

Koleopterologische Rundschau	86	205–212	Wien, September 2016
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Revision of the genus *Optioservus* SANDERSON, 1953, part 3: The *O. elegans* species group (Coleoptera: Elmidae)

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Abstract

The genus *Promoresia* SANDERSON, 1953 (Coleoptera: Elmidae) is synonymized with *Optioservus* SANDERSON, 1953. The *Optioservus elegans* species group, which includes two species, *O. elegans* (LE CONTE, 1852) and *O. tardellus* (FALL, 1925), is newly proposed. Adults and larvae of both species are redescribed.

Key words: Coleoptera, Elmidae, *Optioservus*, *Optioservus elegans* species group, taxonomy.

Introduction

Three species groups of *Optioservus* SANDERSON, 1953 have already been revised: the Nearctic *Optioservus fastiditus* and *O. quadrimaculatus* species groups (KAMITE 2013), and the Palearctic *O. maculatus* species group (KAMITE 2015). The *O. fastiditus* group includes six eastern North American species, the *O. quadrimaculatus* group seven western North American species, and the *O. maculatus* group has 10 eastern Palearctic species.

In this paper, both species of the eastern Nearctic genus *Promoresia* SANDERSON, 1953 are transferred to the genus *Optioservus*. A separate species group is erected for them.

The material examined is deposited in the following collections:

CKN	Collection of Yuuki Kamite, Nagoya, Japan
EUMJ	Ehime University Museum, Matsuyama, Japan
MCZC	Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, USA
NMW	Naturhistorisches Museum Wien, Vienna, Austria

Photographs of the type specimens deposited in MCZC are available at <http://mczbase.mcz.harvard.edu/SpecimenSearch.cfm>.

Material and methods, incl. abbreviations, as in KAMITE (2013, 2015).

Optioservus SANDERSON, 1953

Optioservus SANDERSON 1953: 155 (key to Nearctic genera, adults), 158 (key to Nearctic genera, larvae), 1954: 8; JÄCH et al. 2016: 150.

Promoresia SANDERSON 1953: 155 (key to Nearctic genera, adults), 158 (key to Nearctic genera, larvae), 1954: 9; JÄCH et al. 2016: 183. – Type species: *Helmis tardella* FALL, 1925. **syn.n.**

The synonymy of *Promoresia* and *Optioservus* is based on the following features: [adult] radius posterior long (Fig. 14); [larva] meso- and metathorax with three ventral sclerites (Fig. 17).

Optioservus elegans species group

Optioservus elegans (LE CONTE, 1852) and *O. tardellus* (FALL, 1925).

This species group is characterized by the following features: [adult] posterior margin of pronotum smooth (Fig. 13); tarsi and claws enlarged (Fig. 10); [larva] tarsungulus large (Fig. 12).

Key to the species of the *Optioservus elegans* species group

Adults

- 1 Apical patches of elytra extending to near middle (Fig. 1). Elytra slender, EL/EW 1.61; EW/PW 1.24. Body larger, TL 2.30 mm *elegans*
- Apical patches of elytra not extending to near middle (Fig. 3). Elytra oval, EL/EW 1.34–1.57; EW/PW 1.31–1.44. Body smaller, TL 1.73–2.21 mm *tardellus*

Larvae

- 1 Tarsungulus stout. Abdominal segments 1–8 moderately humped in middorsal view; not humped in sublateral view. Abdominal segment 9 slightly humped in middorsal view; not keeled in sublateral view (Fig. 6) *elegans*
- Tarsungulus slender. Abdominal segments 1–8 strongly humped in middorsal view; clearly humped in sublateral view. Abdominal segment 9 moderately humped in middorsal view; keeled in sublateral view (Fig. 8) *tardellus*

Optioservus elegans (LE CONTE, 1852) comb.n.

(Figs. 1–2, 5–6, 12)

Limnius elegans LE CONTE 1852: 43 (type locality: Massachusetts, USA; type material: MCZC, type number 2274).

Heterlimnius elegans: HINTON 1935: 178.

Promoresia elegans: SANDERSON 1954: 11; BROWN 1972: 42 (key to genera and species, adults); BROWN 1983: 9; JACH et al. 2016: 183.

MATERIAL EXAMINED: **Adults.** USA: 1 ex. (EUMJ): “S. of Dixie Caverns, Roanoke Co., Virginia, Aug., 19, 1976, M. Sato leg.”; 1 ex. (NMW): “ALA: Blount Spgs., Mountain Brook, 76/8/15, H.P. Brown, *Promoresia elegans* det. H.P. Brown”. **Larvae.** USA: 2 mature larvae and 1 immature larva (CKN): “S. C., Oconee Co., Chattooga R at ford approx., 3 mi NW of Whetstone, 27 July 1974 #31A, Brigham, Brigham, Sanderson, Unzicker, Webb, et al., *Promoresia elegans* (LeConte) 1977 Det. David S. White”.

REDESCRIPTION: Adult. TL/EW 2.25. Dorsal surface black, but elytra with yellowish patches at humeral and apical areas, humeral patches of variable length, reaching at least basal 1/3, sometimes extending to middle, apical patches extending to near middle. Ventral surface, mouth parts and legs reddish brown to blackish brown, but antennae and claws paler.

Head almost flat on dorsal surface. Pronotum transverse, moderately convex; without median longitudinal impression; with prescutellar pits; antero-lateral corners weakly produced anteriorly. PW/PL 1.24; sublateral carinae 0.30 times as long as PL.

Elytra elongate; moderately convex; lateral margin not serrate; intervals not strongly rugose, slightly convex; punctate striae shallow or vague; stria punctures of each stria scattered, with large and small punctures, each puncture deep; basal part of 3rd and 4th intervals subequal in width; EL/EW 1.61; EL/PL 2.48; EW/PW 1.24.

Prosternal process narrowing behind and broadly rounded at apex.

MEASUREMENTS (n = 1): TL 2.30 mm; PL 0.66 mm; PW 0.82 mm; EL 1.64 mm; EW 1.02 mm.

Larva. Body cylindrical, TL/TW 5.70. Color brown, but antennae, mouth parts and legs paler. Head about 1.11 times as wide as long; dorsal surface with widely spaced setiferous tubercles; each tubercle relatively large. Mandible subtriangular, 1.30 times as long as wide. Labrum about 2.27 times as wide as long. Pronotum slightly wider than long, PW/PL 1.35, not humped in middorsal view. Tarsungulus large and stout. Abdominal segments 1–8 moderately humped in middorsal view; posterior segments more humped; not humped in sublateral view; abdominal segment 9 slightly humped in middorsal view; dorsally not keeled in sublateral view.

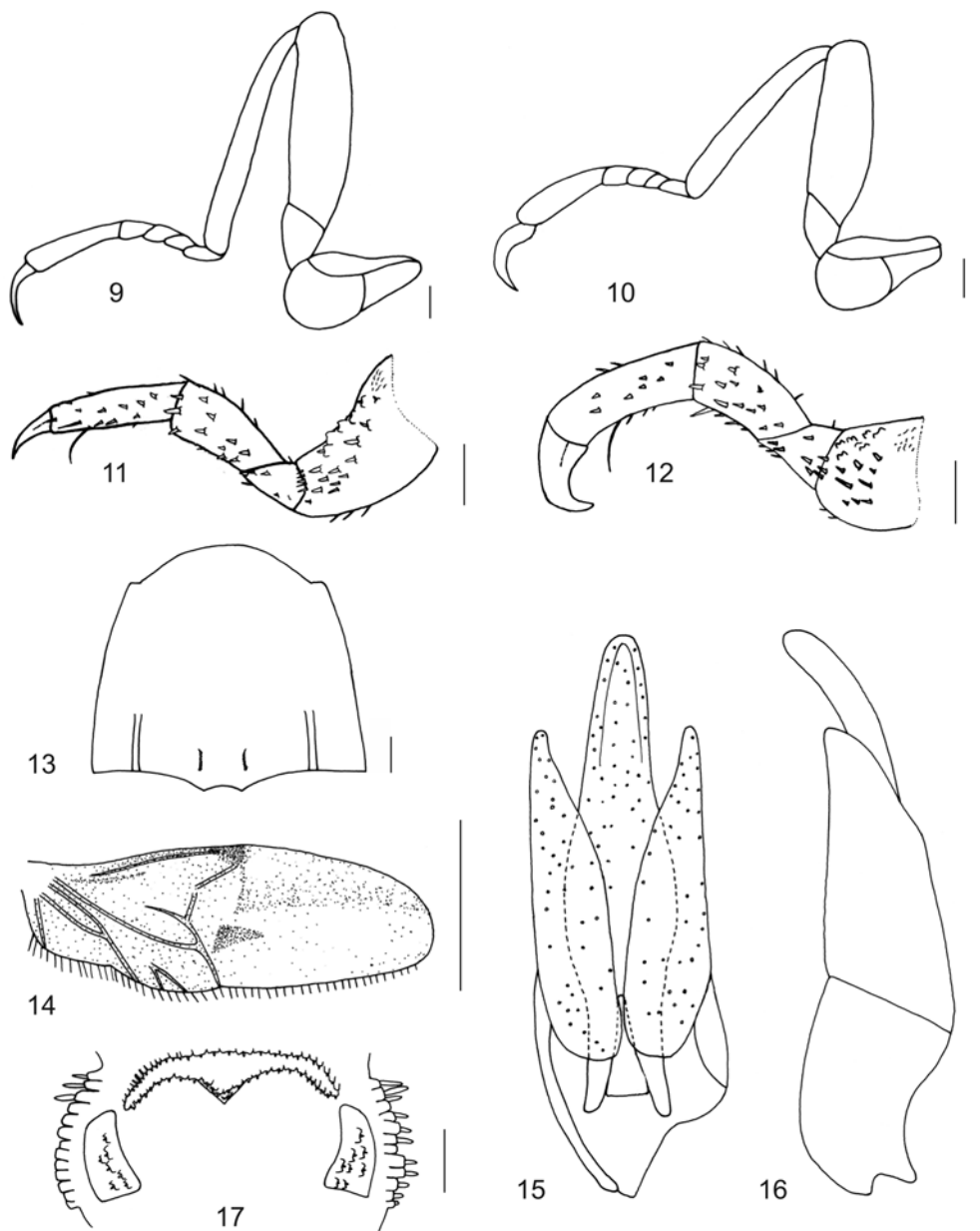


Figs. 1–8: Habitus of *Optioservus elegans* species group; 1–2, 5–6) *O. elegans*; 1) adult, dorsal view; 2) adult, lateral view; 5) larva, dorsal view; 6) larva, lateral view; 3–4, 7–8) *O. tardellus*; 3) adult, dorsal view; 4) adult, lateral view; 7) larva, dorsal view; 8) larva, lateral view.

MEASUREMENTS (n = 1): TL 3.42 mm; HW 0.35 mm; PL 0.43 mm; PW 0.58 mm; TW 0.60 mm.

DISTRIBUTION: Eastern USA, Canada (Quebec) (see JÄCH et al. 2016: 183).

DIFFERENTIAL DIAGNOSIS: This species resembles *O. tardellus* in general appearance, but is distinguishable from the latter by the following characteristics: [adult] body large; humeral and apical patches of elytra elongate (Fig. 1); elytra slender; [larva] abdominal segments 1–8 moderately humped in middorsal view, not humped in sublateral view (Fig. 6); abdominal segment 9 slightly humped in middorsal view, not keeled in sublateral view; tarsungulus stout.



Figs. 9–17: *Optioservus* spp.; 9) *O. trivittatus*, fore leg (adult); 10) *O. tardellus*, fore leg (adult); 11) *O. sakaii*, hind leg (larva); 12) *O. elegans*, hind leg (larva); 13) *O. tardellus*, pronotum (adult); 14) *O. tardellus*, hind wing; 15) *O. tardellus*, aedeagus in dorsal view; 16) *O. tardellus*, aedeagus in lateral view; 17) *O. tardellus*, mesothorax, ventral view (larva). Scales: 9–13, 15–17: 100 μ m; 14: 1.0 mm.

***Optioservus tardellus* (FALL, 1925) comb.n.**
(Figs. 3–4, 7–8, 10, 13–20)

Helmis tardella FALL 1925: 179 (type locality: Tyngsboro, Massachusetts, USA; type material: MCZC, type number 24463).

Heterolimnius tardellus: HINTON 1935: 178.

Promoresia tardella: SANDERSON 1954: 11; BROWN 1972: 42 (key to genera and species by adults); BROWN 1983: 9; JÄCH et al. 2016: 183.

Limnius subarcticus BROWN 1930: 241 (formally synonymized by BROWN 1983: 9, referring to BROWN & WHITE 1978); JÄCH et al. 2016: 183.

MATERIAL EXAMINED: Adults. USA: 3 exs. (EUMJ): “South of Brevard, Williamson Creek, Transylvania Co., N. Carolina, Aug., 17, 1976, M. Sato leg.”; 20 exs. (EUMJ): “Blount Springs, Blount Co., Mt. Brook, Arabama, 14–VIII–1976, M. Sato leg.”; 1 ex. (EUMJ): “Trimble, Cullman Co., Arabama, 14–VIII–1976, M. Sato leg.”; 8 exs. (EUMJ): “Collier Creek, S. Norman, Montgomery Co., Arcansas [Arkansas], Aug., 13, 1976, M. Sato leg.”; 4 exs. (CKN): “ILLINOIS, Pope Co., 3 mi S Glendale, 18.V.2006, 650’, unnamed stream, W. D. Shepard leg.”; 9 exs. (CKN): “Georgia, Habersham Co., Chattahoochee NF-Hwy 441, 17.v.2006, 1740’, Panther Creek, W. D. Shepard leg.”; 13 exs. (CKN): “S. C., Oconee Co., Chattooga R at ford approx., 3 mi NW of Whetstone, 27 July 1974 #31A, Brigham, Brigham, Sanderson, Unzicker, Webb, et al., Promoresia tardella (Fall) 1977 David S. White, Promoresia tardella (Fall) Det. W. U. Brigham (two det. labels)”; 2 exs. (NMW): “TENN: mt. brook e. Gatlinburg, 72/8/21, H.P. Brown, Promoresia tardella det. H.P. Brown (1 det. label handwritten Promoresia tardella)”; 3 exs. (NMW): “TN: Polk Co., 8.5 mi NW Ducktown, 22. 5. 1994, Goforth cr., leg. W. D. Shepard (A 1086), Promoresia tardella W. D. Shepard 1994”. **Larvae.** USA: 1 mature larva (EUMJ): “South of Brevard, Williamson Creek, Transylvania Co., N. Carolina, Aug., 17, 1976, M. Sato leg.”; 2 mature larvae and 2 immature larvae (CKN): “ILLINOIS, Pop. Co., 3 mi S Glendale, 18.V.2006, 650’, unnamed stream, WDS–A–1671, William D. Shepard leg., Promoresia tardella W. D. Shepard”.

REDESCRIPTION: Adult. TL/EW 1.90–2.17 (2.05). Dorsal surface black, but elytra with yellowish patches at humeral and apical areas. Ventral surface, mouth parts and legs reddish brown to blackish brown, but antennae and claws paler.

Head almost flat dorsally, punctate and pubescent (Fig. 18). Eyes small; distance between eyes about 1.95 times as long as the maximum diameter of an eye. Antennae with densely arranged setae at antero-lateral corners of antennomeres 9 and 10 and apical part of antennomere 11; approximate ratio of each antennal segment 2.5 : 2.0 : 1.6 : 1.0 : 1.0 : 1.0 : 1.1 : 1.0 : 1.6 : 1.6 : 3.3. Clypeus transverse, about 3.03 times as wide as long. Labrum transverse, about 1.51 times as wide as long.

Pronotum transverse, moderately convex; lateral part moderately granulate; without median longitudinal impression; with prescutellar pits; antero-lateral corners weakly produced antieriad. PW/PL 1.19–1.33 (1.26); sublateral carinae 0.27–0.34 (n = 10, 0.30) times as long as PL.

Elytra elongately oval; moderately convex; lateral margin not serrate; intervals not strongly rugose, slightly convex; punctate striae shallow or vague; stria punctures of each striae scattered, with large and small punctures, each punctures deep; basal part of 3rd interval wider than 4th (Fig. 19); EL/EW 1.34–1.57 (1.47); EL/PL 2.41–2.67 (2.55); EW/PW 1.31–1.44 (1.38).

Prosternal process narrowing behind and broadly rounded at apex. Anterior part of mesoventral groove relatively narrow. Abdominal ventrite 5 rugose; apex evenly rounded and with long and short hairs (Fig. 20).

Aedeagus as in Figs. 15–16; phallobase smooth at lateral and ventral surface; penis about 2.03 times as long as phallobase, dilated at base, gradually narrowed, apical part somewhat rounded, curved ventrad in lateral view (Fig. 16); parameres slender, about 0.70 times as long as penis.

MEASUREMENTS (n = 10): TL 1.73–2.21 (1.97) mm; PL 0.49–0.62 (0.56) mm; PW 0.61–0.80 (0.70) mm; EL 1.24–1.59 (1.42) mm; EW 0.82–1.06 (0.97) mm.

Larva. Body cylindrical, TL/TW 6.58. Color dark brown, but antennae, mouth parts and legs paler. Head about 1.13 times as wide as long; dorsal surface with sparsely setiferous tubercles;

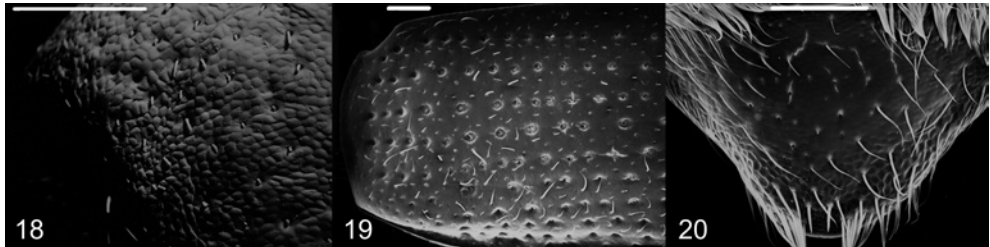
each tubercle relatively large. Mandible subtriangular, 1.43 times as long as wide. Labrum about 1.92 times as wide as long. Pronotum slightly wider than long, PW/PL 1.38, somewhat humped in middorsal and sublateral view. Tarsungulus large and slender. Abdominal segments 1–8 strongly humped in middorsal view; posterior segments more humped; clearly humped in sublateral view; abdominal segment 9 moderately humped in middorsal view; dorsally keeled in sublateral view.

MEASUREMENTS (n = 1): TL 3.95 mm; HW 0.33 mm; PL 0.39 mm; PW 0.54 mm; TW 0.60 mm.

DISTRIBUTION: Eastern USA, eastern Canada (see JÄCH et al. 2016: 183).

VARIABILITY: BROWN & WHITE (1978) mentioned the great range in size (total length: 1.7–2.7 mm), which is highly remarkable. The type specimens of *O. subarcticus* are 2.3–2.4 mm long. Further morphological and molecular studies will be necessary to find out whether *O. tardellus* is a single variable species or a complex of closely related species.

DIFFERENTIAL DIAGNOSIS: This species resembles *O. elegans* in general appearance, but is distinguishable from the latter by the following characteristics: [adult] body small; humeral and apical patches of elytra not elongate (Fig. 3); elytra oval; [larva] abdominal segments 1–8 strongly humped in middorsal view, clearly humped in sublateral view; abdominal segment 9 moderately humped in middorsal view, keeled in sublateral view (Fig. 8); tarsungulus slender.



Figs. 18–20: *Optioservus tardellus* (adults); 18) head; 19) left elytron, anterior half; 20) abdominal ventrite 5. Scales: 100 μ m.

Discussion

According to SANDERSON (1954), BROWN (1972) and WHITE & ROUGHLEY (2008) *Promoresia* is distinguished from *Optioservus* by the smooth lateral and posterior margins of the pronotum (adult) and by the dorsal median and sublateral humps of each segment (larva). But these characters are suitable only for distinguishing species groups or species (KAMITE 2009, 2011, 2012, 2013, 2015). The members of the *O. elegans* group can be recognized easily by the elongate tarsi and claws (tarsungulus) of adults and larvae.

Typical habitats of most species of *Optioservus* are small rocks and gravel in riffles, or sandy substrates (BROWN & WHITE 1978, KAMITE 2015), but the typical habitat of the members of the *O. elegans* group are rootlets or moss (BROWN & WHITE 1978). The length of the tarsi and claws are apparently due to adaptation to these habitats.

Acknowledgements

I wish to express my sincere gratitude to Dr. Masahiro Sakai (Tôon, Japan) and Dr. Hiroyuki Yoshitomi (EUMJ) for their continuous encouragement.

I would also like to thank Dr. William D. Shepard (Essig Museum of Entomology, Berkeley, USA) and Dr. Manfred A. Jäch (NMW) for sending identified material, providing useful advice during my study, and for reading the manuscript.

Thanks are also due to Dr. Masakazu Hayashi (Hoshizaki Institute for Wildlife Protection, Izumo, Japan), the late Mr. Takeshi Ogata and the late Dr. Masataka Satô for providing useful advice during my study, and Dr. David S. White (Hancock Biological Station, Kentucky, USA) for sending material.

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Jahr/Year: 2016

Band/Volume: [86_2016](#)

Autor(en)/Author(s): Kamite Yuuki

Artikel/Article: [Revision of the genus *Optioservus* SANDERSON, 1953, part 3: The *O. elegans* species group 205-212](#)