

***Pterostichus brachylobus* Kavanaugh and LaBonte,
A New Species of the Carabid Beetle Subgenus *Hypherpes*
Chaudoir, 1838, from the Central Coast of Oregon
(Insecta: Coleoptera: Carabidae: Pterostichini)**

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A new species of *Pterostichus*, subgenus *Hypherpes* Chaudoir, *Pterostichus brachylobus* Kavanaugh and LaBonte sp. nov., is described from the central coastal region of Oregon (type locality: Neskowin Creek at Neskowin Campground, 45.0587°N/123.9401°W, Tillamook County, Oregon). Features distinguishing adults of *P. brachylobus* from those of other species of *P. (Hypherpes)* found in the region are discussed. The known geographical range of *P. brachylobus* is quite limited and completely within the range of *P. nigrocaeruleus* Van Dyke, its apparent closest relative.

Adults of species referable to subgenus *Hypherpes* Chaudoir, 1838, of genus *Pterostichus* Bonelli (the *amethystinus* and *sphodrinus* species groups of Lindroth 1966 and the *amethystinus* species group of Bousquet and Laroche 1993) are among the most diverse, conspicuous and, arguably, the most frequently encountered carabid beetles on the west coast of North America. Several species, such as *Pterostichus algidus* LeConte and *Pterostichus amethystinus* Mannerheim, occupy broad latitudinal ranges (e.g., from southeastern Alaska to northern California) and live in habitats and exhibit behaviors that bring them into frequent contact with humans (e.g., *P. algidus* are frequently found in gardens and ecotonal areas created by human activity). Many other species, however, occupy small, restricted geographical ranges and occur mainly in undisturbed habitats in which they are seldom encountered.

The basic pattern of presently known species diversity and endemism within the subgenus is one of dramatic increase in both diversity and endemism from north to south along the coast. Among described species, five (none endemic) occur in Alaska, nine (none endemic) in British Columbia, 12 (none endemic) in Washington, 28 (eight endemic) in Oregon, and at least 75 (57 endemic) in California (data mainly from Bousquet and Laroche 1993). More than 100 different species are already described and dozens of additional species remain to be described (K.W. Will, personal communication).

Due mainly to the landmark works of Hatch (1953) and Lindroth (1966), the pterostichine faunas of Alaska, British Columbia, and Washington are very well known, whereas the large pterostichine fauna of California, which includes most of the presently known but undescribed species and, no doubt, more species yet undiscovered, is still poorly known. The fauna of western Oregon also

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had been considered well-known following the work of Hatch (1953) and Hacker (1968); but with renewed interest in faunal inventory work in that region, new and unexpected discoveries have been made recently. Most recently, LaBonte (2006) described a locally abundant new species, *Pterostichus lattini* LaBonte, recorded from two sites at higher elevations on the eastern flank of the Coast Range and from sites on the western slope of the Cascade Range in westcentral Oregon. This species simply had gone unrecognized as distinct, and LaBonte found many specimens of this taxon mixed in among those of several other species in collections.

On May 1, 2002, while collecting together in a deeply shaded spruce bog formed behind the coastal dunes at the mouth of Moolack Creek in Lincoln County, Oregon, we found a few specimens of what we first believed to be *Pterostichus nigrocaeruleus* Van Dyke. The geographical range of *P. nigrocaeruleus* (Fig. 15) is known to extend narrowly along the coast from southern British Columbia, where it is restricted to forested sites on Vancouver Island, through the Olympic Peninsula in western Washington, along the coast and slopes of the Coast Range in Oregon, south to coastal Humboldt County in northern California. Adults of this species typically are found “along the gravelly margins of the small densely shaded streams which come down from the hills” (Van Dyke 1925:70). In contrast, the beetles encountered at Moolack Creek were found under fallen and rotting spruce branches lying on the moss-covered floor of the forested bog, and not at the nearby graveled stream margin. These beetles also appeared to lack the distinct metallic reflection typical of most *P. nigrocaeruleus* adults.

Intrigued by the possibility that these newly collected pterostichine specimens might represent a new and distinct species, we examined the genitalia of several males immediately after our return from the field. Our suspicions were confirmed when we found a distinct difference in the shape of the apical lamella of the median lobe between these new specimens and specimens of typical *P. nigrocaeruleus*. Subsequent detailed examination of external features in these and additional specimens from previous collections confirmed consistent differences between both males and females of this putative new species and those of *P. nigrocaeruleus*. The purpose of this paper is to describe this unexpected new species, identify the features which distinguish its members from those of other most similar species, and report on its known distribution.

MATERIALS AND METHODS

This study is based on the examination of more than 500 adult specimens of *Pterostichus* (*Hypherpes*) species, including 20 specimens of the new species and more than 300 specimens of *P. nigrocaeruleus* Van Dyke in collections at the Oregon Department of Agriculture, Salem, Oregon State University, Corvallis, and the California Academy of Sciences, San Francisco (CAS) and in the J.R. LaBonte (JRL) and Robert E. Nelson (REN) collections, as well as representatives of all the other *Hypherpes* species occurring in the region that have adults of comparable size (i.e., excluding species formerly included in subgenera *Leptoferonia* Casey and *Anilloferonia* Van Dyke). Measurements were made with the aid of an ocular micrometer in a Leitz stereoscopic dissecting microscope. Total body length was measured along the midline from the apex of the labrum to the apex of the fused elytra. Visualization and study of female genitalic structures were enhanced by staining dissections with Chlorazol Black E. Digital color images of specimens and selected structures and dissections were created using an Automontage imaging system from Synchroscopy. Distribution maps were prepared using Arcview® software.

***Pterostichus brachylobus* Kavanaugh and LaBonte, sp. nov.**

Figs. 1–2, 4, 6, 8, 10, 12, and 14.

TYPES.— HOLOTYPE, a male, deposited in CAS, labeled: “U.S.A., Oregon, Tillamook County, Neskowin Creek at Neskowin Campground, 120m, 27 June 1986, Stop #86-3A, D.H. Kavanaugh collector”/ “D.H. Kavanaugh Collection” [orange label]/ “HOLOTYPE *Pterostichus brachylobus* Kavanaugh & LaBonte sp. nov. des. by D.H. Kavanaugh 2005” [red label]/ “California Academy of Sciences Type No. 18121”. A total of 19 paratypes (12 males and 7 females) are deposited in CAS, JRL, and REN (see specimen data below, under Geographical distribution).

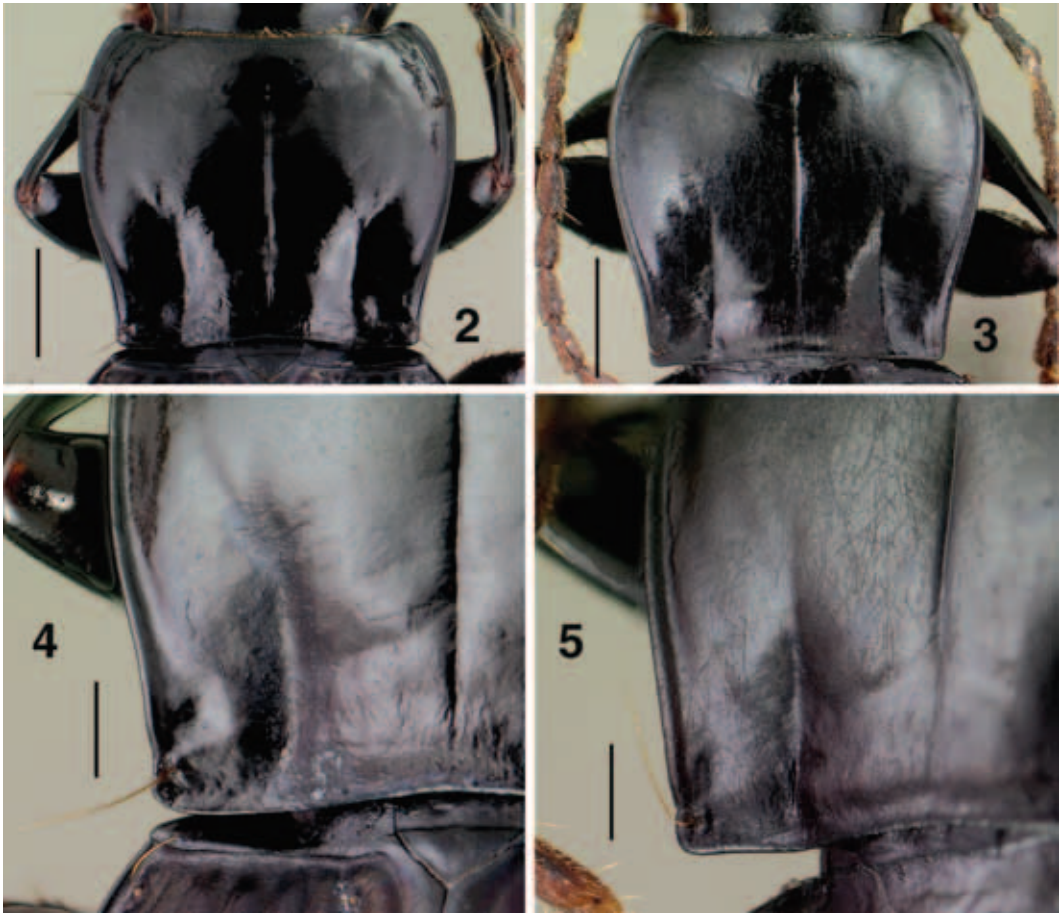
TYPE LOCALITY.— Neskowin Creek at Neskowin Campground, 45.0587°N/ 123.9401°W, Tillamook County, Oregon, U.S.A.

ETYMOLOGY.— The species epithet, *brachylobus*, is a combination of the Greek words *brachys*, meaning short, and *lobos*, meaning a rounded projection or protuberance, in reference to the shape of the apical lamella of the median lobe of male genitalia, which, in dorsal view, is very short and bluntly and broadly rounded (Fig. 12).

DIAGNOSIS.— Adults of this species (Fig. 1) are distinguished from those of all other known *Pterostichus* (*Hypherpes*) species by the following combination of character states: size moderate, total body length males = 10.4 to 12.5 mm, females = 10.5 to 12.7 mm; body color black, elytra with faint to distinct violaceous metallic reflection; head with eyes moderate in size, their diameter about 1.7 times length of tempora, frons smooth, impunctate; pronotum (Fig. 2) slightly cordate, slightly narrowed basally, with lateral margins smooth, not crenulate, smoothly arcuate in anterior four-fifths and slightly but distinctly sinuate toward base, anterior angles slightly and narrowly projected anteriorly and narrowly rounded apically, posterior angles very slightly obtuse, bluntly dentate apicolaterally, inner basal longitudinal impression present, sharply defined, and slightly arcuate (concave laterally), outer basal impression absent, area between inner impression and lateral margin (Fig. 4) slightly but distinctly convex, this convexity with slight depressions on its anterolateral and posterolateral flanks and with a faint ridge between these depressions and extended toward lateral margin, pronotal base without distinct margination (at most with very faint margination laterally); prosternal intercoxal process without margination apically or laterally; elytra with humeri distinctly dentate or tuberculate (at point where basal margin sharply elevated above and slightly extended over lateral margin); abdomen with last visible sternum with one pair of apical setae in males, three pairs in females (Fig. 6); hind femur of males (Fig. 8) without distinct tubercle on posterior (eudorsal) ventral margin; hind tarsomere I with an external, narrowly and sharply-defined longitudinal ridge, ridge also present but successively less distinctly defined on tarsomeres II and III, all tarsi with tarsomere V asetose ven-



FIGURE 1. Digital image of holotype, *Pterostichus brachylobus* Kavanaugh & LaBonte sp. nov., dorsal aspect; scale line = 1.0 mm.

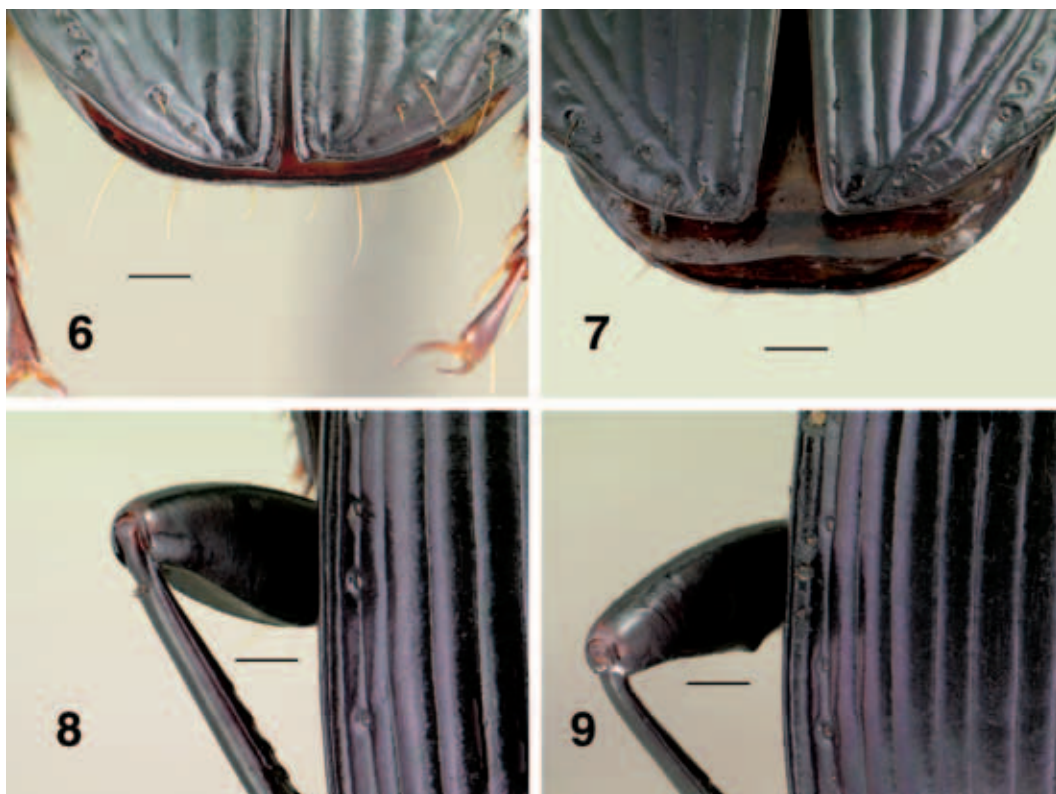


FIGURES 2–5. Digital images of pronota. Figs. 2–3. Full pronotum, dorsal aspect, viewed from the vertical; scale lines = 1.0 mm; 2. *Pterostichus brachylobus* Kavanaugh & LaBonte sp.nov.; 3. *Pterostichus nigrocaeruleus* Van Dyke. Figs. 4–5. Left posterior quadrant of pronotum, dorsal aspect, viewed from about 30° oblique right; scale lines = 0.5 mm; 4. *P. brachylobus*; 5. *P. nigrocaeruleus*.

trally; median lobe of male genitalia (Figs. 10 and 12) with apical lamella short, broadly and roundly truncate.

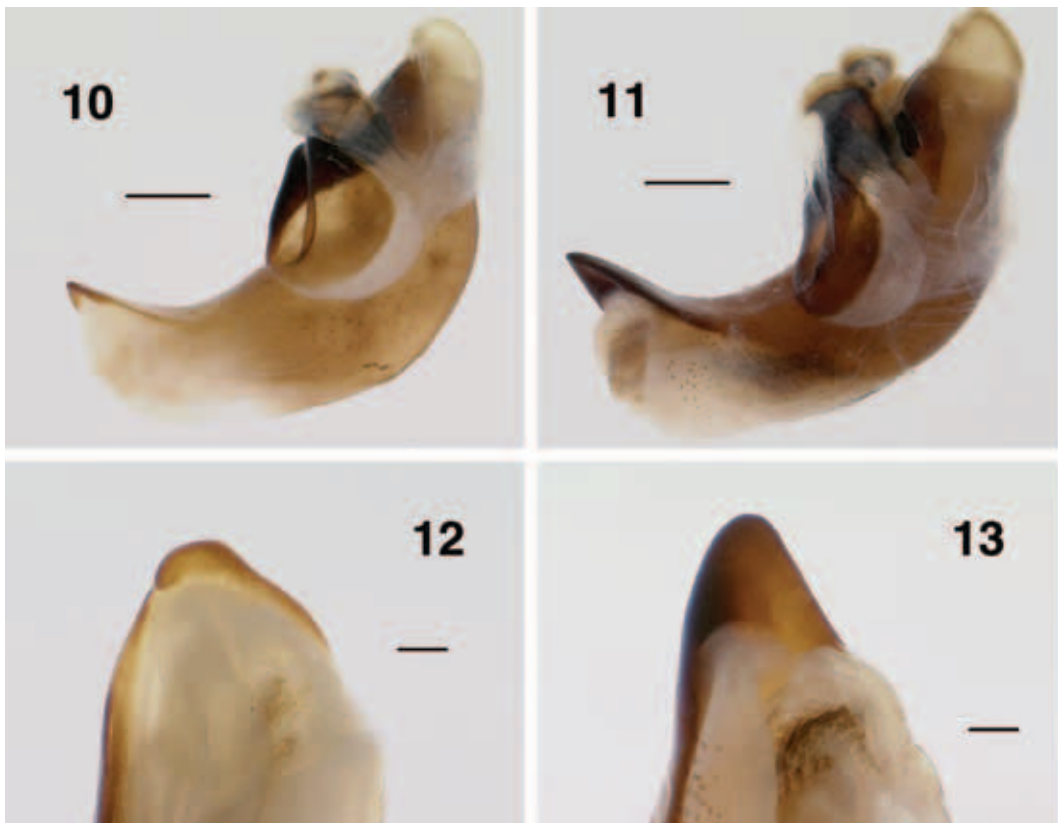
COMPARISONS.— Using Hatch's (1953) key to species of subgenus *Hypherpes*, *P. brachylobus* males are identified (in couplet 3') as *Pterostichus contractus* LeConte (= *Pterostichus castanipes* [Ménétriés]); however, *P. castanipes* males have the prosternal intercoxal process margined apically, elytra without violaceous metallic reflection, and the apical lamella of the genital median lobe more elongate and triangular (compare Hatch 1953, Pl. XXI, Fig. 8c with our Fig. 12). Female specimens of *P. brachylobus* cannot be identified using Hatch's key: the combination of smooth, non-crenulate lateral pronotal margin and last visible abdominal sternum with three pairs of apical setae confounds couplet 1.

Using Lindroth's (1966) key, both males and females of *P. brachylobus* are identified as *P. nigrocaeruleus*. Adults of these two species are indeed very similar and, undoubtedly, are very closely related [preliminary molecular evidence suggests sister species status for this pair; K. W. Will, personal communication]. However, males of *P. nigrocaeruleus* have a distinct tubercle (Fig. 9) on the posterior (eudorsal) ventral margin of the hind femur near its mid-length (absent from *P.*



FIGURES 6–9. Digital images of abdominal apices and left hind femora; all scale lines = 0.5 mm. Figs. 6–7. Abdominal apex of females, viewed from about 45° oblique posterior of vertical; 6. *Pterostichus brachylobus* Kavanaugh & LaBonte sp.nov.; 7. *Pterostichus nigrocaeruleus* Van Dyke. Figs. 8–9. Left hind femur, view of posterior (eudorsal) aspect, viewed from about 20° oblique right of vertical; 8. *P. brachylobus*; 9. *P. nigrocaeruleus*.

brachylobus males [Fig. 8]) and the apical lamella of the genital median lobe (Fig. 11) is more elongate and triangular in dorsal aspect (Fig. 13) (short and bluntly rounded in *P. brachylobus* males [Fig. 12]). Females of *P. nigrocaeruleus* have two pairs of apical setae (Fig. 7) on the last visible abdominal sternum (only two out of more than 120 specimens examined had a third setae on one side only), whereas *P. brachylobus* females (Fig. 6) have three pairs of apical setae (one of the seven females examined had four setae on one side). Both males and females of these two species also differ in several more or less subtle features of their pronota. In *P. brachylobus* adults, the pronotum (Fig. 2) is relatively shorter and broader than in *P. nigrocaeruleus* adults, the anterior angles are slightly shorter and broader, the lateral margin is more smoothly arcuate and slightly more abruptly sinuate, the inner basal longitudinal impression is slightly shorter and more arcuate (concave laterally). The region between the inner longitudinal basal impression and the lateral margin (Fig. 4) is more distinctly convex, and slight depressions in the anterolateral and posterolateral flanks of this convexity define a faint ridge extended laterally toward the lateral margin. In pronota of most *P. nigrocaeruleus* adults, the anterior angles are slightly longer and more narrowly projected anteriorly, the lateral margin (Fig. 3) is less evenly arcuate, with relatively straighter sections posterior to the anterior angle and anterior to the basal sinuation, which itself is slightly less distinct than in *P. brachylobus* adults. The region between the inner longitudinal basal impression and the lateral margin (Fig. 5) is flat or only faintly convex in *P. nigrocaeruleus* pronota; and a trace of outer



FIGURES 10–13. Digital images of median lobe of male genitalia. Figs. 10–11. Median lobe, left lateral aspect; scale lines = 0.5 mm; 10. *Pterostichus brachylobus* Kavanaugh & LaBonte sp.nov.; 11. *Pterostichus nigrocaeruleus* Van Dyke. Figs. 12–13. Apical lamella of median lobe, dorsal aspect; scale line = 0.1 mm; 12. *P. brachylobus*; 13. *P. nigrocaeruleus*.

basal longitudinal impression is seen in a few specimens.

Adults of *P. brachylobus* are easily distinguished from those of *Pterostichus lattini* LaBonte, which was not represented in either Hatch's or Lindroth's key, by the violaceous metallic reflection of the elytra (absent from *P. lattini* adults) and many differences in pronotal shape. In *P. lattini*, the pronotum is more quadrate, relatively broader basally, the base is distinctly margined laterally, and a deep, foveate, outer basal longitudinal impression is distinctly present.

DESCRIPTION.— Size medium (Fig. 1; see Diagnosis for range in body length). Body color piceous to black, except lateral explanations of mandibles, maxillary and labial palpi, antennomeres V to XI, and all tarsi rufous. Elytra with distinct metallic purple reflection (very faint in a few individuals). Head and pronotum shiny, elytra slightly duller, slightly alutaceous in some individuals. Dorsal microsculpture of head comprised of isodiametric meshes, very faintly impressed on frons, slightly more deeply impressed on vertex laterally; pronotal microsculpture comprised of slightly transverse meshes arranged in irregular transverse rows, faintly impressed; elytral microsculpture comprised of deeply impressed isodiametric meshes.

Head large, moderately broad; eyes distinctly convex; antennae relatively short, extended only to basal one-sixth of elytra. Pronotum (Figs. 2, 4) with basal region impunctate. Elytra subquadrate, slightly narrowed basally, slightly convex, fused along medial margin, without setiferous punctures on disk, but parascutellar setiferous puncture present; striae complete, uninterrupted, and deeply

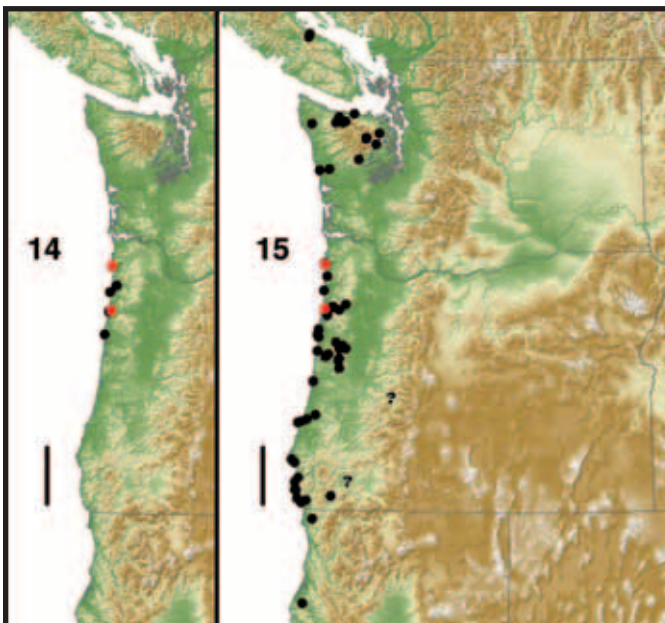
impressed; intervals slightly convex, odd and even numbered intervals similar to each other in width; basal elytral margination complete, distinctly elevated above plane of remainder of elytral surface; elytral internal plica distinctly visible externally in lateral view. Hindwings reduced to short stubs. Abdomen with visible sternites III to V each with one pair of posterior paramedial setae, visible sternite VI of male with symmetrically arcuate apical margin, surface without grooves, tubercles, or any distinct macrosculpture. Male genitalia as in Figs. 10 and 12. Female ovipositor with gonocoxite I (basal) with three to five setae arranged in a diagonal row from basolateral to apicomedial apicoventrally; gonocoxite 2 (apical) moderate in length, arcuate laterally and gradually narrowed to a narrowly rounded apex, with two dorsolateral and one dorsomedial ensiform setae.

SEXUAL DIMORPHISM.— Males and females of *P. brachylobus* are more similar in size than in most carabid species, with the smallest males only slightly smaller than the smallest females and the largest females only slightly larger than the largest males. In males, anterior tarsomeres I through III are distinctly broader than in females and bear two longitudinal rows of squamose adhesive setae ventrally (absent from these tarsomeres in females). Also, males have a single pair of apical paramedial setae on visible sternite VI while females have three pairs of these setae (Fig. 6).

GEOGRAPHICAL DISTRIBUTION.— Fig. 14; known only from a few sites on the northcentral coast of Oregon, all within 6 kilometers of the coast itself. We have examined a total of 20 specimens (13 males and 7 females), including the holotype male and 19 paratypes, from the following localities: UNITED STATES: **Oregon:** Lincoln County, Moolack Creek (just E of Highway 101 [44.70274°N/ 124.06064°W, 15 m]) [May] (4; CAS, JRL); Tillamook County, Cape Lookout ([45.34°N/ 123.992°W]) [March]

(2; CAS), Cascade Head (Teal Creek [45.0512°N/ 123.9985°W, 90 m]) [June] (1; JRL), Nes-kowin Creek (at Neskowin Campground [45.0587°N/ 123.9401°W, 120 m]) [June] (10; CAS), Oswald West State Park [October] (2; REN), Tillamook ([45.4557°N/ 123.8461°W]) [May] (1; CAS).

GEOGRAPHICAL RELATIONSHIPS WITH RELATED SPECIES.—The known geographical range of *P. brachylobus* is restricted to a small portion of the range of its apparent closest relative, *P. nigrocaeruleus* (Fig. 15). To date, members of these two species have been found together at two sites: (1) at the Neskowin Creek site, the type locality of *P. brachylobus*, where a single specimen of *P. nigrocaeruleus* was collected along with 10 specimens of *P. brachylobus*; and (2) at Oswald West State Park, where two specimens of *P. brachylobus* were collected along with seven *P. nigrocaeruleus* specimens.



FIGURES 14–15. Maps of the west coast of North America, from southern British Columbia to northern California (California Albers projection), showing the geographical location of samples examined for each species; red dots = sites where both species have been found together; ? = doubtful records; scale lines = 100 km. 14. *Pterostichus brachylobus* Kavanaugh & LaBonte sp.nov.; 15. *Pterostichus nigrocaeruleus* Van Dyke.

HABITAT DISTRIBUTION.— As noted in the introduction, one of our first clues to the existence of *P. brachylobus* as a distinct species was the fact that the specimens collected at the Moolack Creek site were found under rotting spruce branches on the mossy floor of the deeply shaded forested bog, rather than under stones at the gravelly margin of the adjacent shaded stream, a habitat more typical of *P. nigrocaeruleus* adults. While both of us recall having collected *P. nigrocaeruleus* specimens in very wet places away from stream margins in the past, neither of us can recall whether these were found under stones or logs or on organic or inorganic substrate. Field notes [dhk] from the Neskowin Creek site, where adults of both species were collected on the same day, note simply that specimens were “collected under rocks along the shaded stream...forest of mixed alder, willows streamside, Douglas fir and hemlock.” All of the specimens collected at that time were thought to be of *P. nigrocaeruleus*, hence there was no reason to be looking for specific differences in habitat selection among them. Field notes from the Teal Creek site [jrl] describe the area as consisting of predominantly old-growth Sitka spruce with smaller western hemlock and some red alder, with a shrub understory varying from absent to dense. No specific comments were recorded as to the precise habitat from which the single specimen of *P. brachylobus* was collected. Consequently, our collective experience with adults of both of these species remains inadequate to establish whether or not any significant difference in habitat preference exists. What is clear is that members of both species appear to require cool, moist, deeply shaded sites. Now that the existence of two distinct species is known, biologists can begin to look for differences in habitat preference.

LIFE HISTORY.— Adults of *P. brachylobus* have been collected in March, May, June, and October, and all specimens studied have been fully pigmented (non-teneral). Nothing else is known at present about the life history of this species.

ADDITIONAL COMMENTS.— Among carabid beetles species in western North America for which phylogenetic relationships have been hypothesized, it is unusual to find sympatry among sister taxa (Kavanaugh 1979); so the co-occurrence of *P. brachylobus* with *P. nigrocaeruleus*, presumed sister species, as reported here is noteworthy. Adults of both species are very similar in general body size, form, and appearance, and we have no evidence to suggest differences in life cycle timing, food preference, or behavior. Any actual difference in habitat preference also remains unsubstantiated. So how do these two species co-exist? Why is the geographical range of *P. brachylobus* restricted to only a small part of the range of *P. nigrocaeruleus* and why that particular area along the Oregon coast? These are some of the questions to be addressed now that the existence of these two distinct species is known. Answers to these and other questions will come only from additional study.

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LITERATURE CITED

- BOUSQUET, Y., AND A. LAROCHELLE. 1993. *Catalogue of the Geadephaga (Coleoptera: Trachypachidae, Rhysodidae, Carabidae including Cicindelini) of America north of Mexico*. Memoirs of the Entomological Society of Canada No. 167. 397 pp.
- HACKER, H.A. 1968. The species of subgenus *Leptoferonia* Casey (Coleoptera: Carabidae: *Pterostichus*).

- Proceedings of the United States National Museum* 124:1–61.
- HATCH, M.H. 1953. *The Beetles of the Pacific Northwest. Part I: Introduction and Adephaga*. University of Washington Publications in Biology 16. 340 pp.
- KAVANAUGH, D.H. 1979. Rates of taxonomically significant differentiation in relation to geographical isolation and habitat: examples from a study of the Nearctic *Nebria* fauna. Pages 35–57 in T.L. Erwin, G.E. Ball, D.R. Whitehead, and A.L. Halpern, eds., *Carabid Beetles: Their Evolution, Natural History, and Classification*. Proceedings of the First International Symposium of Carabidology, Smithsonian Institution, Washington, D.C., August 21, 23, and 25, 1976. W. Junk, b.v., Publishers, The Hague, Netherlands. 635 pp.
- LABONTE, J.R. 2006. *Pterostichus lattini* LaBonte, a new species of carabid beetle (Coleoptera: Carabidae: Pterostichini) from Oregon. *Proceedings of the California Academy of Sciences*, ser. 4, 57:169–179.
- LINDROTH, C.H. 1966. The ground beetles (Carabidae, excl. Cicindelinae) of Canada and Alaska, Part 4. *Opuscula Entomologica, Supplementum* 29:409–648.
- VAN DYKE, E.C. 1925. New species of Carabidae in the subfamily Harpalinae, chiefly from Western North America. *The Pan-Pacific Entomologist* 2:65–76.