CNCI). **Puebla:** Zoquiapan NF (CNCI). **USA. Arizona:** Apache Co.: Brady Springs, SE Vernon, Sitgreaves NF (UAIC); Cochise Co.: Barfoot Grds. (DEBC), Barfoot picnic area Chiricagua Mountains (CNCI); Graham Co.: Mount Graham (CNCI), Pinaleno Mountains (CNCI); Greenlee Co.: Hannagan Camp (CNCI), 15 mi. S Alpine (CNCI); Pima Co.: Mount Lemmon Sta. Catalina Mountains (CNCI), Bear Canyon Chiricagua Mountains (CNCI). **California:** El Dorado Co.: Blodgett (CNCI), Fallen Leaf Lake (CNCI), Placerville (CNCI), El Dorado NF (CNCI); Madera Co.: Chiquito Creek (CNCI); Modoc Co.: Modoc NF (CNCI); San Bernardino Co.: Big Bear Lake (CNCI); San Diego Co.: Park near Zoo (CNCI). **Colorado:** Chaffee Co.: CR-386 N Buena Vista (CSUC), Droney Gulch, Salida (CSUC); Douglas Co. Franktown (CSUC); El Paso Co.: Black Forest (CSUC); La Plata Co.: Electra Lake (CSUC); Montezuma Co. Dolores FS Rd 527 (CSUC), Mancos (CSUC); Montrose Co.: Sanborn Pk. (CSUC). **Idaho:** Kootenai Co.: Coeur d' Alene (CNCI); Latah Co.: Deary (CNCI). **Montana:** Lake Co.: Pablo (CNCI); Ravalli Co.: Hamilton (CNCI). **New Mexico:** Otero Co.: Cloudcroft (CNCI). **Oregon:** Klamath Co.: Ft. Klamath (CNCI). **South Dakota:** Custer Co.: Bear Mountain

area Black Hills NF (RMRS), Pennington Co.: Rushmore (CNCI). **Utah:** Iron Co.: Dixie (CNCI); Juab Co.: Mount Mammoth (CNCI); Sevier Co.: Fish Lake (CNCI). **Washington:** Walla Walla Co.: Kooskooskie (CNCI).

Taxonomy

Hylastes subcostulatus was described by Mannerheim (1853) from a single specimen collected by Dr. Fredrick Frankenhaeuser from the Kenai Peninsula in Alaska as part of an early Russian expedition. Another specimen in the same collection was described as *Hylastes cristatus* by Mannerheim (1853) and later synonymized with *H. subcostulatus* by Wood (1982).

The lack of collection records between British Columbia and the Mannerheim type from the Kenai Peninsula is intriguing. The type specimens of both *H. subcostulatus* and *H. cristatus* are considered lost (Wood 1969, 1982). Subsequent re-descriptions including those of LeConte (1868) and Chapuis (1869) were made from specimens collected from British Columbia and Mexico respectively; however, the original description by Mannerheim is adequate to identify the species.

Wood (1982) recognized *H. alternans* as a subspecies of *H. subcostulatus* based on characters of the declivital interstriae which he described more elevated and with each tubercle more inflated in specimens occurring south of central Arizona contrary to the specimens occurring north of that area. The sub-specific concept has been questioned (D.E. Bright pers. comm.) based on the continuity in the distribution of both “sub-species”. Examination of specimens from throughout the species range suggests that the size of the tubercles and the elevation of interstriae are variable and do not correlate with the arbitrary geographical distribution of the subspecies considered by Wood (1982).

Pachysquamus subcostulatus ranges from the Canadian Cascades in southern British Columbia to the Sierra de Chiapas in southern Mexico. The Black Hills of South Dakota represent the easternmost limit of the species. The northern distribution of *P. subcostulatus*

corresponds with that of *P. ponderosa*. The species occurs from altitudes of 60 to 700 m in Canada. In the continental United States, it occurs from elevations of 60 to 3,300 m. Although it is a species which primarily attacks *P. ponderosa*, it occurs in other conifers in the genus *Pinus*, *Picea*, *Pseudotsuga*, and *Tsuga*. In Mexico, specimens examined were collected from elevations ranging from 2,300 to 3,700 m.

As with other members in the Hylastina, *P. subcostulatus* is a secondary pest of conifers which have been weakened or killed by primary bark beetles such as *Dendroctonus*, or by other natural or anthropogenic agents such as severe drought and fires.

GENUS *HYLURGOPS* LECONTE 1876

Type species: *Hylurgops pinifex* (Fitch 1858)

Description: By those characters of the Hylastina (Wood 1982) and the following: **Size.** Length 2.2–5.9 mm, length /width ratio 2.4–2.8X. **Color.** Callow adult yellowish-brown, reddish-brown or brown, mature color from dark brown to black, some bicolored with pronota darker than elytra. **Frons.** Down curving impression at level centrally to the eyes. **Eyes.** Elongate-oval (2.2–2.5X longer than wide). **Antennae.** Basal sclerite longest. **Pronotum.** Broad, length/width ratio 0.92–1.09 (mean 1.00, n=200), apically constricted or smoothly tapering; surface smooth to reticulate, spaces between large punctures with medium sized punctures (Fig. 3c); interspaces narrower than larger puncture diameter (Fig. 3c); unpunctate midline usually present, sometimes raised from base to anterior impression, reaching the apex in some; vestiture, hair-like, whitish to reddish, indistinct to distinctly long. **Elytra.** Length/width ratio 1.55–1.97 (mean 1.73, n=200); bases procurved to nearly straight (Fig. 11a–b), margin not strongly elevated, asperities indistinct to small, rounded (Fig. 12a) or keyhole-shaped (Fig. 12b–c), 9th striae indistinguishably separated from 10th posterior to metacoxae; interstriae near as wide as striae, with 3–5 rows of short, recumbent, whitish to reddish-yellow, hair-like setae extending usually from half of disc to its

end, emerging from minute punctures or rugosities; single line of long, semi-erect to erect, whitish to reddish hair-like setae, becoming longer after middle of disc, emerging behind a granule or rugosity. **Declivity.** Convex; striae narrower than interstriae, punctures as in elytra; 1st, 9th and 10th striae reaching apex (Fig. 13), 3rd and 8th meeting above interstriae 9 and 3 junction, 6th and 7th meeting anterior and between previous, and 4th and 5th meeting or ending singly over previous, further away from apex; interstriae convex, 2nd variably impressed, 3rd widest, intersecting 4th or not, with uniseriate row of granules followed by long, hair-like setae, ground vestiture of 3 to 5 rows of short, recumbent, whitish to reddish, scale-like setae, emerging from a minute puncture. **Ventral.** Precoxal costa large, acute; anterior margin of intercoxal mesosternal process slightly rounded to straight (Fig. 2b–c); procoxae subcontiguous; abdominal sclerites one and five longer than two, three and four, fifth longer in females. **Tarsi.** Tibia with 3 toothed tubercles, before apical angle; third tarsal segment distinctly (1.3–1.7X) broader than second (Fig. 1a), fifth near 2X broader at apex than at base. **Male external genitalia.** The spiculum gastrale is slightly longer than the aedeagus. It resembles a desk lamp; proximally it is rounded at the tip from there it extends slightly arcuately ending distally in a bent base with two short stubs. The aedeagus is cylindrical, shorter than in *Pachysquamus*. Ventrally it is straight with or without a characteristic step-like lobe (Fig. 6d) and arcuate dorsally. The neck-like extension (Fig. 7c) between the aedeagus and the aedeagal apodemes present in some *Hylastes* (Grocholski *et al.* 1976) is absent in all the New World *Hylurgops* (Figs. 7b, 8b–i). The tegmenal manubrium is very short or completely absent (Fig. 6b).

KEY TO THE NEW WORLD *HYLURGOPS*

1. Pronotum slightly wider than long (0.93X, n=100), distinctly constricted anteriorly (Fig. 14a); color reddish-brown to dark brown, never pitch-black **2**
- Pronotum slightly longer than wide (1.05X, n=117), not constricted but smoothly tapering anteriorly (Fig. 14b); color dark reddish-brown to pitch-black..... **5**

- 2(1). Smaller species (2.5–3.3 mm); declivital apex upturned (Fig. 15a); striae more distinctly impressed; granules larger; color brown to reddish-brown..... *palliatu*s (Gyllenhal), **p. 17**
— larger species (3.71–5.56 mm, n=75); declivital apex rounded, not upturned; striae less distinctly impressed; declivital granules smaller; color brown to black **3**
- 3(2). Dorsal surfaces dull; pronotal interspaces coarser, punctures deeper; color brown to black; distribution trans-Mexican volcanic belt to high mountains in SW Honduras.....
..... *planirostris* (Chapuis), **p. 18**
— Dorsal surfaces lustrous to semi lustrous; pronotal interspaces smooth, punctures shallow; color reddish-brown to deep dark-reddish brown; distribution Alaska to New Mexico... **4**
- 4(3). Pronotum interspaces distinctly, finely reticulated (Fig. 16a), larger punctures less than twice the diameter of smaller; averaging shorter (4.15 mm, n=25); distribution coastal from Alaska to southern California..... *rugipennis* (Mannerheim), **p. 21**
— Pronotum interspaces smooth to granulated (Fig. 16b), larger punctures more than double the diameter of smaller; averaging longer (4.55 mm, n=25); distribution transcontinental, from northern British Columbia to Nova Scotia south to Arizona and North Carolina.....
..... *pinifex* (Fitch), **p. 26**
- 5(1). Pronotum covered by distinct, long, erect, hair-like setae..... **6**
— Pronotum covered by indistinct, short, recumbent hair-like setae..... **7**
- 6(5). Pronotum nearly as wide as elytral bases, punctures abundant, shallower, larger twice diameter of smaller; hair-like setae yellow to reddish-yellow; distribution Arizona and New Mexico to northern Honduras and El Salvador..... *incomptu*s (Blandford), **p. 30**
— Pronotum narrower than elytral bases, punctures scarce, larger more than twice diameter of smaller; hair-like setae whitish; distribution Central Mexico.....
..... *longipennis* (Blandford), **p. 34**
- 7(6). Pronotum with abundant, similar sized punctures, larger less than twice diameter of smaller punctures; ventral vestiture shorter..... *knausi* Swaine, **p. 36**
— Pronotum with fewer, differently sized punctures, larger twice diameter of smaller; ventral vestiture longer..... **8**
- 8(7). Elytral surfaces dull, entirely, distinctly reticulated, visible at 30X magnification; pronotum longer averaging 1.07X long as wide; body length averaging longer (4.46 mm, n=25)
..... *reticulatu*s Wood, **p. 38**
— Elytral surfaces smooth and glossy, varying from granulate to reticulate on basal third of elytra; pronotum shorter, averaging 1.03X long as wide; body length averaging shorter (3.97 mm, n=25)..... *porosu*s (LeConte), **p. 41**

*Hylurgops palliatu*s (Gyllenhal 1813)
(Figures 15a, 17a)

Type specimen: Syntypes, unknown sex, UZIU. Not examined.

Type locality: Sweden.

Hylesinus palliatus Gyllenhal 1813:340.

Hylastes palliatus, Thomson 1865: 349.

Hylurgops palliatus, Reitter 1913: 50; Wood & Bright 1992:35; Bright & Skidmore 1997:9; Haack 2001:252; Bright & Skidmore 2002:9; Haack 2006:272; Hoebeke 2006:267; Haack & Petrice 2009:1082. For a complete list of references see Wood & Bright (1992).

Diagnosis. *Hylurgops palliatus* is distinguished from all the New World species by its smaller size, by its elytral apex ascending towards the suture (Fig. 15a) and by the discal striae more distinctly impressed.

Description. Length 2.85 mm (n=15), length/width ratio 2.30X (n=15); mature color reddish brown.

Frons. Transverse frontal impression shallow; vestiture hair-like setae; longer below mid-impresion, length 2–4X diameter of average frontal puncture. **Pronotum.** Broad, 0.87X long as wide (n=15), strongly constricted anteriorly (Fig. 17a), widest anterior to middle; lateral margin rounded, bulging, from base to constriction near apical edge; dorsal middle line elevated, from base up to anterior dorsal impression, surface smooth; discal punctures relatively few for genus, larger twice diameter of smaller; inter-puncture area smooth, or with sparse reticulation; vestiture distinct, short, recumbent, yellowish, hair-like setae, 1X length diameter of larger puncture.

Elytra. Anterior margin procurved; striae distinctly impressed, as wide as interstriae except narrower than 2nd; punctures round, less than 1/2 diameter apart; interstriae convex, surface rugose, minutely, indistinctly punctured (visible at > 115X), with uniseriate line of erect bristles separated by two strial punctures diameter, 1.5X diameter strial puncture diameter, rising behind interstitial granule.

Declivity. Second interstriae widest, indistinctly impressed, 3rd not intersecting 4th; vestiture consisting of 3 rows of whitish, scale like setae and a single 1–1.5X length of declivital puncture, thicker, reddish-brown, hair-like setae projecting after each granule; elytra declivital apex ascending towards the suture. **Ventrally.** Dark reddish-brown to black, surfaces shiny, setose-

punctate; intercoxal mesosternal process anterior margin rounded; tarsi dark reddish-brown, metatibia with 2 large spines before apical angle.

Gallery. Longitudinal, biramous, slightly sinuate and about 30–50 mm, it runs above and below the entrance hole (Davis *et al.* 2008). Eggs are laid on niches at both sides of the gallery, brood digs perpendicular at both sides of the gallery.

Nearctic host: *Pinus sylvestris*

Nearctic distribution: An exotic species introduced to North Eastern USA.

Material examined: 15 specimens. Mount Fuji, Japan (DEBC); Blandford, England (DEBC); Amstetten, Austria (DEBC); Bialowiezki NP, Poland (DEBC).

Hylurgops planirostris (Chapuis)
(Figures 2b, 8b, 12c, 14a, 15b, 17b, 22)

Holotype: *H. planirostris*: Lectotype female, designated by Wood (1971c), deposited in ISNB (not examined).

Location: Rachos de Suapam, near Cordoba, Vera Cruz in Mexico.

Hylastes planirostris Chapuis 1869:21; Blandford 1896:144; Gemminger & Harold 1872:2670; Chapuis 1873:229.

Hylurgops planirostris, Hopkins 1905:81; Hagedorn 1910a:46, 1910b:11; Kleine 1912:166, 1914:158, 347; Schedl 1940:320, 338; Ferrer 1942:21; Blackwelder 1947:786; Hartig 1954:193; Schedl 1955:6; Schwerdtfeger 1957:365; Schedl 1963:156, Wood 1971c:146; Schedl 1977:42; Wood 1982:85; Atkinson & Equihua-Martínez 1985a:67, 1985b:228, 1988:90, 93; Atkinson *et al.* 1986:15, Wood & Bright 1992:39; Bright & Skidmore 1997:10; Romero *et al.* 1997:48; Tkacz *et al.* 1998:18; Bright & Skidmore 2002:10.

Diagnosis. *Hylurgops planirostris* is distinguished from the sympatric *H. incomptus* by the wider than long pronotum which is distinctly constricted anteriorly (Fig. 14a) and by the procurved anterior margin of each elytron. It can be distinguished from *H. knausi* of the Sierra Madre Occidental and north by the distinctly constricted anterior margin of the pronotum and from the Nearctic *H. rugipennis* and *H. pinifex* by the brown coloration and the coarser pronotal interpuncture surface.

Description. Length 3.75–5.17 mm (mean 4.59 mm, n=25), length/width ratio 2.56X (n=25); mature color black to brown, callow adult reddish brown.

Frons. Vertex convex or with shallow, short, vertical impression, if present with raised central rounded area below; shallow to moderately deep and slight procurved mid-frontal impression; vestiture hair-like setae; longer below mid-impression 2–7X length diameter of average frontal puncture; epistomal brush with reddish-brown setae. **Pronotum.** Broad, 0.93X long as wide (n=25), distinctly constricted anteriorly, widest anterior to middle; lateral margin rounded especially anterior to middle, constricting near apical edge; dorsal middle line distinctly elevated, from base up to anterior impression, surface granulated to reticulated, dull to semi glossy; discal punctures abundant, minute, larger slightly less than twice diameter of smaller; inter-puncture area granulated, or with minute reticulation; vestiture distinct, consisting of short, recumbent, reddish-brown, hair-like setae, 2X length diameter of larger puncture. **Elytra.** Anterior margin procurved; striae slightly concave, punctures keyhole-shaped (Fig. 12c), half their diameter apart; interstriae 1.5X wider than striae, surface minutely punctured (visible at > 100X), each with a short, recumbent, hair-like setae, uniseriate line of erect bristles, rising from a central puncture, separated by 1.5 strial punctures diameter, slightly longer than a disc strial puncture. **Declivity.** Second interstriae slightly impressed with conical granules, 3rd interstriae widest not intersecting 4th; vestiture of dense reddish-brown scale like setae and longer than declivital puncture, thicker, erect reddish-brown hair-like setae from each granule. **Ventrally.** Dark reddish-brown, surfaces granulate to reticulate; intercoxal mesosternal process anterior margin straight; tarsi dark reddish-brown, tibia with 3 short spines before apical angle due an extension of the sclerites between them. **Male external genitalia.** Of typical *Hylurgops* type, lacking a ventral lobe (Fig. 8b). **Gallery:** Longitudinal, biramous with irregular branches. It extends downward from the entrance hole (Schwerdtfeger 1957).

Hosts: *Abies religiosa* (Kunth) Schltdl. et Cham., *Pinus ayacahuite*, *P. hartwegii*, *P. caribaea* var. *hondurensis* Morelet, *P. leiophylla*, *P. montezumae*, *P. tecunumanii*, *P. pseudostrobus* var. *oaxacana*, *P. strobus* var. *chiapensis* (L.).

Distribution: NORTH AMERICA-CENTRAL AMERICA: Trans-Mexican volcanic belt in Mexico to southern Sierra Madre de Chiapas in southern Honduras.

Material examined. 92 specimens. GUATEMALA. **Totonicapan** (USNM). HONDURAS: **El Paraiso:** Cerro Montserrat, 7 Km Yuscaran (USNM); **Francisco Morazan:** Cerro Uyuca Morazan 30 Km E Tegucigalpa (DEBC). MEXICO. **Chiapas:** 5 mi. E San Cristobal (CNCI), 5 mi. S El Bosque (CNCI). **Oaxaca:** 37 mi. S Valle Nacional (CNCI), 40mi. S Valle Nacional (CNCI), 53 mi. S Valle Nacional (CNCI), 3 mi. N Suchixtepec (CNCI), Juquila Mixes, Yautepec (DEBC). **Mexico State:** Cahuacan (CNCI), Parque Nacional Izta-Popo, Zoquiapan (CNCI). **Puebla:** 8 mi W Teziutlan (CNCI), Iztaccihuatl (CNCI).

Taxonomy

Chapuis (1869) described *Hylastes planirostris* from Mexico without specifying a locality. The determination of the type locality has remained unclear and has been suggested to be Choapan in Oaxaca, Mexico by Dampf after the label “Suapam” (Schedl 1940) and later by Wood (1971c) as “Suapan” (State undetermined) Mexico. The collector of the type specimen was Auguste Sallé who collected in Ranchos de Suapam, near Cordoba in Vera Cruz, Mexico; therefore, here it is considered the type locality for this species.

Both Chapuis (1873) and Blandford (1896) placed *H. planirostris* under Erichson’s (1836) second division for having the third tarsomeres bilobed. Blandford (1896) examined specimens from (Alta) Vera Paz in Guatemala, which he thought were different than *H. planirostris* (*knausi*) specimens of Mexico. He considered the Guatemalan specimens resembled *H. rugipennis*, differing from it by the closer and more rugose pronotal punctures. However, he could not define characters to separate the Guatemalan specimens from the Mexican *H. planirostris* (*knausi*). Hopkins (1905) agreed with Blandford (1896) observations and found relatedness between one *H. planirostris* specimen from Mexico City and *H. rugipennis*. Hopkins (1905) mentioned the specimen could be separated from the Nearctic *H. rugipennis* by the

“obscure punctures” and “fine rugosities” of the pronotum. He placed *H. planirostris* under *Hylurgops* based on the characters of the bilobed third tarsal segments.

Wood (1971c) studied Chapuis’ syntypes and a homotype of *H. knausi* Swaine which he synonymized with *H. planirostris* and placed it on his key under the species with longer than wide pronota and obscure anterior pronotal constrictions. It is possible that Wood (1971c) did not examine specimens from neither the Southern or the Chiapas Sierra Madre Mountains since taxa in these mountain ranges have wider than long and anteriorly constricted pronota. In his key to the genus *Hylurgops*, Wood (1982) included *H. planirostris* with the species lacking a distinct anterior pronotal constriction.

Differently from the specimens previously placed under *H. planirostris* (*knausi*) occurring north of the trans-Mexican volcanic belt, these have wider than long pronota (0.93X, n=25), which is distinctly constricted on the anterior third with deeper and closer punctures and dull interpuncture spaces, in addition to a reddish-yellow vestiture.

Hylurgops rugipennis (Mannerheim 1843)
(Figures 5a, 6d, 8c, 13b, 15c, 16a, 17c, 18)

Type specimen: Syntypes (sex?), deposited in MZHF, lost (Wood & Bright 1992).

Type locality: Sitka Island, Alaska, USA.

Hylurgus rugipennis Mannerheim 1843:297; Melsheimer 1853:88; Lacordaire 1866:359.

Hylastes rugipennis, Mannerheim 1852:385, 1853:238; LeConte 1857:22; 1868:176; Chapuis 1869:20; Gemminger & Harold 1872:2670; Chapuis 1873:228; Crotch 1873:125.

Hylurgops rugipennis, LeConte 1876:390; Austin 1880:57; Henshaw 1885:149; Wickham 1893:220; Hamilton 1894a:36; Wickham 1896b:310; Schwarz 1900:537; Hopkins 1904:19, 1905:81; Swaine 1909:115; Hagedorn 1910a:46, 1910b:11; Chamberlin 1917:326; Swaine 1918:81; Hopping 1922:133; Chamberlin 1924:57; Keen 1928:57, 1929:25, 61; Chamberlin 1939:205; Patterson & Hatch 1945:151; Jaques 1951:350; Keen 1952:154; Chamberlin 1958:118; Ruppel 1967:52; Schuder 1969:78; Wood 1969:116, 1971a:400; Bright & Stark 1973:24; Bright 1976:46; Furniss & Carolin 1977:365; Evans 1983:33; Bright & Skidmore 1997:10, 2002:10; Safranyik *et al.* 2004:27.

Hylurgops rugipennis, Chamberlin 1918:33.

Hylurgops rugipennis rugipennis, Wood 1982:89; McNamara 1991:356; Furniss *et al.* 1992:375; Wood & Bright 1992:40; Furniss & Johnson 1995:339; Bright & Skidmore 1997:10; Furniss *et al.* 2002:84, 87; Hoebeke & Acciavatti 2006:268.

Hylurgops rugipennis pinifex, Wood 1982:89; Werner *et al.* 2006:136.

Diagnosis: *Hylurgops rugipennis* is reddish brown above and usually darker below, the pronotum is broad and strongly constricted anteriorly (Fig. 17c). It is distinguished from *H. pinifex* at > 50X magnification by the complete and distinct, pronotal reticulation (Fig. 16a), by the regularly-sized pronotal punctures (Fig. 16a) the narrower metatarsi, and by the more restricted distribution (Fig. 18).

Description: Length 3.71–4.67 mm (mean 4.15 mm, n=25), length/width ratio 2.43X (n=25); mature color reddish to brownish-red with dark spots on anterior margin of pronotum, ventrally dark reddish-brown to near black, sternites light reddish-brown.

Frons. Transverse impression strong (Fig. 5a); inter-puncture areas reticulated, rarely shiny; carina broadly elevated, surface shiny; vestiture hair-like, longer on lower half, 2–7X as long puncture's diameter. **Pronotum.** Broad, 0.93X long as wide (n=25), slightly narrower than elytral base, distinctly constricted anteriorly, widest anterior to middle; lateral margin narrowly rounded on basal fourth, becoming broadly rounded on central two fourths and broadly constricted on anterior fourth; middle line from base sometimes to entire pronotal length, surface reticulated (Fig. 16a), rarely smooth, slightly raised; discal punctures of two sizes, equally abundant, smaller two-thirds of larger, inner surface shiny, inter puncture area reticulated; vestiture short, recumbent, hair-like setae indistinct to 1X length diameter larger punctures on disc, 2X length around margins. **Elytra.** Anterior margin moderately procurved, slightly raised dark margin; striae shallowly concave, wide as first interstriae, narrower than rest, with round to keyhole-shaped, smooth, dark surfaced punctures, averaging half their diameter apart at disc; interstriae smooth, shiny, minutely punctate (seen at > 50X magnification), each with a short, recumbent, hair-like setae becoming scale-like on posterior half to last third of disc, a central punctate granule with a long, sub-erect, hair-like setae long as a strial puncture appearing as rugosities on

disc, separated by 1.5 strial puncture diameter. **Declivity.** Convex; striae slightly impressed, less than half as wide as interstriae, punctures elongated and deep some keyhole-shaped, smaller than at disc, separated by 1X their diameter, 2nd interstriae slightly impressed, 3rd widest, usually intersecting 6th (Fig. 13b) all with regularly spaced pointed granules, 2X puncture diameter apart; vestiture scale-like, short, recumbent, confused and a central, erect, hair-like setae as long as strial width. **Ventral areas.** Surface punctured, interspaces reticulated; setae hair-like, long as three punctures or more, recumbent; precoxal ridge acutely elevated; tibia reddish, narrower than in other species; pro-tibia with 1–2 mid-sized spines before angle, meso-tibia with 2 mid-sized spines before angle, and meta-tibia broad with 3 medium sized spines before apical angle; third tarsomeres, bilobed broader than second. **Male external genitalia.** Of the typical *Hylurgops* type; distinguished from *H. pinifex* (Fig. 8d) by its distinct ventral lobe (Fig. 8c).

Gallery: Maternal gallery longitudinal, slightly sinuate, extending up and down from entrance hole (Bright and Stark 1973), usually just over the root collar of a dead tree or stump. Larval galleries extend perpendicular to brood gallery becoming confused at later stages. These galleries can extend into the roots, where they can be found at considerable distance from the brood gallery (Bright & Stark 1973).

Hosts: *Abies concolor* (Gordon et Glendinning) Hildebrand, *A. lasiocarpa* (Hooker) Nuttall, *Callitropsis nootkatensis* D. Spack (see Patterson & Hatch 1945), *Larix occidentalis* Nuttall, *Picea engelmannii*, *P. sitchensis*, *Pinus attenuata* Lemmon, *P. balfouriana* Greville et Balfour, *P. banksiana* Lambert, *P. contorta*, *P. lambertiana*, *P. monticola*, *P. muricata* D. Don, *P. ponderosa*, *P. radiata* D. Don, *Pseudotsuga menziesii*, *Tsuga heterophylla*.

Distribution. NORTH AMERICA. CANADA and USA. Kodiak Island, Alaska to Monterey and Tulare in southern California.

Material examined. 150 specimens. CANADA. **Alberta:** Red Rock Cny. Waterton Lakes NP (CNCI). **British Columbia:** Aspen Groove (CNCI), 21 mi. W Creston (CNCI), 2 mi. S Salmo River, Creston (CNCI), Glacier (CNCI), Inverness (CNCI), “Tatler Lake”, Kleena kleene (CNCI), Long Beach, Tofino (CNCI), Lorna (CNCI), Mainland (CNCI), Massett, Graham Is.

QCI (CNCI), McBride (CNCI), 4.7 Km N Renell Sound Rd. Ghost Cr., Graham Is. (CNCI), Sicamous (CNCI), Skidegate, Graham Is. (CNCI), Stanley Park, Vancouver (CNCI), Tlell, Graham Is., QCI (CNCI), Tow Hill, Graham Is. (CNCI), Trinity Valley (CNCI), Vancouver (CNCI), Laskeek Bay, Reef Island, QCI. **Saskatchewan:** Cypress Hills (CNCI). **USA. Alaska:** 15 Km N Juneau (CNCI); 41.5 Km N Juneau (CNCI); Juneau (DEBC), N End Douglas Is., 15 Km N Juneau (CNCI). **California:** Del Norte Co. (CNCI); El Dorado Co.: Blodgett Forest, 10 mi. E Georgetown (CNCI); Fresno Co. (CNCI); Humboldt Co.: Eureka (CNCI); Marin Co.: 1 mi. SE Inverness (CNCI); Mariposa Co.: Tuolumne Meadows (CNCI); Mono Co.: Blanco's Corral, White Mountain (CNCI); Monterey Co.: Carmel (CNCI), Monterey (CNCI); San Mateo Co.: Año Nuevo (CNCI); Santa Cruz Co.: Swanton (CNCI); Tulare Co.: Kaweah (CNCI); Tuolumne Co.: Avalanche Meadows, Sequoia NP (CNCI). **Idaho:** Blaine Co.: Priest Rd. (CNCI); Kootenai Co.: Coeur d'Alene NF (CSUC). **Oregon:** (no county) Blue Mountains (CNCI); (no county) Ochoco NF (CNCI); Clatsop Co.: Olney (CNCI); Lincoln Co.: Otis, Cascade Head (CNCI); Linn Co.: Santiam Pass (DEBC); Tillamook Co.: Kiwanda viewpoint on Cape Lookout, 2.5 mi. N 1.5 mi. W Sand Lake (CNCI); Wallowa Co.: "Minam NF" Wallowa NF (CNCI), Wasco Co. Wapinitia (DEBC). **Washington:** (no county) Mount Rainier NP (CNCI, CSUC); Grays Harbor Co.: Westport (CSUC); Pierce Co.: West side Mt Rainier (CSUC); West side Rd. 1.6N Hwy 706 (CSUC).

Taxonomy

Mannerheim (1843) described *Hylurgus rugipennis* from Sitka, Alaska and in 1852 he placed it in the genus *Hylastes*. LeConte (1868) and Chapuis (1869, 1873) supported the placement under Erichson's (1836) second division of the genus *Hylastes* for possessing the third tarsomeres bilobed and a protuberant anterior intercoxal mesosternal process. LeConte (1876) placed *H. rugipennis* in his genus *Hylurgops*, where he placed those in the division mentioned above.

Wood (1971a) considered that *H. rugipennis* hybridized with *H. pinifex* in an area east of the Canadian Cascades to Vernon in British Columbia and later Bright (1976) considered this hybridization area extended into Alberta. Wood (1982) reduced *H. rugipennis* to a subspecies based on the apparent hybridization with *H. pinifex* in the above mentioned area. The characters used to define the intergrades were not detailed by Wood (1971a, 1982). Bright (pers. comm.) mentioned the character used by Wood to determine the hybridization of the two species was the distribution of the scale-like setae cover in the elytra, suggesting that in the "intergradation zone"

H. rugipennis had elytral scale-like setae extending further towards the disc as in *H. pinifex* and differing from the coastal forms of the species, in which the scales were limited to the declivity.

While considering it a subspecies Wood (1982) described the phenotypes of *H. r. rugipennis* occurring throughout the Pacific Northwest to be morphologically and biologically distinct from *H. r. pinifex*. Also the distribution of the scale-like setae used in his subspecies determination represents a variation occurring across the two species distribution that was not observed by Wood (1982). Other characters such as the reticulated surface of the pronotal interspaces and the more regularly sized pronotal punctures of *H. rugipennis* are constant throughout the two species distribution. The fact that *H. rugipennis* was found occurring in areas where its host *P. monticola* and known hosts of *H. pinifex* co-occur but apparently not in areas where this conditions are not met explains the reason for their sympatry in areas in Alberta and British Columbia as well as in an area in the Sierra Nevada of California (Fig. 18). In this revision *H. rugipennis* is treated as a distinct species from *H. pinifex* by the characters specified in the given key and other characters included in the description of the two species.

Hylurgops rugipennis was found to be restricted to the coastal forests in the Pacific Northwest from the Kodiak Island in Alaska to Monterey in California and east to the Northern Rockies in Alberta, British Columbia, Idaho, Washington and the Sierra Nevada of California (Fig. 18). In its coastal range from Alaska to the extreme northern California the species occurs primarily in *P. sitchensis*. South from there the range of this species seems determined by the occurrence of the coastal “closed cone pine” species, *P. attenuata*, *P. muricata*, and *P. radiata*. The distribution of *H. rugipennis* east of the Canadian Cascade Mountains into the Northern Rockies primarily follows the distribution of *P. monticola* which extends up to the Waterton Lakes National Park in Alberta. In the Sierra Nevada the southernmost distribution of the species into Central California appears delimited by this conifer host as well.

Hylurgops pinifex (Fitch 1858)

(Figures 3b, 8d, 11a, 12b, 13a, 15d, 16b, 17d, 18)

Type specimen: Lectotype female (No. 42087), designated by Wood (1982), USNM.

Type locality: New York, USA.

Hylastes pinifex Fitch 1858:729; LeConte 1868:176; Gemminger & Harold 1872:2670; Crotch 1873:125; Provancher 1877:574.

Hylurgops pinifex, LeConte 1876:389; Hubbard *et al.* 1878:643; Austin 1880:57; Harrington 1884:85; Henshaw 1885:149; Schwarz 1886:56; Henshaw 1887:220; Hamilton 1889:159; Packard 1890:722, 826; Smith 1890:270; Hamilton 1891:132; Blandford 1894:58; Hamilton 1894b:407; Henshaw 1895:44; Eichhoff 1896:605; Wickham 1897:169; Smith 1900:365; Ulke 1902:36, 56; Easton 1909:56; Swaine 1909:114; Smith 1910:405; Kleine 1912:166, 1914:399, 409; Hopkins 1914:123, 1915:211; Blatchley & Leng 1916:666; Swaine 1918:81; Britton 1920:289; Hopping 1922:133; Chamberlin 1924:57; Keen 1928:57, 1929:61; Easterling 1934:142; Dodge 1938:14, 32; Chamberlin 1939:205; Beal & Massey 1945:92; Patterson & Hatch 1945:151; Blackman 1950: 302, 324; McNeel 1955: 54; Thomas 1957:4, 26, 1967:77; Wood 1971a:400; Bright & Stark 1973:22; Bright 1976:44; Titus *et al.* 1985:76; Syme & Nystrom 1988:56.

Hylurgops rugipennis, Snow 1881:70, 1883:44; Wickham 1896a:170; Cockerell 1898:178; Fall & Cockerell 1907:218; Wood 1951:127; Reid 1955:320; Kusch 1967:5.

Hylastes glabratus, Heyden 1890:132.

Hylurgops glabratus, Riley 1891:92; Hopkins 1893a:144, 1893b:213, 1894:280, 1899:449; Smith 1900:365; Swaine 1909:113; Smith 1910:404; Blatchley & Leng 1916:666; Easterling 1934:142.

Hylastes (Hylurgops) pinifex, Blandford 1898:6; Hagedorn 1910a:46; Hagedorn 1910b:11.

H. decumanus, Kleine 1912:166, 1914:407.

H. rugipennis pinifex, Wood 1982:90; Wood 1986:266; Furniss & Johnson 1987:381; Gast *et al.* 1989:385; Atkinson *et al.* 1991:154; McNamara 1991:356; Sequeira & Farrel 2001; Wood & Bright 1992:40; Bright & Skidmore 1997:10; Rykken & Hanson 1999:13; Bright & Skidmore 2002:10; Rabaglia & Valenti 2003:318; Rabaglia 2003:377; Nystrom & Ochoa 2006:39; Hoebeke & Acciavatti 2006:268; Majka *et al.* 2007:433.

Diagnosis: *Hylurgops pinifex* is usually reddish-brown above and darker below; the pronotum is broad and strongly constricted anteriorly (Fig. 17d). It is distinguished from *H. rugipennis* at > 50X magnification by the absence of a complete and distinct pronotal reticulation (Fig. 16b), by the distinct, different-sized pronotal punctures (Fig. 16b), the larger metatarsal spines, and its wider distribution (Fig. 18).

Description: Length 4.10–5.30 mm (mean 4.55 mm, n=25), length/width ratio 2.44X (n=25); mature color nearly black to reddish-brown with black spots on anterior margin of pronotum with ventral surfaces dark-reddish to black.

Frons. Transverse impression moderate to subtle; carina sharply elevated, surface shiny or granulated; vestiture hair-like setae, longer below middle, 2–7X times as long the diameter of a puncture. **Pronotum.** Broad, 0.95X long as wide (n=25); slightly narrower than elytral base, distinctly constricted anteriorly (Fig. 17d), widest anterior to middle; lateral margin narrowly rounded on basal third, broadly rounded on middle third, constricted on anterior third; middle line from base up to entire pronotal length, surface shiny to granulated, slightly raised; discal punctures of three sizes, medium more abundant, larger 3X diameter of smaller, inner surface shiny to granulated, inter puncture spaces smooth to granulated, reticulation if present limited to basal and apical margins; vestiture sparse to absent on disc, short, recumbent, hair-like, about 1X length of small puncture diameter at disc, 2X length around margins. **Elytra.** Anterior margin procurved (Fig. 11a), slightly raised dark margin; striae shallowly concave, averaging half as wide as interstriae on disc, punctures deep, coarse, keyhole-shaped (Fig. 12b), half their diameter apart on disc; interstriae smooth, shiny, with confused small punctures (seen at 100X or more) each with a short, recumbent, hair-like setae becoming scale-like setae on last third, uniseriate line of short, erect hair-like setae exiting from a central puncture, 1.5 discal striae diameter apart long as diameter of a puncture on last third of disc. **Declivity.** Striae slightly impressed, a third width of interstriae, punctures elongate, deep, smaller than at disc separated by 0.75X their diameter; 2nd interstriae slightly impressed, 3rd widest, not intersecting 6th (Fig. 13a), with pointed granules, separated 1.5–2X puncture diameter, 2nd with fewer granules; ground vestiture consists of abundant, recumbent scale-like setae and a uniseriate, erect hair-like setae long as one striae. **Ventrally.** Vestiture consists of short, recumbent hair; tarsi dark reddish-brown; protibia with two spines before angle; meso and meta-tibia with one or two large spines before angle.

Male external genitalia. Of typical *Hylurgops* type; distinguished from *H. rugipennis* (8c) by its lack of a ventral lobe (Fig. 8d).

Gallery: Brood gallery is longitudinal (Fig. 3b), slightly sinuate, and 50–85 mm long (Blackman 1919). It extends up or down from entrance hole, usually on the lower 3 feet of a dead tree or stump. The larvae burrow at both sides of the maternal gallery. Their galleries become confused at later stages and they also burrow into the roots.

Hosts: *Picea glauca* (Moench) Voss, *Pinus banksiana*, *P. contorta*, *P. resinosa*, *P. strobus*, *P. virginiana* Miller, *Larix laricina* (Du Roi) K. Koch, *L. occidentalis*.

Distribution. NORTH AMERICA, CANADA and USA. Transcontinental from northern British Columbia to Nova Scotia south to Arizona and South Carolina (Fig. 18).

Material examined. 458 specimens. CANADA. **Alberta:** Banff (CNCI), Cypress Hills (CNCI), Jasper Park (CNCI), Laggan (CNCI), Lake Louise (CNCI), Marysville (CNCI), Olds (CNCI), Whirlpool River, Jasper (CNCI). **Manitoba:** Grass River Prov. Pk. (CNCI), 30 mi. E Winnipeg (CNCI). **New Brunswick:** Bathurst (CNCI), Kouchibouguac NP (CNCI), McGraw Brook (CNCI), Plaster Rock (CNCI), Saint Louis (CNCI), Salmon River, Saint Martins (CNCI). **Nova Scotia:** Crescent Beach, Bridgewater (CNCI), Halifax (CNCI), Kejimkujik NP (CNCI), Kentville (CNCI). **Ontario:** Algonquin Pk. (CNCI), Atikokan (CNCI), Chalk River (CNCI), Constance (CNCI), Fort William (CNCI), Frater (CNCI), Ignace (CNCI), “King Mtn.” Mont King, Gatinau Pk. (CNCI), Kormak (CNCI), Longlac (CNCI), Marmora (CNCI), Ottawa (CNCI), Petawawa (CNCI), Prince Edward (CNCI), Quentico (CNCI), Seaforth (CNCI), Sudbury (CNCI), Thessalon (CNCI), Toronto (CNCI). **Quebec:** Fort Coulogne (CNCI), Hudson (CNCI), Hull (CNCI), Kazabazua (CNCI), PSP Sta., Lake Opatatika (CNCI), Laniel (CNCI), Menphremagog (CNCI), Montreal (CNCI), “Sainte-Anne’s” de Beaupré (CNCI), Queens Park, Aylmer (CNCI). **Saskatchewan:** Cypress Hills (CNCI). USA. **Alaska:** Ft. Yukon (CNCI). **California:** Mariposa Co.: Tuolumne Meadows; Mono Co.: White Mts.; Tulare Co.: Near Mt. Brewer. **Colorado:** Boulder Co.: Longmont (CSUC); Chaffe Co.: 17 Km W Buena Vista, Cottonwood Pass Rd. (DEBC); Grand Co.: Moffat Rd. (CSUC), Tabernash (CSUC), Williams Fork (CSUC); Gunnison Co.: 10 mi. E Almont (CSUC); Jackson Co.: Cameron Pass (CSUC); Jefferson Co.: (CSUC); Larimer Co.: 9.1 Km W Bellvue, Rist Canyon (CSUC), Estes Park (CSUC), Fort Collins (CSUC); Teller Co.: Mueller State Park (CSUC). **Connecticut:** Litchfield Co.: Cornwall (CNCI). **Idaho:** Blaine Co.: Priest Rd. (CNCI); Cassia Co.: Minidoka NF (CSUC). **Maine:** Kennebec Co.: Monmouth (CNCI); Somerset Co.: Norridgewock (CNCI); Oxford Co.: Paris (CNCI); Penobscot Co.: Orono (UAIC). **Massachusetts:** Middlesex Co.: Framingham (CNCI). **Minnesota:** Cook Co.: Grand Portage NM 0.8 Km N Cowboys Rd./Co. Rd 89 (DEBC, CSUC); St. Louis Co.: Duluth (CNCI). **New Hampshire:** Strafford County: Durham (CNCI). **New Jersey:** no county DaCosta (CNCI); **New York:** Tompkins Co.: Ithaca (CNCI). **North Carolina:** Buncombe Co.: Asheville (CSUC); Macon Co.: near Cliffside Lake cpgd. NW Highlands (CNCI). **Virginia:**

Montgomery Co.: Christiansburg (CSUC). **Wisconsin:** Ashland Co.: Apostle Islands (CSUC). **Wyoming:** Riverton Co.: Dubois (CSUC).

Taxonomy

Asa Fitch (1858) described *Hylastes pinifex* from New York. Later LeConte (1868) supported the placement of *H. pinifex* in the genus *Hylastes* under Erichson's (1836) second division for having the third tarsomere bilobed and the intercoxal mesosternal process protuberant. LeConte (1876) placed *H. pinifex* in his genus *Hylurgops*.

During the late 1800's Hamilton (1889, 1891, 1894b), Heyden (1890), Hopkins (1893a, b), and Schwarz (1886) suggested that *H. pinifex* was the same species as the European *H. glabratus* but those considerations found opposition later by Blandford (1894, 1898). The Palearctic *Hylurgops glabratus* has the pronotal punctures more regularly sized and it has the interspaces shiny with some reticulation as in *H. rugipennis* but it differs from that species in that the first interstriae is wider than the second; whereas is the inverse in *H. rugipennis*. It differs from both *H. pinifex* and *H. rugipennis* in the complete lack of granules and uniseriate hair-like setae on the second declivital interstriae. Hagedorn (1910b) considered *Hylurgops* to be a subgenus of *Hylastes*, where he placed *H. pinifex*. Thereafter, the species has been placed in the genus *Hylurgops*.

Wood (1982) reduced *H. pinifex* to a subspecies of *H. rugipennis* based on the apparent hybridization of the two (see Taxonomy section of *H. rugipennis* for details). The characters used by Wood (D.E. Bright pers. comm.) are variable and occur outside the "hybridization zone". However, the characters of the distinctly different size pronotal punctures and the glossy to granulate surface of the pronotal interspaces are constant along the species distribution and were never observed in *H. rugipennis*.

Hylurgops pinifex is the only Nearctic species occurring in eastern USA and eastern Canada. The primary hosts of the species in the east are *P. strobus* and *P. resinosa* and apparently

it could have spread to the east or to the west naturally by using *P. banksiana* and *Larix laricina* as a bridge to the west. The last two hosts reach the Northern Rockies along Alberta's and British Columbia's southern border where *H. pinifex* occurs in sympatry with *H. rugipennis*.

In this review *H. pinifex* is considered a valid species supported by the consistent diagnostic features mentioned in the species key and the diagnosis.

Hylurgops incomptus (Blandford 1897)

(Figures 8e, 15e, 17e, 19, 21)

Type specimen: *H. incomptus*: 3 Syntypes (sex?), deposited in BMNH (not examined); *H. grandicollis* Lectotype (sex?) No. 9241, designated by Bright (1967), deposited in CNCI.

Type localities: *H. incomptus*- Andres Chalchicomula, now Ciudad Serdan in Puebla, Mexico (1), Salazar (1), Chilpancingo in Guerrero (1); *H. grandicollis*- Cloudcroft, New Mexico, USA.

Hylastes incomptus Blandford 1897:145.

Hylastes (Hylurgops) incomptus, Hagedorn 1910a:45, 1910b:10.

Hylurgops incomptus, Kleine 1912:166, 1914:347; Schedl 1940:338; Blackwelder 1947:786; Hartig 1954:194; Schedl 1955:5; Schwerdtfeger 1957: 363; Wood 1957:397; De Ruelle 1970:102; Furniss & Carolin 1977: 365; Schedl 1977:42; Wood 1982:82; Atkinson & Equihua-Martínez 1985a:67, 1985b:228; Atkinson *et al.* 1986:13; Wood & Bright 1992:33; Romero *et al.* 1997:48; Bright & Skidmore 1997:9; Tkacz *et al.* 1998:18; Bright & Skidmore 2002:9, Fonseca-Gonzales *et al.* 2009:156.

Hylurgops grandicollis Swaine 1917:17, 1918:80; Leng 1920: 339; Keen 1929:61; Chamberlin 1939:204; Bright 1967:675; De Ruelle 1970:102.

Diagnosis: *Hylurgops incomptus* is distinguished from all other *Hylurgops* by the near complete acute margin of the sides of its pronotum (Fig. 19a), and from the sympatric *H. longipennis* by its larger size, and the pronotum nearly as broad as the elytra with smaller more abundant punctures, also by its vestiture of long and yellowish hair-like setae.

Description: Length 4.20–5.49 mm (mean 4.89 mm, n=25), length/width ratio 2.71X (n=25); vestiture abundant, long, yellowish, hair-like setae; mature color black.

Frons. Transverse impression moderately strong; lower carina distinct, elevated from epistomal margin to convexity below frontal impression where it bifurcates until reaching it, vestiture hair-

like, longer below middle impression, 4–7X length puncture diameter. **Pronotum.** Broadening from base to middle (Fig. 19b), slightly elongate, 1.03X longer than wide (n=25), smoothly tapering anteriorly widest at middle or slightly anteriorly; lateral margin basal 3/4 sharply elevated, anterior 1/4 less but not broadly rounded; middle line indistinct, indicated by lack of punctures, from base to entire length, surface smooth, not raised; discal punctures small, deeply impressed, abundant of two different sizes, larger 2–2.5X diameter of smaller, inter-puncture surface reticulate; vestiture distinct, erect 3–6X length diameter of larger puncture on disc, 5–9X length around margins. **Elytra.** Anterior margin almost straight, with scattered medium sized crenulations; stria punctures, small, round; interstriae 2–3X wider than striae, surface reticulate on northern populations from Arizona to Durango, Mexico; uniseriate interstitial row of long, erect hair-like setae from crenulate-punctate areas. **Declivity.** 2nd interstriae impressed, 3rd not distinctly wider than 2nd and not widened apically, all with pointed granules medially, some up to 1/2 as high width of a declivital puncture, separated 1.5X length discal puncture diameter; surface with 4–5 rows of minute rounded to oval punctures of deeply acuminate serrations on their blunt apex; vestiture consisting of uniseriate row of long, erect, hair-like setae with cover of scale-like setae. **Ventral areas.** Finely reticulated; tarsi almost black; protibia with one to two large spines before the angle, meso and metatibia with two large spines each, before the angle; third tarsomeres slightly broader than rest. **Male external genitalia.** Of typical *Hylurgops* type, lacking a ventral lobe (Fig. 8e).

Variation: Mexico south of Chiapas. Pronotum smoothly tapering form base (Fig. 19c), interpuncture surfaces smooth, glossy; elytral disc smooth, glossy, interstriae with two rows of punctate granules, each with a long, semi erect, hair-like setae beginning on disc, flanking an erect, thicker, longer (4–6X length discal puncture diameter) hair-like setae, from an uniseriate granule. Declivital vestiture more abundant, scale-like setae cover replaced by hair-like setae. Populations from Durango, Mexico appear intermediate.

Gallery: The maternal gallery is constructed near or below the root collar, upward from the entrance hole. It is longitudinal and slightly sinuate, from 60–120 mm long (Schwerdtfeger 1957). The larval gallery runs at both sides of the maternal gallery (Wood 1982).

Hosts: *Pinus arizonica*, *P. duranguensis*, *P. engelmannii*, *P. hartwegii*, *P. leiophylla*, *P. montezumae*, *P. oocarpa* var. *ochoterenai* Martínez, *P. patula* Schiede ex Schlechtendahl et Chamisso, *P. pseudostrobus*.

Distribution. CENTRAL AMERICA: Honduras, Guatemala and El Salvador; NORTH AMERICA: Arizona and New Mexico to southern Mexico.

Material examined. 108 specimens. MEXICO. **Chiapas:** 5 mi. E San Cristobal (CNCI), 6 mi. NE San Cristobal (CNCI), 7 mi. E San Cristobal (CNCI), 8 mi. E San Cristobal (CNCI), 25 mi. SE Teopisca (CNCI). **Chihuahua:** Mesa del Huracan (CNCI). **Durango:** 9 mi. E El Palmito (CNCI). **Mexico DF:** 15 mi S El Guarda (CNCI). **Nuevo Leon:** Cerro Potosi (CNCI). **Oaxaca:** Hwy. 175 3.5 mi. S Suchixtepec (CNCI). **Puebla:** 6 mi. W Teziutlan (CNCI). **Toluca:** Vivero San Cayetano (DEBC, CNCI). **Vera Cruz:** 3.6 mi. W Las Vigas (CNCI). USA. **Arizona:** Cochise Co.: Rustler Pk., Chiricagua Mountains (CNCI); Pima Co.: Sta. Catalina Mountains (CNCI). **New Mexico:** Otero Co.: Cloudcroft (RMRS); Santa Fe Co.: Santa Fe Canyon Paratype 9241 (CNCI).

Taxonomy

This species was described as *Hylastes incomptus* under Erichson's second division by Blandford (1897). Hagedorn (1910b) included *H. incomptus* under the subgenus *Hylurgops*. Kleine (1912) considered Hagedorn (1910) species concept of *Hylastes* was too broad and did not follow his subgenus concept placing *H. incomptus* as a member of *Hylurgops*.

When Swaine (1917) described *H. grandicollis* from three specimens from New Mexico, he did not make any reference to Blandford's (1897) species. Swaine (1917) mentioned having examined specimens from California but gave no specific locality for them. Specimens from California were not found for study during this review and Bright & Stark (1973) did not mention the species from the state. In 1955, Schedl reported *H. incomptus* from Guatemala, its southernmost distribution. Wood (1957) synonymized *H. grandicollis* Swaine with *H. incomptus* Blandford after comparing Swaine's *grandicollis* type with several of his and Eggers specimens

of unspecified locations. Wood (1982) based his description on a homotype from Cerro Cael in Guatemala among 151 others, and also examined the types of both *H. incomptus* and *H. grandicollis*.

Specimens from Arizona and New Mexico, including the Swaine *H. grandicollis* types, have pronota that gradually broadens from the base to the middle or to slightly anterior of it (Fig. 19b). These specimens also have elytra with a reticulate surface. The declivital hair-like setae is shorter and reddish-yellow and less abundant due to the presence of a single row of medially arranged granules on the interstriae, also the scale-like setae are more abundant. The pronota of some Mexican specimens from Chiapas gradually narrow from the base towards the apex (Fig. 19c). The elytral surface vary from reticulate to smooth and glossy and the declivital vestiture is light-yellowish, with abundant medium length hair-like setae due to the presence of a pair of lateral granules in addition to the central interstitial row, and less abundant scale-like setae.

The range of the species south of Arizona and New Mexico is partly interrupted from Mexico by the Sonoran desert and the host patchiness in the few Sierras in southeastern Arizona, southwestern New Mexico and in northeastern Sonora and northwestern Chihuahua. The northernmost record in Wood (1982) from Mexico is from Mesa del Huracan in Chihuahua about 300 Km southeast of the southernmost record in Arizona in the isolated range of the Huachuca Mountains. However, specimens from these two disjunct regions do not vary much in habitus. Specimens from the Sierra Madre del Sur in the Mexican State of Oaxaca also closely resemble the northern populations except in that some of the examined specimens are smaller. The greatest differences are found between the Arizona-New Mexico and the western Mexican specimens and some in Chiapas in southeastern Mexico. However, some individuals at both extremes of the range share characters suggesting at least that the species exhibits a clinal variation. The collection of other material for additional morphometric and molecular analysis would help determine if these populations represent different species.

Hylurgops longipennis (Blandford 1896)

(Figures 1a, 8f, 12a, 15f, 17f, 21, 26)

Type specimen: Lectotype female, designated by Wood (1982), deposited in BMNH (not examined).

Type locality: Rancho de Popocatepetl, Mexico.

Hylastes longipennis Blandford 1896:143; Kleine 1912:162, 1914:347; Schedl 1940:338; Ferrer 1942:21; Blackwelder 1947:786; Gibson & Carrillo 1959:142.

Hylastes (Hylastes) longipennis, Hagedorn 1910a:45, 1910b:10.

Hylurgops longipennis, Wood 1982:87; Atkinson & Equihua-Martínez 1985a:68, 1985b:228; Wood & Bright 1992:34; Bright & Skidmore 1997:9; Romero *et al.* 1997:48; Tkacz *et al.* 1998:18; Bright & Skidmore 2002:9.

Diagnosis: *Hylurgops longipennis* is distinguished from the sympatric *H. incomptus* by the larger prothoracic punctures of two distinctly different sizes (Fig. 17f), by the larger and coarser elytral punctures and by the whitish versus yellowish setae in *H. incomptus*.

Description: Length 3.82–4.84 mm (mean 4.34 mm, n=25), length/width ratio 2.96X (n=25); vestiture long, whitish, hair-like setae at declivital interstriae; mature color black.

Frons. Transverse impression indistinct, shallow; middle carina from epistomal margin to transverse impression, surface granulated, dull; vestiture whitish, hair-like setae, longer below middle impression, 3–6X frontal puncture diameter. **Pronotum.** Elongate, 1.09X longer than wide (n=25), smoothly tapering anteriorly (Fig. 17f), widest at middle; lateral margin basal 4/5 roundly elevated, anterior fifth broadly constricted; middle line raised from base to 4/5 its length, surface granulated, dull; discal punctures two sized, equally abundant, larger 2X diameter of smaller, punctures inner surface granulated, dull; interpuncture surface smooth to granulate; vestiture long, erect, whitish, 1.5X length large puncture diameter on disc, 2.5–5X length large puncture diameter on sides. **Elytra.** Interstriae smooth, glossy to finely granulate, minutely punctured, each with a short, erect, hair-like setae beginning posterior to disc's middle, becoming scale-like towards the declivity and a near central, erect, thicker hair-like setae, 1–5X discal puncture diameter; strial punctures deep, round (Fig. 12a), as wide or slightly wider than

interstriae at disc, half their diameter apart. **Declivity.** The 1st and 2nd interstriae impressed (Fig. 15f), with pointed granules, some 1/3 high declivital puncture diameter; striae punctures round, large deep, half interstitial width diameter; vestiture of oval, scale-like setae on rows of 3–4, uniseriate setae, long, erect, slightly longer diameter of interstitial width. **Ventral areas.** Finely reticulated; posterior face of abdominal sternites reddish; tarsi black, third tarsomeres distinctly broader than 2nd (Fig. 1a). **Male external genitalia.** Of typical *Hylurgops* type, with a distinct ventral lobe (Fig. 8f).

Gallery: On the stem collar and roots of its host (Atkinson & Equihua-Martínez 1985a). The pattern has not been described.

Hosts: *Pinus hartwegii*, *P. leiophylla*, *P. patula*, *P. pseudostrobus*.

Distribution. NORTH AMERICA: MEXICO. From two disjunct localities in the Sierra Madre Oriental, the northern in Nuevo León and the southern in Hidalgo, to the trans-Mexican volcanic belt (Fig. 21).

Material examined. 17 specimens. MEXICO. **Nuevo Leon:** Mpio. Galaena NE slope Cerro Potosi (CNCI). **Puebla:** 11 mi. E Amecameca (USNM), Parque Nacional Iztaccihuatl-Popocatepetl (USNM), Parque Nacional Zoquiapan (USNM).

Taxonomy

Blandford described *Hylastes longipennis* in 1896 from five specimens from “Rancho Popocatepetl”. Hagedorn (1910b) and Schedl (1940) treated *H. longipennis* as a *Hylastes*. Wood (1982) designated a female in Blandford’s series, as the lectotype and placed the species in the genus *Hylurgops* for having the third tarsomeres bilobed and the intermixed large and small punctures of the pronotum.

The species distribution appears limited to that of the primary hosts, *P. hartwegii* and *P. montezumae*. These pines occur discontinuously at high elevations in the trans-Mexican volcanic belt, the Sierra Madre de Oaxaca, the Sierra Madre de Chiapas and in other smaller patches. The previous distribution of the species showed the species was restricted to the trans-Mexican

volcanic Belt (Atkinson 1985a, b). New records from the USNM collection expand the known distribution of this species, which seems to match that of *P. hartwegii*, as exemplified by its occurrence in small population of that species in the Cerro Potosí, Nuevo León in the Sierra Madre Oriental.

Hylurgops knausi Swaine 1917
(Figures 8g, 14b, 15g, 17g, 22)

Type specimen: *H. knausi*: Lectotype (sex?) No. 9243, designated by Bright (1967), deposited in CNCI.

Type locality: Cloudcroft, New Mexico, USA.

Hylurgops planirostris, Schedl 1940:323, 338; Hartig:1954:193; Schedl 1966:76; Thomas 1967:73, 77; Wood 1971c:146; Livingstone 1980:29; Wood 1982:85; Livingstone *et al.* 1983:675; Wood & Bright, 1992:39.

Hylurgops knausi Swaine 1917:17; Swaine 1918:81; Leng 1920:339; Chamberlin 1939:205; Bright 1967:675; De Ruelle 1970:102.

H. kanusi, Keen 1929:61.

Diagnosis: Pronotum elongate, smoothly tapering anteriorly, larger punctures < 2X diameter of smaller (Fig. 14b). It is distinguished from the similar and sympatric *H. porosus* and *H. reticulatus* by the short, recumbent, hair-like ventral setae. The short pronotal setae, distinguishes it from *H. longipennis* and *H. incomptus* in northern Mexico. The absence of a distinct anterior pronotal constriction, the straighter anterior margin of the elytra, the more elongated habitus and reduced elytral disc vestiture separates it from *H. planirostris* of southern Mexico to Honduras.

Description: Length 4.15–5.56 mm (mean 4.72 mm, n=25), length/width ratio 2.69X (n=25); vestiture short, whitish, hair-like distinctly to indistinctly longer than scales at declivital interstriae; mature color dark brown to black.

Frons. Transverse impression moderately strong; median carina from above epistomal margin to middle of convex area below frontal impression; vestiture short, recumbent, hair-like, 2X long as one frontal puncture diameter, 3X as long immediately above epistoma. **Pronotum.** Slightly

elongate, 1.01X longer than wide (n=25); narrower than elytral margin at base, evenly or slowly widening to near or slightly anterior to middle, where appears wider than elytral margin, then smoothly tapering anteriorly (Fig. 14b). Lateral margin narrowly constricted on basal 1/3–1/4, slightly rounded at middle; middle line low, sometimes indicated only by lack of punctures; discal punctures small, numerous, appearing regularly sized at low magnification; smaller 2/3 diameter of larger observed at magnifications > 100X, discal interpuncture surface shiny, with scattered reticulation; vestiture short, near indistinct, recumbent, hair-like setae 1X length puncture diameter on sides. **Elytra.** Interstriae glossy, 1.5X wider than striae on disc, surface rugose, 2–3 rows confused punctures, each with a short, recumbent, hair-like setae, becoming semiplumose towards discal end; striae punctures small, keyhole-shaped (Fig. 12 b–c), moderately impressed. **Declivity.** 3rd interstriae widest (Fig. 15g), slightly impressed, all with uniseriate granules of 1/2 high width of a puncture with semi-erect, hair-like setae about from 1X (females) to 4X (males) length of diameter of discal puncture, ground vestiture of 4–5 rows, short, recumbent, scale-like setae. **Ventral areas.** Black, finely reticulated; tarsi dark reddish; vestiture short, recumbent hair-like setae, third tarsomere only slightly broad, bilobed. **Male external genitalia.** Of typical *Hylurgops* type, with a moderate ventral lobe (Fig. 8g) unlike the straight ventral shape of *H. planirostris* (Fig. 8b).

Gallery: On stem collar and roots (Livingstone 1980).

Hosts: *Picea engelmannii*, *Pinus arizonica*, *P. duranguensis*, *P. leiophylla*, *P. ponderosa*, *P. pseudostrabus*, *P. strobiformis*.

Distribution. NORTH AMERICA: MEXICO and USA. Arizona and New Mexico to northern Mexico including Baja California.

Material examined. 235 specimens. MEXICO. **Durango:** 10 mi. SW El Salto (CNCI), 24 mi. E El Salto (CNCI), Buenos Aires 10 mi. W La Ciudad (CNCI), 24 mi. W La Ciudad (CNCI).

Nuevo Leon: Cerro Potosi (CNCI). USA. **Arizona:** no County: S. Arizona (CNCI); Apache Co.: Alpine (CNCI), Big Bonito Creek, White Mts. (UAIC); Cochise Co.: Rustler Camp., Chiricagua Mountains (CNCI), Paradise (CNCI); Graham Co.: Pinaleño Mountains (CNCI, UAIC), Pinaleño Mountains, Soldier Creek (UAIC); Gila Co.: Globe (CNCI); Greenlee Co.: Buffalo Crossing, East

Fork Black R., White Mts. (UAIC), Hannagan Camp. (CNCI); Pima Co.: Bear Wallow, Santa Catalina Mountains (CNCI), Florida Cny. Sta. Rita Range Res. (UAIC), Green Spg., Mt. Lemmon (UAIC), Mt. Bigelow (UAIC), Sta. Catalina Mts. near Summerhaven (UAIC); Santa Cruz Co.: Carr Canyon, Huachuca Mountains (CNCI). **New Mexico**: Grant Co.: McMillan Camp. 13 mi. N Silver City (CNCI); Otero Co.: Cloudcroft (CNCI), Lincoln NF 1 mi. SE Cloudcroft (CNCI), Pine Camp., 2 mi. NE Cloudcroft (CNCI); San Miguel Co.: near hot springs, Las Vegas (CNCI); Socorro Co.: Bear Trap Camp., 28 mi. SW Magdalena (CNCI).

Taxonomy

Swaine (1917) described *Hylurgops knausi* from Cloudcroft, Otero County, New Mexico, describing the pronotum longer than wide and tapering apically after the middle. He suggested that a series having short interstitial hair-like setae on the declivity probably represented the opposite sex of the species. Swaine (1918) placed it under *Hylurgops* for the broad and bilobed third tarsal segments. Wood (1971c) compared Chapuis' syntypes of *H. planirostris* with his homotypes of *H. knausi* and found them to be identical, considering them synonymous. In the key to the *Hylurgops* of his monograph, Wood (1982) placed the synonymized species under those lacking a distinct pronotal anterior constriction.

Differently from the specimens occurring from the trans-Mexican volcanic belt south to the Sierra Madre de Chiapas, *H. knausi* have slightly longer than wide pronota (1.01X, n=25), which smoothly tapers on the anterior third, shallower punctures, shiny and slightly wider spaces between the punctures, and a whitish-yellow vestiture.

Hylurgops reticulatus Wood 1971
(Figures 6b, 8h, 15h, 17h, 23a, 24)

Type specimen: Holotype male, USNM.

Type locality: Summit Lake, Shasta County, California, USA.

Hylurgops reticulatus Wood 1971b:71; Bright & Stark 1973:22; Bright 1976:47; Furniss & Carolin 1977:365; McNamara 1977:196; Wood 1982:83, 88; Furniss & Johnson 1987:381; Gast *et al.* 1989:385; McNamara 1991:356; Furniss *et al.* 1992:375; Wood & Bright 1992:41; Furniss & Johnson 1995:339; Bright & Skidmore 2002:10; Furniss & Johnson 2002:45; Safranyik *et al.* 2004.

Diagnosis: *Hylurgops reticulatus* is distinguished from the sympatric *H. porosus* at > 50X magnification by the entirely reticulated elytral surfaces (Fig. 23a), from *H. knausi* by the distinctly different sized pronotal punctures, by the long, hair-like setae on the ventral surfaces and from black specimens of *H. pinifex* in Colorado by the longer than wide pronotum (Fig. 17h), which smoothly tapers anteriorly.

Description: Length 3.93–5.34 mm (mean 4.46 mm, n=25), length/width ratio 2.78X (n=25); vestiture whitish, hair-like setae; mature color black to brownish red, rarely bicolored, and then black pronotum and elytra reddish-brown to brown.

Frons. Middle impression moderately deep; carina from middle impression to epistoma, elevated, surface smooth to reticulate; vestiture hair-like setae, longer below middle, 2–7X long as puncture's diameter; club, first segment longest. **Pronotum.** Elongate, 1.07X longer than wide (n=25), anterior margin narrower than elytra; smoothly tapering anteriorly (Fig. 17h), widest near middle; dorsal median line from base to entire length, surface reticulated, slightly raised; discal punctures of two sizes, small more abundant (2:1), larger 3X diameter of smaller, inner surface shiny or dull, inter-puncture area reticulated, some with scattered smooth areas; disc setae sparse to absent, short, recumbent, hair-like, averaging length of small punctures at disc, 2X longer at marginal areas; color black varying to dark reddish brown; lateral margin basal two thirds narrowly rounded becoming more rounded anteriorly to an apical slight constriction. **Elytra.** Anterior margin almost straight; interstriae, evenly reticulate (visible at > 50X, Fig. 23a), punctures minute, confused, a central uniseriate, erect, hair-like setae behind each granule, 1X diameter of discal striae puncture becoming longer posteriorly, separated by 1.5 striae puncture diameter; striae shallowly concave, straight lengthwise, with deep, round punctures of shiny surface, separated half their diameter at disc. **Declivity.** Striae slightly impressed, as wide as interstriae except narrower than third (Fig. 15h), punctures round and deep, smaller than at disc, separated by 0.5X their diameter, second interstriae slightly impressed, all with pointed granules separated by 1.5 puncture diameter and with a ground vestiture of small, round, scale-like setae,

3–4 across interstriae, uniseriate midline of erect, hair-like setae as long to slightly longer than interstriae. **Ventrally.** Surface punctured, reticulated; vestiture distinctly long, hair-like; precoxal ridge acutely elevated; tarsi dark, almost black, tarsi lighter; protibia with two large spines before angle; meso and meta-tibia with one or two large spines before angle; third tarsomere slightly broader than second. **Male external genitalia.** Of typical *Hylurgops* type, with a distinct ventral lobe (Fig. 8h) unlike in *H. porosus* (Fig. 8i).

Gallery: As in *porosus* (Wood 1982). Uniramous, longitudinal with broods mining perpendicular to the brood gallery.

Hosts: *Picea engelmannii*, *P. sitchensis*, *Pinus attenuata*, *P. contorta*, *P. jeffreyi*, *P. monticola*, *P. muricata*, *P. ponderosa*, *P. radiata*, *Pseudotsuga menziesii*, *Tsuga heterophylla*.

Distribution. NORTH AMERICA: MEXICO and USA. From southern Alaska to Chihuahua, Mexico.

Material examined. 100 specimens. CANADA. **Alberta:** Lake Louise (CNCI). **British Columbia:** Creston (CNCI), Indian Meadows Midday Creek (CNCI), Midday Valley, Merritt (CNCI), Midday Valley, Merritt Paratypes No. 12578 (CNCI), Lake Cowichan (CNCI), Oliver (CNCI), Summerland (CNCI), Voght Valley (CNCI). USA. **California:** Lassen Co.: Lassen NF (CNCI); Los Angeles Co.: Big Pines (CNCI); Plumas Co.: Meadow Valley (CNCI); San Bernardino Co.: Big Bear Lake (CNCI). **Colorado:** El Paso Co.: 15 mi. S. Colorado Springs (CNCI). **New Mexico:** Otero Co.: Cloudcroft (CNCI). **Oregon:** Klamath Co.: Fort Klamath (CNCI); **Utah:** Juab Co.: Eureka (CNCI), The Mammoth (CNCI).

Taxonomy

Wood (1971b) described *Hylurgops reticulatus* from specimens collected by him in 1946 from Summit in Shasta County, California. He mentioned *H. reticulatus* was previously confused with *H. porosus* and *Hylastes macer* LeConte, the second species having reticulated elytral surface as well.

The third tarsomeres of *H. reticulatus* are not as broad as in other *Hylurgops*, however they are not narrow as in *Hylastes*, and the pronotal punctures are of two distinct sizes which are

intermixed (Fig. 17 h). The species resembles *H. porosus* and it occurs in sympatry with it throughout most of its distribution.

Hylurgops porosus (LeConte 1868)
(Figures 8i, 15i, 17i, 23b, 24, 25b)

Type specimen: Lectotype *H. porosus* (sex?) deposited in MCZC; Holotype of *H. lecontei* (sex?), CNCI.

Type locality: *H. porosus*, Cayo de los Reyes (Point Reyes?), California, USA; *H. lecontei* Colorado, USA.

Hylastes porosus LeConte 1868:175; Gemminger & Harold 1872:2670; Crotch 1873:125; LeConte 1876:388; Austin 1880:57; Wickham 1896b:310; Hopkins 1902:13; Swaine 1909:146; Kleine 1912:162, 1914:389.

Hylastes (Hylastes) porosus, Hagedorn 1910a:46, 1910b:11.

Hylurgops lecontei Swaine 1917:16; Chamberlin 1917:326; Swaine 1918:81; Hopping 1922:133; Chamberlin 1924:57; Keen 1928:57, 1929:25, 61; Bruck 1936:48, 50; Keen 1938:27; Chamberlin 1939:205, 207; Patterson & Hatch 1945:151; Keen 1952:154; Chamberlin 1958:119; Ruppel 1967:52; Bright 1967:675; Schuder 1969:74; De Ruelle 1970:102; Hoebeke 1978:22.

Hylurgops porosus, Swaine 1918:81, 82; Chamberlin 1924:57; Keen 1928:57, 1929:25, 61, 1938:27; Chamberlin 1939:205, 207; Hayward 1945:118; Patterson & Hatch 1945:151; Wood 1951:127; Keen 1952:154; Chamberlin 1958:119; Kusch 1967:5, 10; Schuder 1969:78, 79; Wood 1971a:399, 1971c:147; Bright & Stark 1973:22, 23; Bright 1976:46; Furniss & Carolin 1977:365; Livingstone 1980:29; Wood 1982:83; Evans 1983:33; Pardy 1983:61; Furniss & Johnson 1987:381; Gast *et al.* 1989:385; McNamara 1991:356; Furniss *et al.* 1992:375; Wood & Bright 1992:39; Furniss & Johnson 1995:339; Bright & Skidmore 1997:10, 2002:10; Furniss & Johnson 2002:45; Kelsey & Joseph 2003:7; Safranyik *et al.* 2004.

H. sorosus, Hopping 1922:133.

Diagnosis: *Hylurgops porosus* is distinguished from the similar *H. reticulatus* at high (> 50X) magnification by the absence of an entire reticulation on the elytra (Fig. 23b) and from *H. knausi* by the distinctly different-sized pronotal punctures (Fig. 17i) and the long ventral hair-like setae. It can be distinguished from dark specimens of *H. pinifex* by its narrower body and the indistinct pronotal constriction.

Description: Length 3.49–4.53 mm (mean 3.97 mm, n=25), length/width ratio 2.70X (n=25); mature color black or brownish red to bicolored with black pronotum and reddish-brown or brownish elytra.

Frons. Transverse impression moderately impressed; carina from lower frons convex area to epistoma, elevated, surface shiny; vestiture consisting of hair-like setae, longer below middle, 2–7X long as diameter of one puncture. **Pronotum.** Slightly elongate (Fig. 17i), 1.03X longer than wide (n=25), narrower than elytra, smoothly tapering anteriorly, widest near middle; middle line from base up to entire length, surface shiny to variably reticulated, slightly raised; discal punctures of two sizes, small more abundant, larger 3X diameter of smaller, inner surface shiny or reticulated, often dirty, margin smooth to reticulated, shiny; vestiture sparse to absent on disc, short, recumbent hair-like setae, averaging the length of larger punctures on disc, 2X longer on marginal areas; color black to dark reddish brown; lateral margin basal third narrowly rounded becoming broadly rounded anteriorly to slight anterior constriction. **Elytra.** Anterior margin near straight; interstriae smooth, slightly wider than discal striae, minutely punctured (>100X or more), each with a short, recumbent, hair-like setae on anterior two thirds of disc, with a single line of erect hair-like setae from behind a punctate granule, long as 1X diameter of a discal puncture on last discal third, 1.5X strial puncture diameter apart; striae round to keyhole-shaped, shallowly concave, surface glossy (Fig. 23b), separated by half their diameter at disc. **Declivity.** Striae slightly impressed half as wide as interstriae, punctures round, deep, smaller than at disc, 0.75X their diameter apart, second interstriae slightly impressed, all with granules 1.5 punctures apart, each erect hair-like setae long to slightly longer as interstriae. **Ventral areas.** Surface reticulated; ground vestiture of distinct long hair-like setae; tarsi dark reddish-brown; protibia with two large spines before angle; meso and meta-tibia with one or two large spines before angle; third tarsomere slightly broader than second. **Male external genitalia.** Of the typical *Hylurgops* type; distinguished from *H. reticulatus* (8h) by the lack of the ventral lobe (Fig. 8i). **Gallery:** Uniramous, longitudinal gallery (Hopkins 1902).

Hosts: *Picea engelmannii*, *Pinus attenuata*, *P. banksiana*, *P. contorta*, *P. flexilis* E. James, *P. jeffreyi*, *P. ponderosa*, *P. radiata*.

Distribution: NORTH AMERICA: USA. Alaska to New Mexico west of South Dakota (Fig. 24).

Material examined. 93 specimens. CANADA. **Alberta:** Cypress Hills (CNCI), Lake Louise (CNCI). **British Columbia:** Atlin (CNCI), Golden (CNCI), Kingsvale (CNCI), Kleena kleene (CNCI), Merritt: Cranbrook (CNCI), Midday Valley (CNCI), Peachland (CNCI), Summerland (CNCI), Trepanier Creek (CNCI), Trinity Valley (CNCI), Vermillion Summit (CNCI), Vernon (CNCI). USA. **California:** Alameda Co.: Piedmont (CSUC); Mariposa Co.: Yosemite (CSUC); Nevada Co.: Truckee (CNCI); Tuolumne Co.: Avalanche Meadows at Sequoia NP (CNCI).

Colorado: Adams Co.: JCK Corp. Henderson (CSUC); Archuleta Co.: Fairfield (CSUC); Boulder Co.: Gold Hill (CSUC); Chaffee Co.: 17Km W Buena Vista (CSUC), Custer Rd 306 2 mi. S Rd 307, Droney Gulch (CSUC); Denver Co.: Denver (CSUC); El Paso Co.: Black Forest (CSUC); Fremont Co.: 5 mi. N Cotopaxi (CSUC), US 285 W Aspen Park (CSUC); Jackson Co.: Cameron Pass (CSUC), CO St. Forest (CSUC); Larimer Co.: Estes Park (CSUC), Fort Collins (CSUC), Glen Haven (CSUC), Manhattan (CSUC), Mt. Margaret trail near Parvin Lake (CSUC), Rd. to Pingree Pk. (CSUC), Red Feather Lakes (CSUC), Round Mt. trail Big Thompson Canyon (CSUC); Las Animas Co.: Sugarite Canyon at Dorothy Lake (CSUC); Montezuma Co.: W shore McPhee Res. (CSUC); Morgan Co.: Ft. Morgan (CSUC); Pueblo Co.: 2 mi S San Isabel (CSUC), Beulah (CSUC); Weld Co.: Meadow Springs (CSUC). **Montana:** Hill Co.: Rocky Boy Indian Reserve (CNCI). **Oregon:** Curry Co.: Little redwood campground (CSUC); Wallowa Co.: Whitman NF (CNCI).

Taxonomy

LeConte (1868) described *Hylastes porosus* from a specimen from California and placed it under Erichson's first division of *Hylastes* for having the third tarsomeres emarginated and the anterior intercoxal mesosternal process not protuberant, as those of the second division (*Hylurgops sensu* LeConte 1876). LeConte (1876) kept *H. porosus* under *Hylastes* even after he had erected the genus *Hylurgops*.

Swaine (1917) described a specimen of *H. porosus* originally studied by LeConte from Colorado as *Hylurgops lecontei*. He based his determination on differences in the degree of impression of the elytral striae as well as in differences on the size of pronotal punctures of the specimens he studied. Examined material throughout the range indicates that *H. porosus* can vary

in size, degrees of elytral striae impression and coloration among other characters. However, these characters vary in series from the same area.

Swaine (1918) placed *Hylastes porosus* in the genus *Hylurgops* under the species with widened and bilobed third tarsomeres and anteriorly protuberant intercoxal mesosternal processes. Wood (1971c) synonymized *H. lecontei* with *H. porosus* after he examined the types of both species and considered them to be identical. Based on the characters used in this review *H. porosus* is considered to fit into the generic concept of *Hylurgops*.

DISCUSSION

Hylurgops is a valid genus within the Hylastina and is defined by the characters of a third tarsal segments that is distinctly wider than the second tarsomeres and a fifth that broadens apically (Fig. 1a), by the presence of medium sized punctures between the large pronotal punctures (Fig. 4c), by having a pronotum that is equal to or wider than long, and by the presence of a well-defined frontal impression (Fig. 5a). The reinterpretation of several traditionally used characters and incorporation of new characters was needed for an effective and simpler way of differentiating the genera *Hylurgops* and *Hylastes*. Previously used diagnostic characters separating the two genera have been arguably defined.

If LeConte (1876) is strictly followed to separate *Hylastes* and *Hylurgops*, placing any of the treated species herein could result in a misidentification. The original character of a bilobed versus emarginate third tarsal segment (Erichson 1836) is difficult to interpret. An incorrect evaluation of the character could misdiagnose species without strongly bilobed tarsomeres like: *H. knausi*, *H. porosus*, and *H. reticulatus* into the genus *Hylastes*. This character has been redefined making reference to the fact that the third tarsomeres of *Hylurgops* are 1.3 to 1.7X (Fig.1a) wider than their second, while those of *Hylastes* are 1 to 1.1X (Fig.1b) wider than their

second. The distinction of bilobed versus emarginate leads to confusion and the use of this character is not suggested.

Another morphological character which may be difficult to interpret is the shape of the intercoxal mesosternal process. Described by LeConte (1876) as being protuberant in *Hylurgops* (Fig. 2a) versus truncate in *Hylastes* (Fig. 2b), this character was not found to be mutually exclusive of either genera. When LeConte (1876) erected the genus *Hylurgops* the three species he used to designate his genus were *H. pinifex*, *H. rugipennis* and *H. subcostulatus*, out of these species *H. subcostulatus* is the only one that has a intercoxal mesosternal process which is distinctly anteriorly protuberant (Fig. 2a) in the other two genera the anterior extension is reduced to a procurved margin which it is difficult to observe. The precise definition of this character is difficult. LeConte (1876) termed the character following Erichson (1836) as protuberant; Chapuis (1869, 1873) was more specific when he defined it as anteriorly protuberant in *Hylurgops* versus straight or emarginate in *Hylastes*. The confusion of the term is evident in Swayne (1918) key, where he described it as protuberant in front but his illustration shows it ventrally sub-inflated (Fig. 25a); Bruck (1936) provided an illustration faithful to the original description (Fig. 25b) of this character in his revision of the tribe Hylesinini. This character is not useful to separate the genus *Hylurgops* from *Hylastes*; however, it is useful to distinguish the genus *Pachysquamus* from both *Hylastes* and *Hylurgops*.

Eichhoff (1881) described the anterior margin of each elytron as procurved (Fig. 11a) for *Hylurgops* versus nearly straight for *Hylastes* (Fig. 11b). Although *Hylurgops* usually can be separated from *Hylastes* by this character, its variability even among individuals of the same species results in a poor separation utility. The elytral anterior margin curvature in *H. incomptus*, *H. longipennis*, *H. porosus*, *H. knausi*, and *H. reticulatus* is not pronounced, even appearing straight in some specimens; the opposite can be observed in specimens of *Hylastes macer*

LeConte which show considerable curvature of the anterior elytral margin. Therefore, this character is not reliable in separating the two genera.

Eichhoff (1881) grouped under *Hylurgops* the species with wider than long pronota and under *Hylastes* those species with the opposite proportion. The character was later used by Swaine (1909), Reitter (1913), and Pfeffer (1944, 1989, 1995). Measurements of a large number of specimens from various geographical areas validated the use of this character for the identification of the New World fauna with the modifications shown in the generic key provided in this review.

The intermixed size of the pronotal punctures is frequently used for separating *Hylurgops* from *Hylastes*. This character was defined by Wood (1961) as the small punctures equally abundant as the large in *Hylurgops* versus the small punctures absent or less abundant than the large in *Hylastes*. Although some *Hylastes* can have medium sized punctures between the larger this is never evenly present as in *Hylurgops*. The presence of the medium sized punctures, evenly intermixed between the large (Fig. 4c) makes the density of pronotal punctures in *Hylurgops* greater than in *Hylastes* (Fig. 4b).

Previous studies have found both sexes in *Hylurgops* to be morphologically similar (Krivolutskaya 1996, Yin *et al.* 1984), whereas most species in *Hylastes* are sexually dimorphic (Grocholski *et al.* 1976, Yin *et al.* 1984, Pfeffer 1995). Hopkins (1894), Munro (1917) indicated several morphological structures which could be used to distinguish the sexes in *Hylurgops*; however, these were not confirmed in this study. Swaine (1917) indicated that the shorter hair-like setae on the declivity of some *H. knausi* could represent the male of the species. It was found that males of *H. knausi*, and *H. pinifex* and *H. rugipennis* have distinctly longer uniseriate hair-like setae on the declivity than females.

Hylastes sexual differences are indicated by a longitudinal impression on the male's 7th sternite which is usually vested with apically directed setae. Two exceptions to this are the American species *H. tenuis* and *H. exilis*, where the 7th sternite is not longitudinally impressed. Different from *Hylastes* the 7th sternite on males is not grooved nor has the distinctive vestiture as do most *Hylastes* except for slightly so in *H. porosus*. A valid way to determine the sex in *Hylurgops* is examining the ventral sternites. Females have a longer and more apically tapered 7th sternite; this sternite is distinctly longer than 5th and 6th combined (Fig. 26a) in females, but it is equal or indistinctly longer than 5th and 6th combined in the males (Fig. 26b).

Only a few studies have studied the genitalia of members of the subtribe Hylastina. Nüsslin (1912) described differences among *Hylastes* and *Hylurgops*; however, he only compared *H. palliatus* and *Hylastes ater*. Also, he based his observations on figures by Lindemann (1875) who drew extruded genitalia, which changes the natural aspect desired in genitalia descriptions.

Grocholski *et al.* (1976) described male genitalia differences in six *Hylastes* species from the Palearctic; giving emphasis to slight differences of the median lobe and the tegmen. In their line drawings five of the six *Hylastes* species they studied showed an elongated and pointed tegmenal manubrium. Dissections of all American species revealed a greatly reduced to absent manubrium (Fig. 6a–b, d).

Another character not mentioned by Grocholski *et al.* (1976) was an extension of the aedeagus at the base of the aedeagal apodemes which forms a neck-like extension (Fig. 6c) in four of their treated *Hylastes* species. This character is not present in any New World *Hylurgops* species; however, some New World species of *Hylastes* examined during this study lacked the elongated manubrium and/or the “neck” as well.

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FIGURES

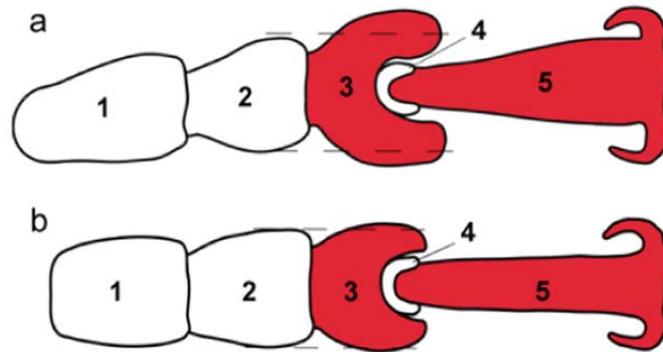


Figure 1. Hylastina protarsi. (a) *Hylurgops longipennis*, 3rd tarsal segment broader than the 2nd and the 5th tarsal segment broadening apically, (b) *Hylastes mexicanus*, 3rd tarsal segment broad as the 2nd and the 5th not broadening apically.

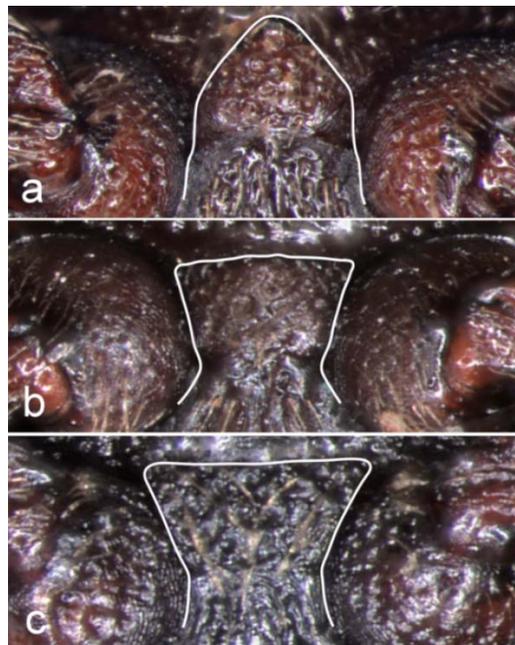


Figure 2. Hylastina intercoxal mesosternal process, anterior margin. (a) *Phachysquamus subcostulatus*, anterior margin pointed, (b) *Hylurgops planirostris*, anteriorly, slightly rounded and sub-inflated, (c) *Hylastes salebrosus* truncate, anterior margin straight.

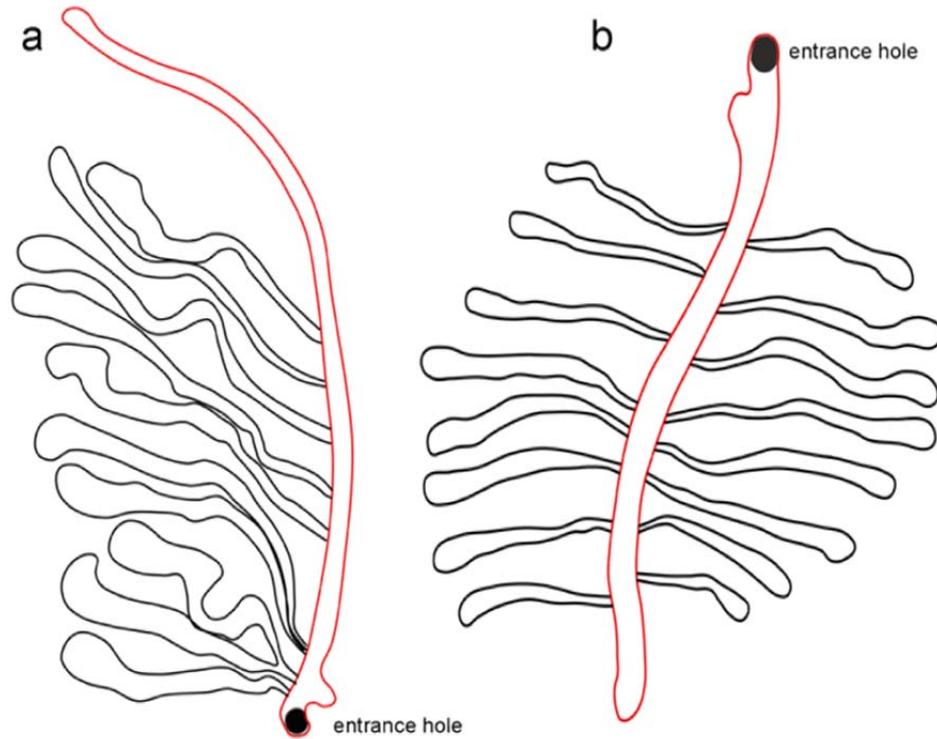


Figure 3. Hylastina galleries. a) *Pachysquamus subcostulatus*, maternal (red) and larval gallery (Adapted from Cibrián-Tovar *et al.* 1995), b) *Hylurgops pinifex*, maternal (red) and larval gallery (Adapted from Blackman 1919).

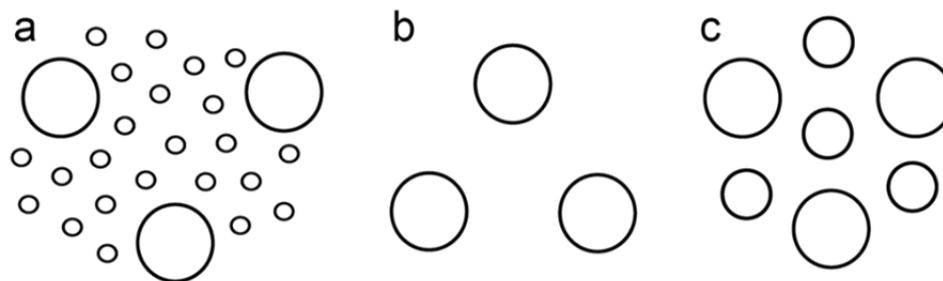


Figure 4. Hylastina pronotal punctures. a) *Pachysquamus* spaces between large punctures densely, minutely punctate, b) *Scierus* and *Hylastes* spaces between large punctures without punctures, c) *Hylurgops* spaces between large punctures with medium sized punctures.

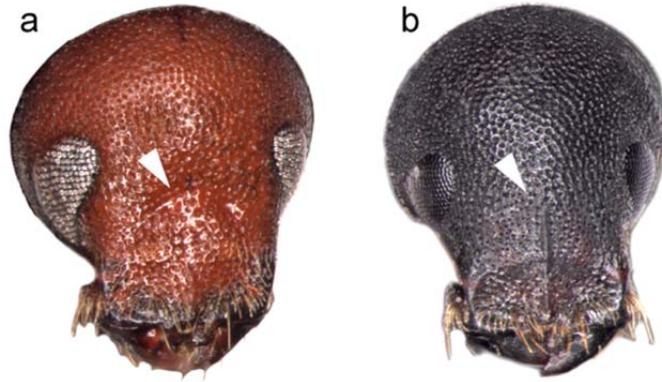


Figure 5. Hylastina mid frontal impression. a) *Hylurgops rugipennis*, deep and distinct, b) *Hylastes mexicanus*, indistinct or absent.

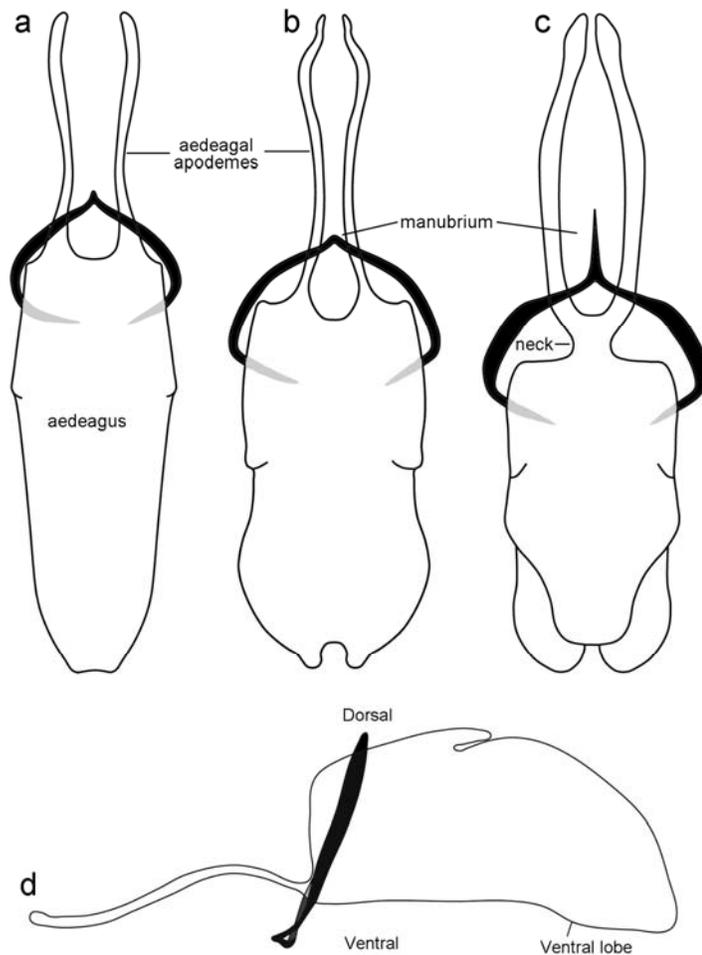


Figure 6. Hylastina male external genitalia. a) *Pachysquamus subcostulatus*, b) *Hylurgops reticulatus*, c) *Hylastes ater* (modified from Grocholski *et al.* 1976), d) *Hylurgops rugipennis*, natural position.



Figure 7. *Hylurgops piger*, drawing of a Florissant's shale impression (Modified from Wickham 1913).

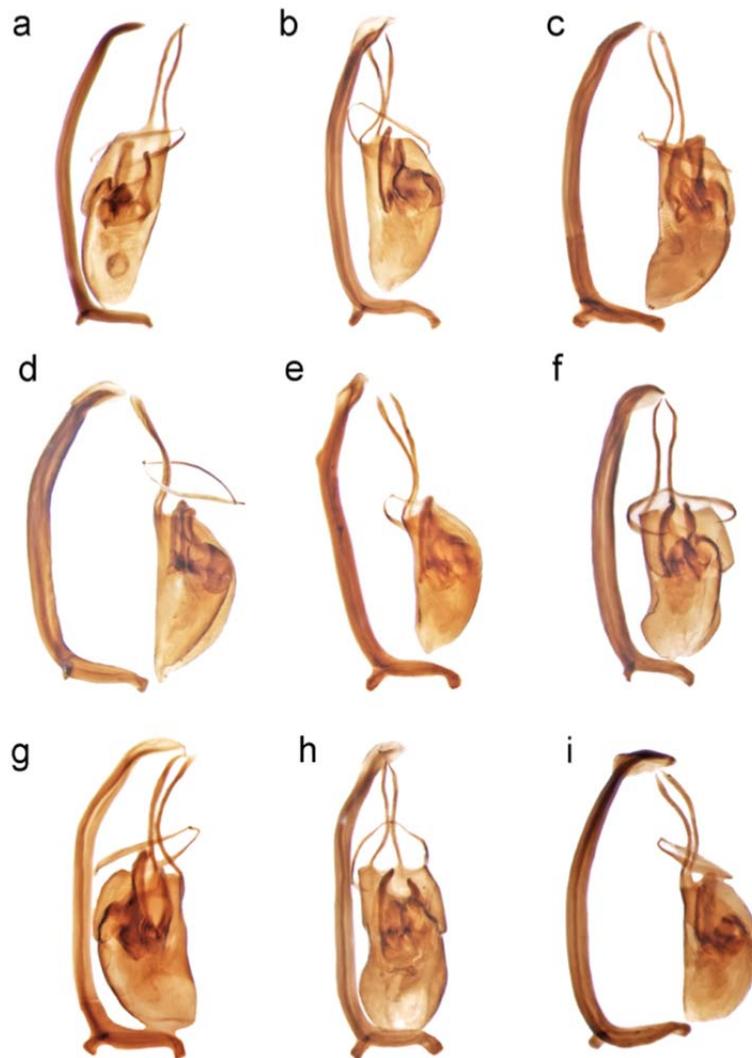


Figure 8. American Hylastina male genitalia. a) *P. subcostulatus*, b) *H. planirostris*, c) *H. rugipennis*, d) *H. pinifex*, e) *H. incomptus*, f) *H. longipennis*, g) *H. knausi*, h) *H. reticulatus*, i) *H. porosus*.

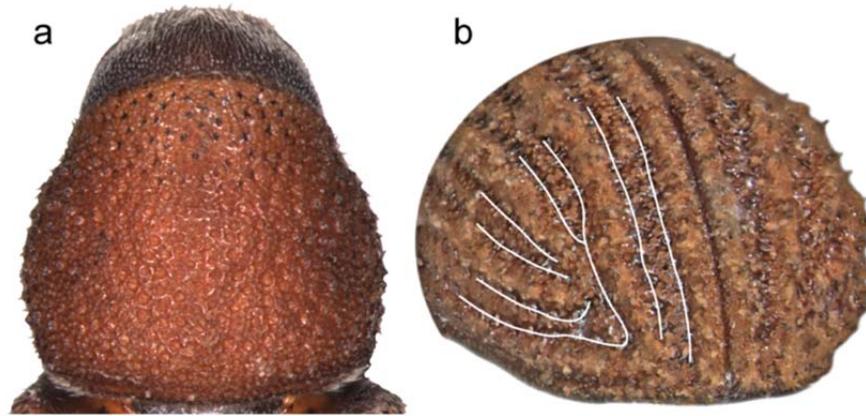


Figure 9. *Pachysquamus subcostulatus*. a) Prothorax, b) elytral declivity.

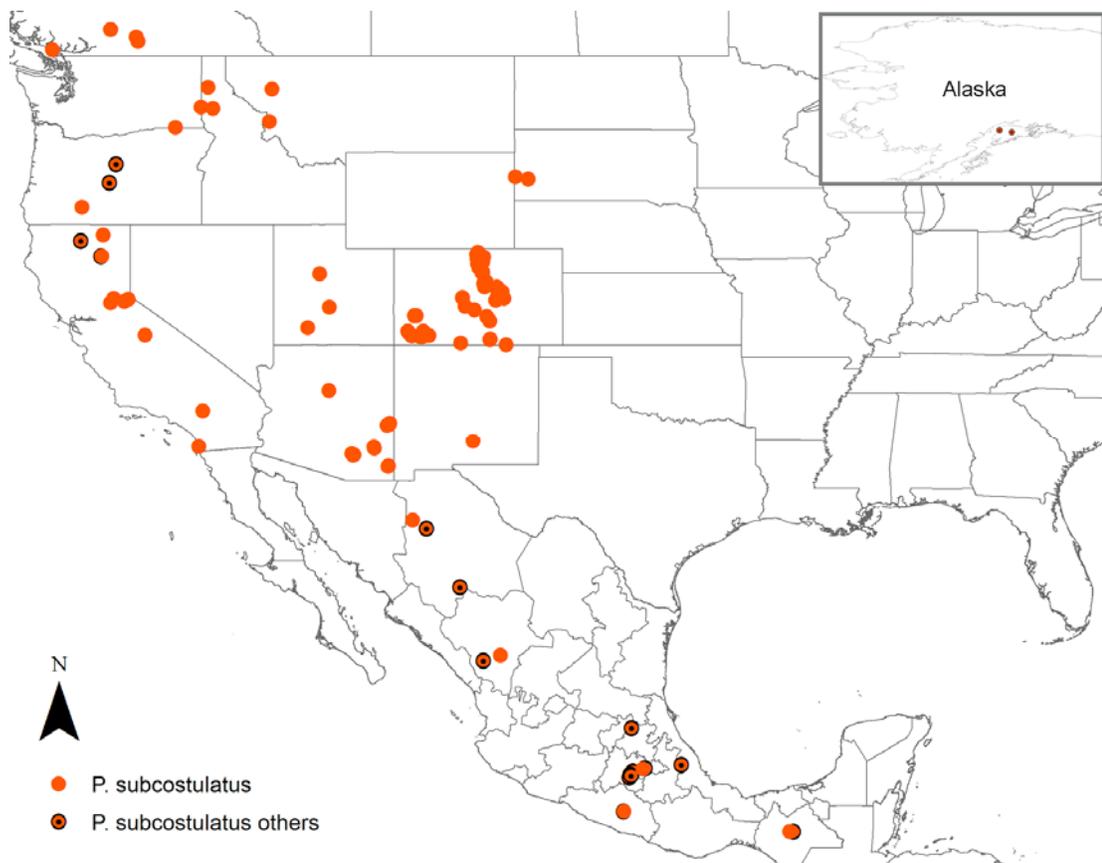


Figure 10. *Pachysquamus subcostulatus*, distribution.

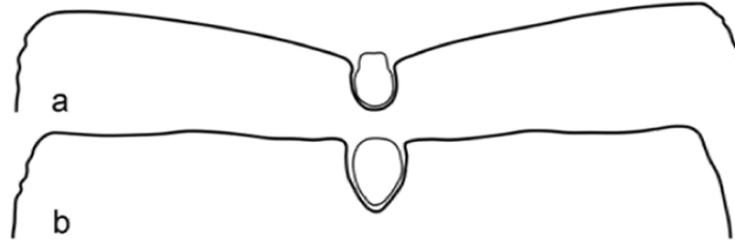


Figure 11. Hylastina anterior margin of the elytra. a) *Hylurgops pinifex*, anteriorly procurved, b) *Hylastes mexicanus*, nearly straight.

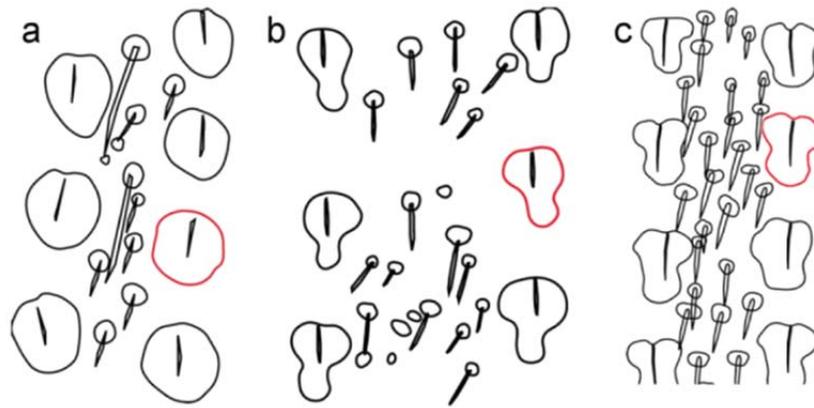


Figure 12. *Hylurgops* elytral disc striae puncture shape. (a) *H. longipennis*, round, (b) *H. pinifex*, keyhole-shaped, (c) *H. planirostris*, keyhole-shape variation.

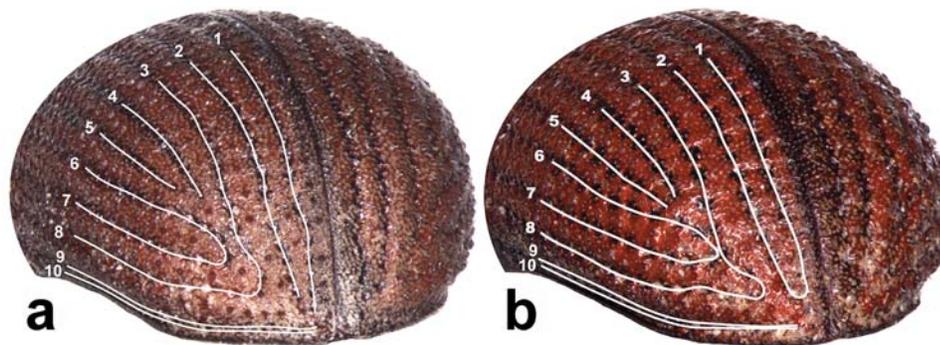


Figure 13. *Hylurgops* strial pattern on elytral declivity. (a) *H. pinifex*, 3rd striae not touching the 6th (b) *H. rugipennis*, 3rd striae sometimes touching the 6th.

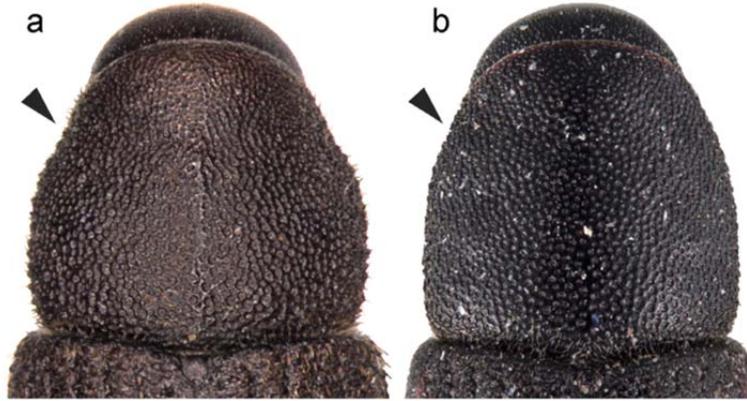


Figure 14. *Hylurgops*, prothorax shape. (a) *H. planirostris*, wider than long and constricted anteriorly, (b) *H. knausi*, longer than wide and smoothly tapering anteriorly.

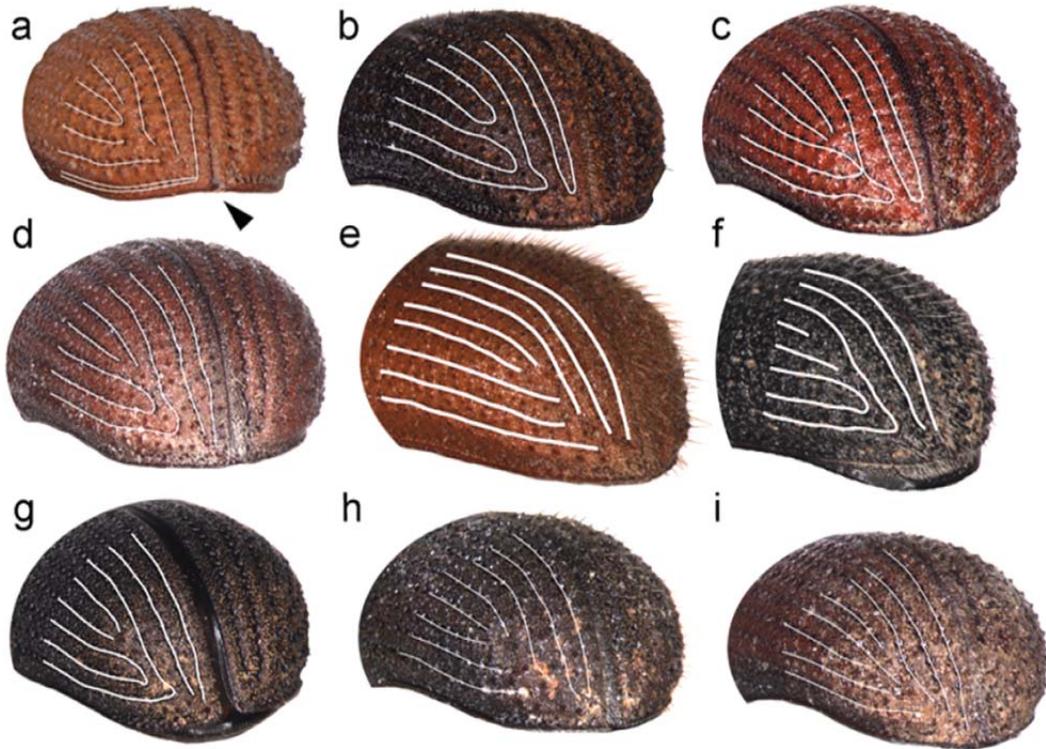


Figure 15. *Hylurgops* elytral declivities. (a) *H. palliatus*, (b) *H. planirostris*, (c) *H. rugipennis*, (d) *H. pinifex*, (e) *H. incomptus*, (f) *H. longipennis*, (g) *H. knausi*, (h) *H. reticulatus* and, (i) *H. porosus*.

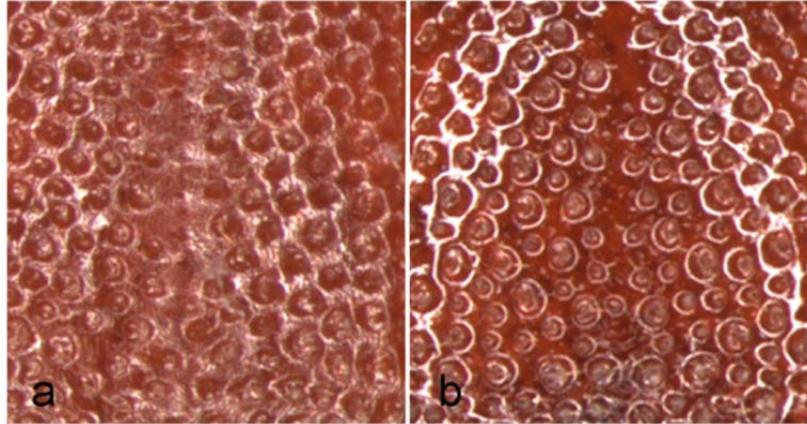


Figure 16. *Hylurgops*, prothoracic disc surface. (a) *H. rugipennis*, reticulate and dull, sometimes shiny, with similarly-sized punctures, (b) *H. pinifex*, shiny, sometimes granulate with distinct, differently-sized punctures.

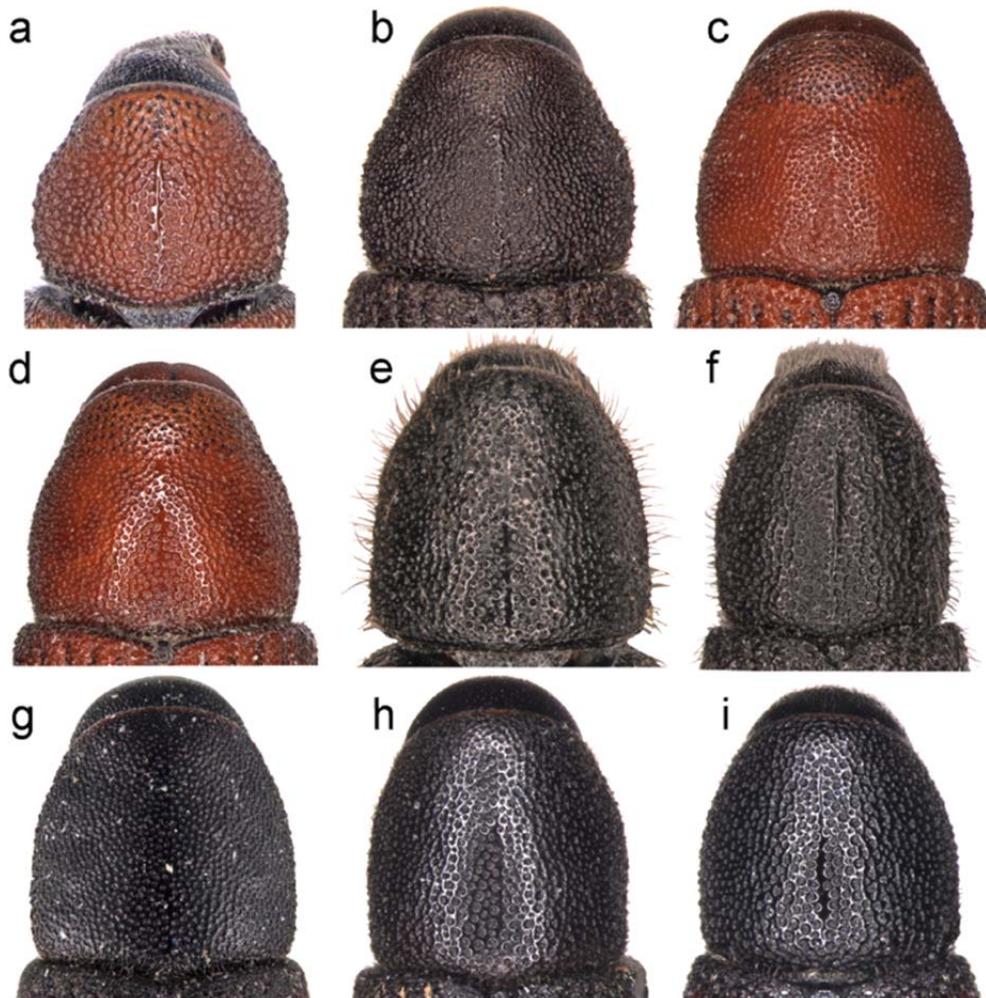


Figure 17. *Hylurgops* prothorax. (a) *H. palliatus*, (b) *H. planirostris*, (c) *H. rugipennis*, (d) *H. pinifex*, (e) *H. incomptus*, (f) *H. longipennis*, (g) *H. knausi*, (h) *H. reticulatus* and, (i) *H. porosus*.

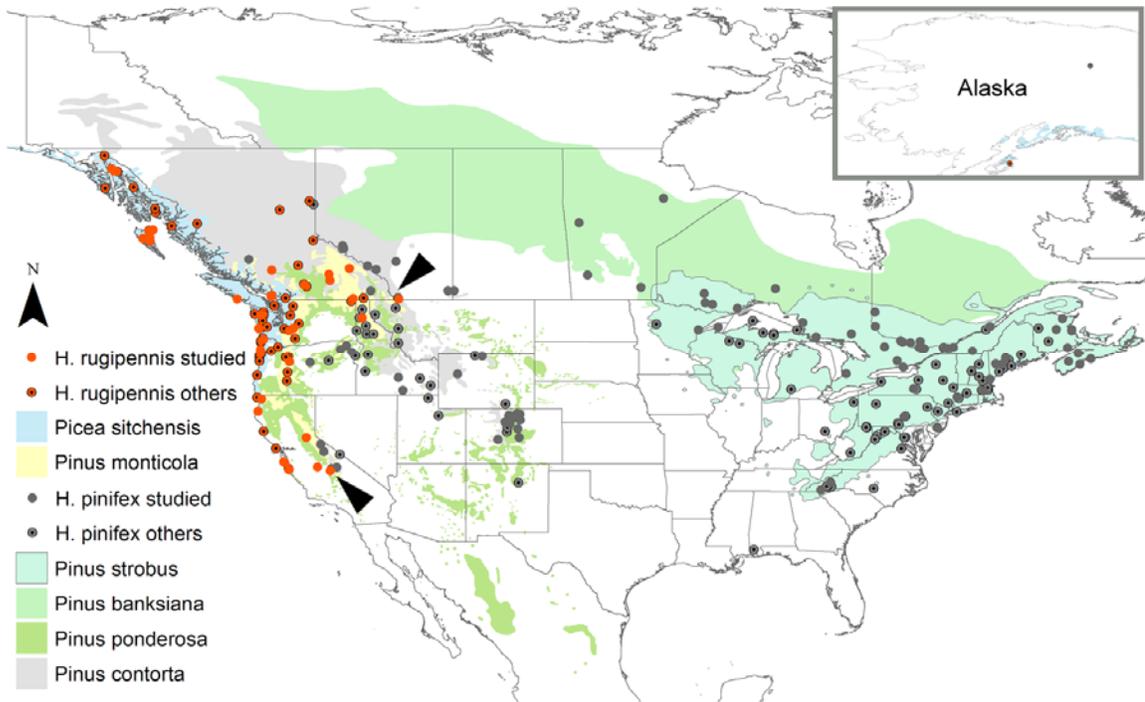


Figure 18. Species distribution with main hosts. *Hylurgops rugipennis* (orange) and *H. pinifex* (gray) with observed sympatric areas (arrows).

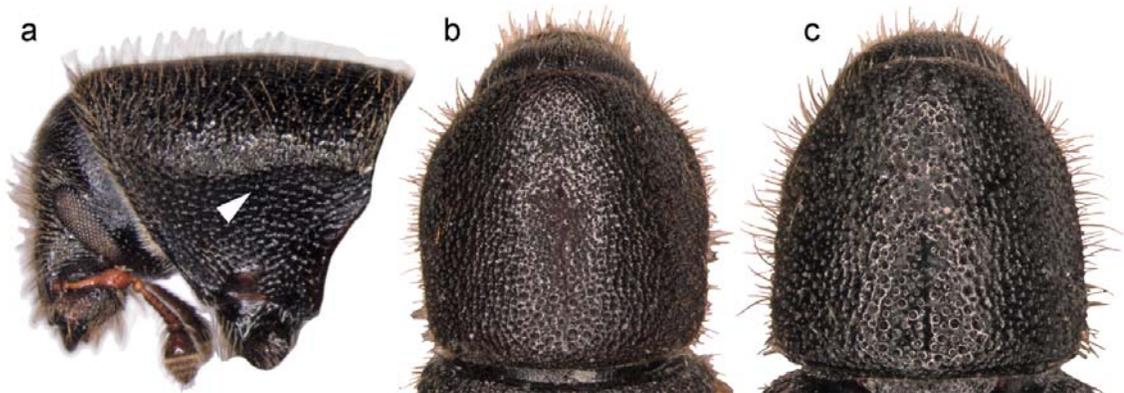


Figure 19. *Hylurgops incomptus* pronotum. a) prothoracic lateral margin, b) pronotum broadening from base, c) pronotum narrowing from base.

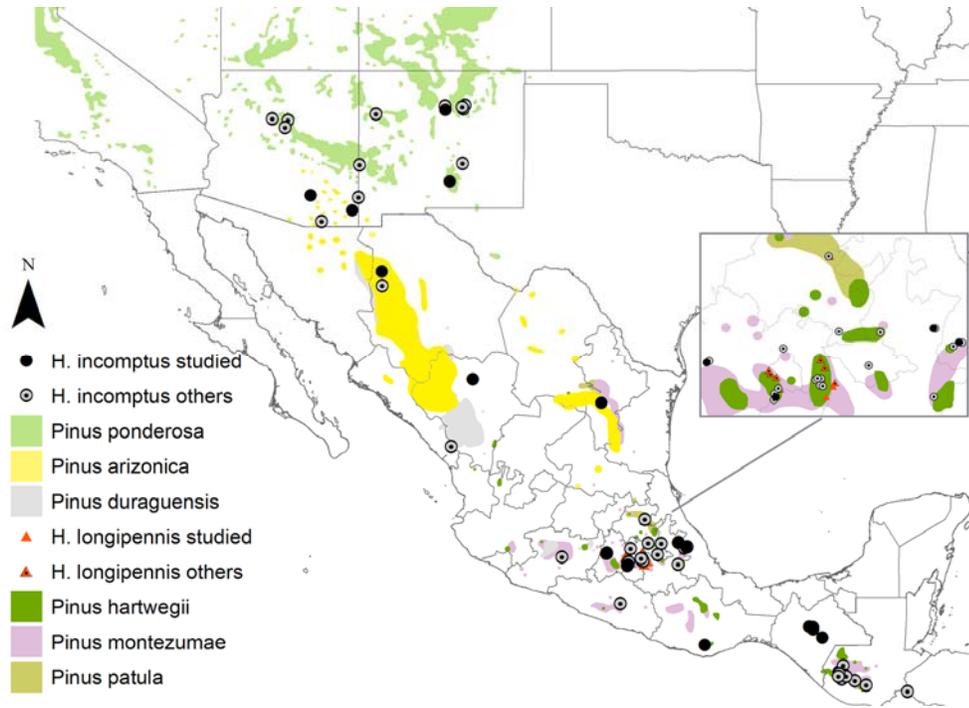


Figure 21. Species distribution and main hosts. *Hylurgops incomptus* (circles) and *H. longipennis* (triangles).

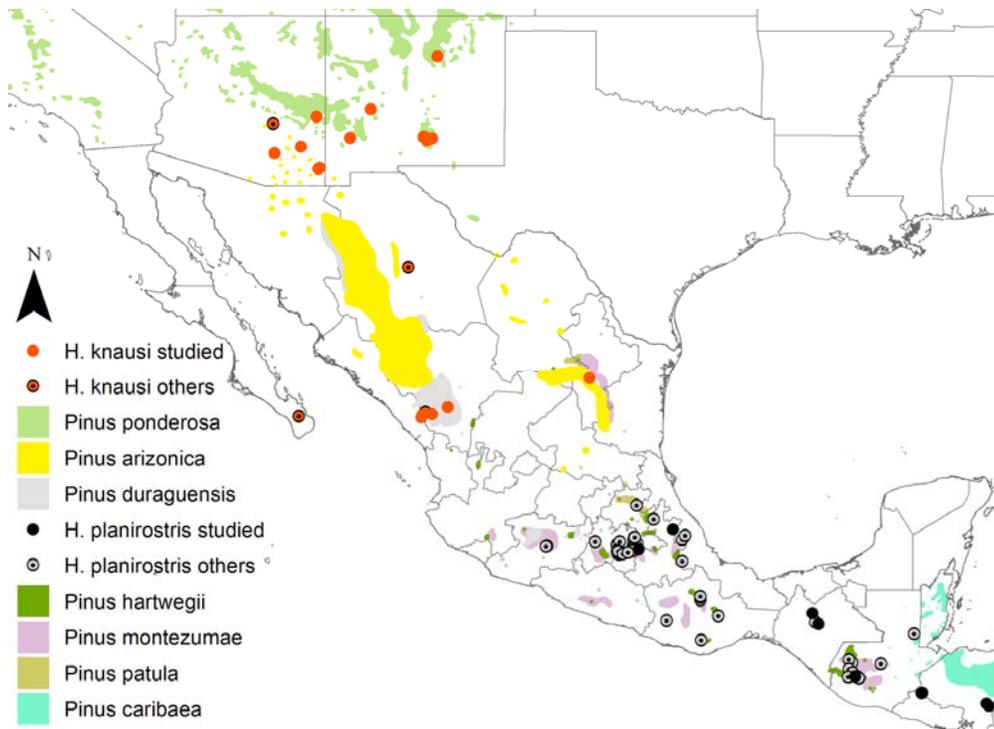


Figure 22. Species distribution with main hosts. *Hylurgops knausi* (orange and dotted orange circles) and *H. planirostris* (black and dotted gray circles).

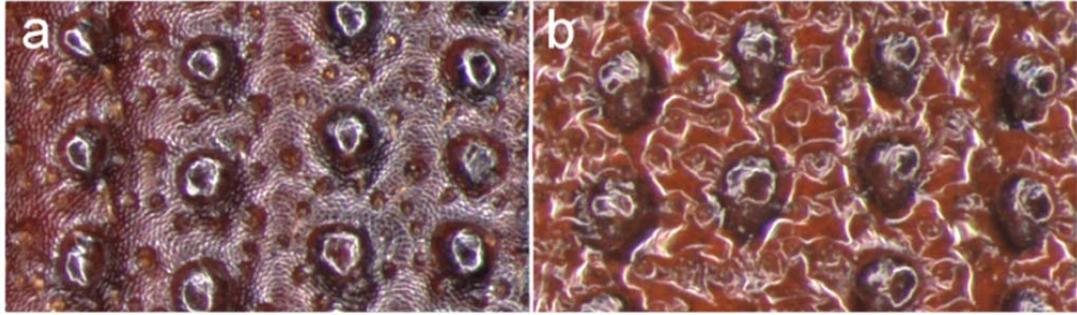


Figure 23. *Hylurgops* elytral disc surface. a) *Hylurgops reticulatus*, surface reticulate, b) *Hylurgops porosus*, surface smooth and glossy.

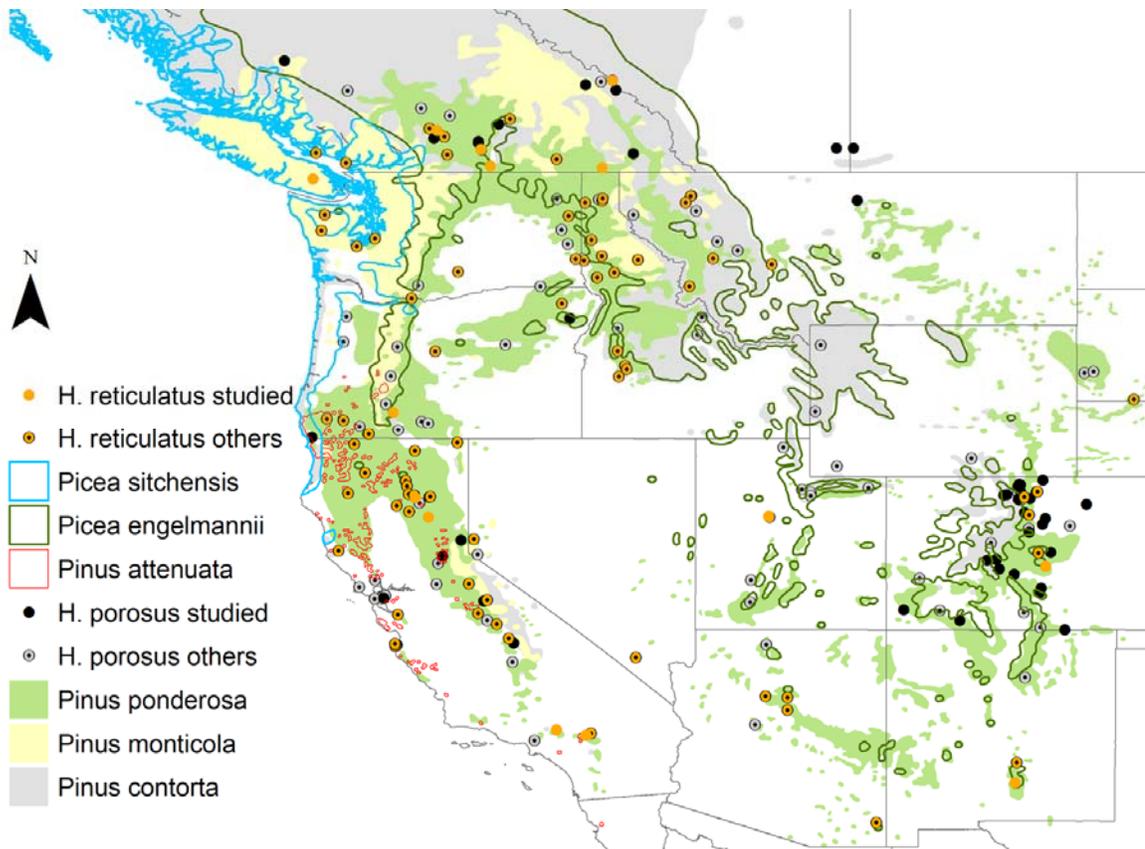


Figure 24. Species distribution with some of the principal hosts. *Hylurgops reticulatus* (orange and dotted orange circles) and *H. porosus* (black and dotted gray circles).

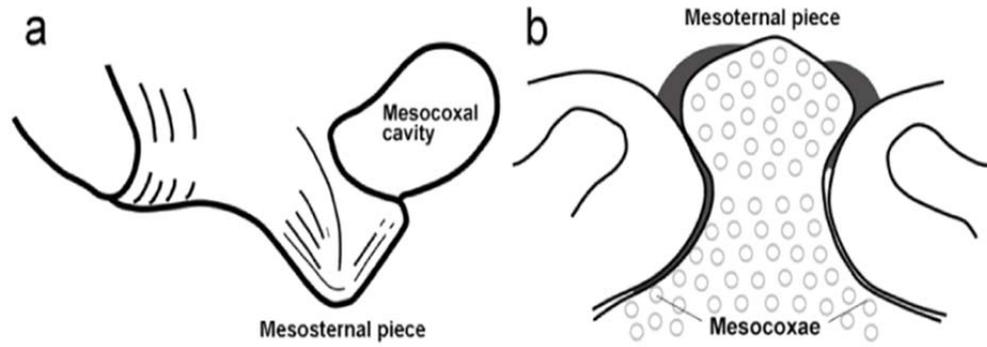


Figure 25. *Hylurgops* intercoxal mesosternal process interpretations. a) Sub-inflated (Modified from Swaine 1918), b) *Hylurgops porosus*, protuberant anterior to mesocoxae (Modified from Bruck 1936).

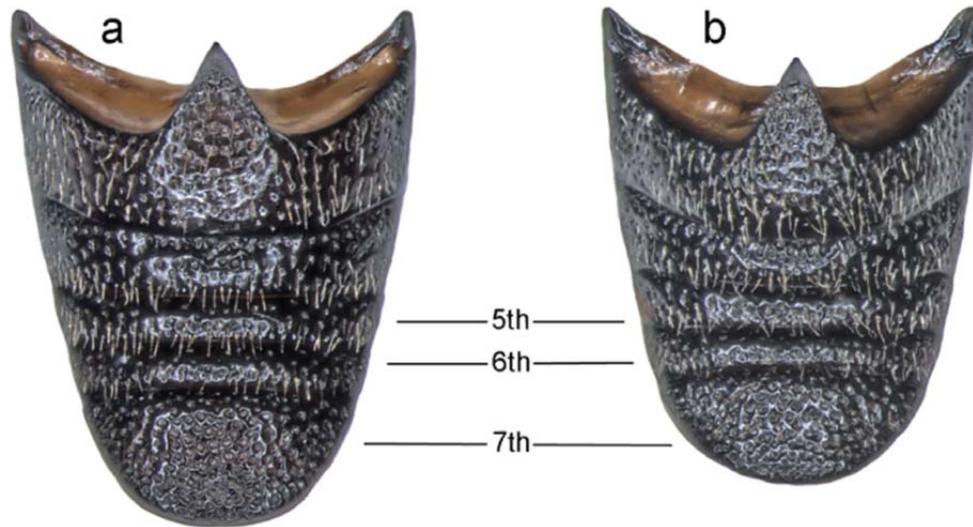


Figure 26. *Hylurgops longipennis* sternites. a) female, 7th sternite distinctly longer than the 5th and 6th combined, b) male, 7th sternite not distinctly longer than the 5th and 6th combined.