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Revision of the *Agrilus cyanescens* species-group (Coleoptera: Buprestidae) with description of three new species from the east Palaearctic region

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Abstract

The *Agrilus cyanescens* species-group of jewel beetles is defined to include seven species, three of which are newly described: *A. dali* Jendek **sp. n.** (China: Yunnan), *A. zhongdian* Jendek **sp. n.** (China: Yunnan) and *A. arsenevi* Jendek **sp. n.** (Russia: Primorsky Kray). Three new synonyms are proposed for *A. cyanescens* (Ratzeburg, 1837) (= *italicus* Obenberger, 1920 **syn. n.**; **=** *cockerelli* Fisher, 1925 **syn. n.**; = *pooli* Théry, 1936 **syn. n.**). Each member of the group is illustrated and an identification key to species, based on males, is provided.

Key words: Taxonomy, new species, Coleoptera, Buprestidae, *Agrilus*, Palaearctic region, invasive alien species

Introduction

The cosmopolitan jewel beetle genus *Agrilus* with 2788 species (Bellamy 2008) is among the largest conventionally accepted genera of the Animal Kingdom. One Asian species, *A. planipennis* Fairmaire, 1888, has recently become a subject of intensive research due to the fact that it is among the most notorious invasive alien species in North America. In spite of this focused attention the vast majority of species have never been illustrated or keyed, a satisfactory internal generic classification does not exist, and apparently hundreds of new *Agrilus* species are still to be described.

This paper continues the series of the first author's publications (Jendek, 2003, 2004, 2005, 2007) on the taxonomy and systematics of the genus *Agrilus* with particular emphasis on those from the Palaearctic Region. The aim of this paper is to diagnose and revise yet another presumably natural (monophyletic) assemblage informally termed here as *A. cyanescens* species-group. This group presently consists of seven species; three of them are newly described below. A member of this assemblage, *A. cyanescens* (Ratzeburg, 1837), is one of the most widely naturally distributed *Agrilus* species ranging through most of the Palaearctic Region, and has also been introduced to North America

Material and methods

Only available names are cited in the synonymy; for unavailable names, misidentifications and mistyping see Jendek (2002). Synonyms are listed chronologically. The type locality is quoted in the language and form of the original citation, the order of these data is sometimes altered from the original sequence. All taxonomic acts proposed in this paper should be attributed to the first author.

The following abbreviations are used in the text: [p], preceding data 'printed'; [h], preceding data 'handwritten'. Square brackets [ ] are used for remarks and addenda; the backslash (\ )separates data from different labels. Codens for museums and collections are:

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EJCB: Collection of E. Jendek, Slovak Academy of Sciences, Bratislava, Slovakia;
MNAG: Collection M. Niehuis, Albersweiler, Germany;
MHNH: Muséum National d'Histoire Naturelle, Paris, France;
NMPC: Národní muzeum, Prague, Czech Republic;
LJSK: Collection Lee, Jun-gu, Seoul, Republic of Korea;
UMMZ: University of Michigan, Museum of Zoology, Ann Arbor, Michigan, USA;
USNM: National Museum of Natural History, Washington D.C., USA;
ZIN: Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia.

Taxonomy

Agrilus cyanescens species-group

Diagnosis. Robust, medium sized, blue, green or bronze beetles without distinct ornamental pubescence. Pronotal disk variously depressed laterally; prehumerus absent or represented by elongate protuberance. Elytral apices separately arcuate. The group is further characterized by having a peculiar form of sexual dimorphism in size and form of prosternal lobe, shape of metacoxal plates, impression of basal ventrite and emargination of apical ventrite (Fig. 33). Males differ from females by having prosternal lobe more robust and more deeply emarginated medially, with sides of emargination often spiniform (Figs. 25–32). Metacoxal plates in males protrude sharply (except of *A. bidentulus*) (Figs. 35–41), basal ventrite is usually distinctly subtriangularly impressed between metacoxae (Fig. 33), and apex of the last ventrite is deeply emarginated (Fig. 33). Members of the *A. cyanescens* species-group do not demonstrate distinct sexual differences in the pubescence of dorsal side between male and female, unlike in other *Agrilus* species with documented sexual dimorphism. The aedeagus is rather uniform externally (Fig. 34) with its median lobe variously shaped (Figs. 9–17).

Members of the *A. cyanescens* species-group as presently defined are most similar to the bluish metallic species from the Oriental and southern Palaearctic (Yunnan) regions preliminary and informally termed as *A. laetecyanescens* species-group. Similar to the *A. cyanescens* species-group, males of this assemblage also have a markedly enlarged prosternal lobe, lack pubescence on the ventral side of the body, and both sexes have a medial emargination on the apical abdominal ventrite.

Composition and distribution. As presently defined, the group comprises seven species and one subspecies with the majority of species distributed in the eastern part of the Palaearctic region. One widely distributed species (*A. cyanescens*) occurs through most of Europe and recently became introduced to, and successfully established in, the North America.

A key to species of *Agrilus cyanescens* species-group (males only)

1. Prosternal lobe shallowly and narrowly emarginate medially, sides of emargination forming two sharp spinules (Figs. 27–29) 2
- Prosternal lobe deeply and widely emarginate medially, sides of emargination rather rounded or spiniform, but not forming sharp spinules (Figs. 25–26, 30–32) 3
2. Metacoxal plates in antero-ventral view flat (Fig. 37); sides of aedeagal median lobe not denticulate (Fig. 13); vertex in postero-dorsal view with deep median sulcus (Fig. 20); median surface of pronotum transversely rugose; basal ventrite with fine subtriangular impression between metacoxae; body slender; body length 6.0–7.8 mm; China (Gansu, Sichuan) ..... *A. bidentulus* (Fig. 4)
- Metacoxal plates in antero-ventral view sharply protruding (Fig. 38); sides of aedeagal median lobe denticulate (Fig. 14); vertex in postero-dorsal view with fine median sulcus (Fig. 21); median surface of pronotum granulate; basal ventrite with deep subtriangular impression between metacoxae; body stout; body length 5.0–7.2 mm; China (Hebei, Heilongjiang); Japan (Honshu); Korea North; Korea South; Russia (Primorsky Kray, Sakhalin) ..... *A. asahinai* (Fig. 5)
3. Sides of aedeagal median lobe not denticulate (Figs. 12, 15, 16)..... 4

- Sides of aedeagal median lobe denticulate (Figs 9–11, 17) 6
4. Prosternal process distinctly widened posteriorly (Fig 26); body length 6.5–7.8 mm; Tibet ..... *A. thibetanus* (Fig. 3)
- Prosternal process subparallel or weakly widened posteriorly (Figs. 25, 30–32) 5
5. Sides of pronotum markedly arcuate (Fig. 6); disc in lateral view distinctly convex, with small, deep semi-foveolate depression antero-laterally; prosternal process wide, with blunt angles (Fig. 30); body bluish-green, brightly lustrous; body length 5.1–7.9 mm; China (Sichuan, Yunnan) ..... *A. dali* (Fig. 6)
- Sides of pronotum feebly arcuate (Fig. 7); disc in lateral view feebly convex, with wide, vague impressions on each side; prosternal process narrow with sharp angles (Fig. 31); body with silky lustrous; body length 5.8–7.9 mm; China (Yunnan) ..... *A. zhongdian* (Fig. 7)
6. Median lobe of aedeagus with markedly denticulate sides and pointed apex (Fig. 17); body length 6.6–6.9 mm; Russia (Primorsky Kray)..... *A. arsenevi* (Fig. 8)
- Median lobe of aedeagus with finely denticulate sides and obtuse apex (Fig. 9–11)..... 7
7. Body without pubescence; blue, bluish-green, bluish-violet or bronze; body length 5.2–7.8 mm; Europe, Asia (except Syria), North America (see distribution) ..... *A. cyanescens* s. str. (Fig. 1)
- Body with sparse, whitish, sub-recumbent pubescence; bronze; body length 5.0–7.4 mm; Syria..... ..... *A. cyanescens johanidesi* (Fig. 2)

Agrilus cyanescens cyanescens **(Ratzeburg)**
(Figs. 1, 9–10, 18, 25, 35)

= *caeruleus* (Rossi, 1792) [preoccupied]
= *amabilis* Gory & Laporte, 1837
= *sulcaticeps* Abeille de Perrin, 1869
= *acuticornis* Abeille de Perrin, 1897
= *fissifrons* Abeille de Perrin, 1897 [preoccupied]
= *teriolensis* Obenberger, 1916
= *italicus* Obenberger, 1920 **syn. n.**
= *kyselyi* Obenberger, 1924 [replacement name for *fissifrons* Abeille, 1897]
= *cockerelli* Fisher, 1925 **syn. n.**
= *pooli* Théry, 1936 **syn. n.**

Buprestis cyanescens Ratzeburg, 1837: 54–55.

Type specimens. We could not locate the type of *Buprestis cyanescens*. The taxonomic considerations are based on the generally accepted concept of this taxon.

Type locality: "Wäldern Preufsens" [The type locality is taken from the title of the publication and should be close to the city of Eberswalde in north-eastern Germany, the residence of Ratzeburg].

Remarks. The name *cyanescens* Ratzeburg was for a long time considered as a junior subjective synonym of *A. caeruleus.*

Buprestis caerulea Rossi, 1792: 62.

Type specimens. We could not locate the type of *Buprestis caerulea*.

Type locality: "silvae Pisanae".

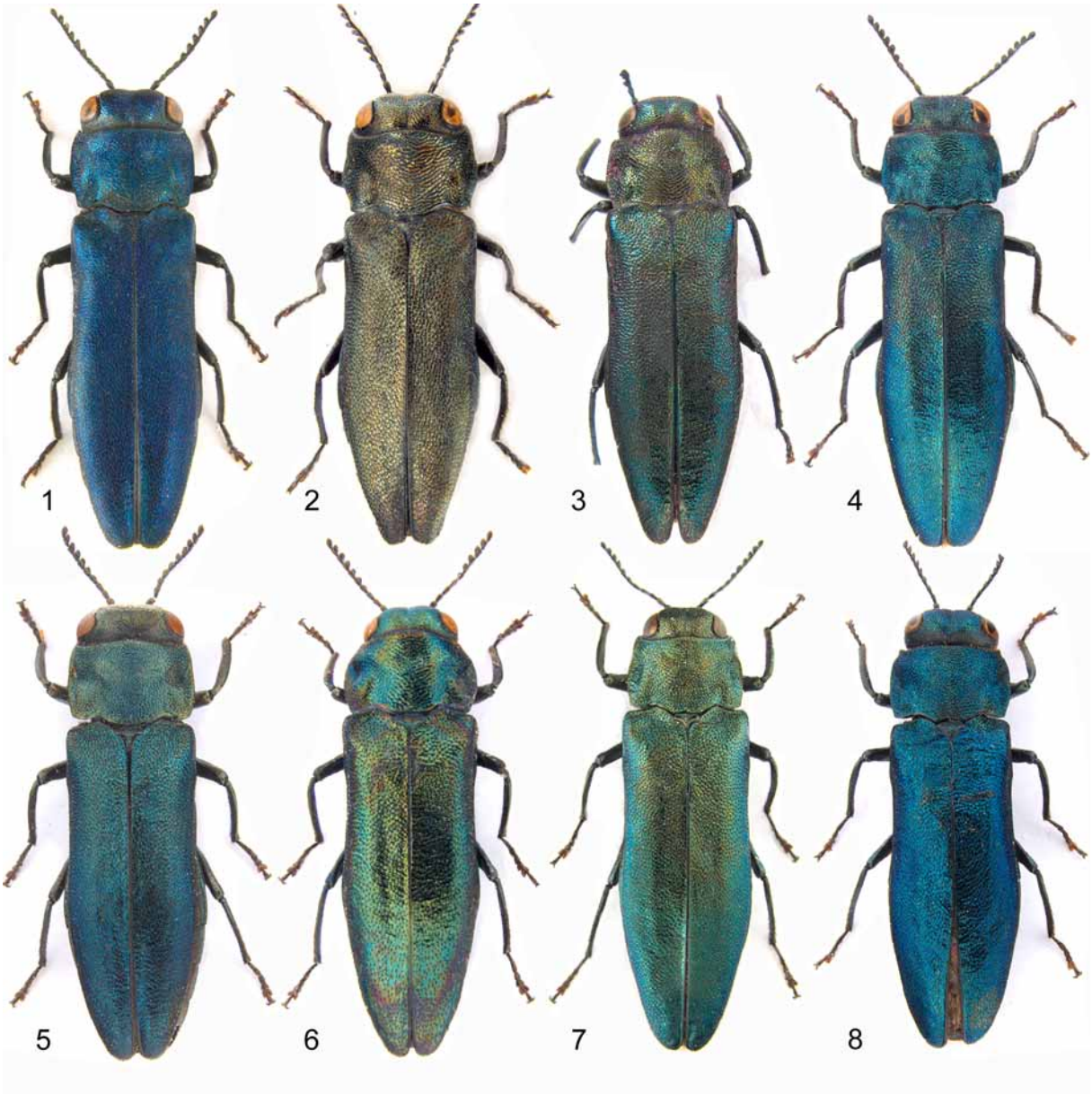
Remarks. The specific name of this taxon is often cited erroneously as *coeruleus*. The conspecifity of *A. cyanescens* and *A. caeruleus* was mentioned for the first time by Bach (1854). The name *caerulea* Rossi, 1792 is a junior primary homonym of *caerulea* Thunberg, 1789 (currently *Meliboeus* Deyrolle) and *caerulea* Olivier, 1790 (currently *Lampetis* Dejean).

Agrilus amabilis Gory & Laporte, 1837: 52–53.

Type specimens. See lectotype designation by Jendek (1998).

Type locality: "Saxe".

Remarks. The conspecifity of *A. cyanescens* and *A. amabilis* was mentioned for the first time by Bach (1854).



FIGURES 1–8. Habitus of 1) *A. cyanescens*, 6.1 mm; 2) *A. cyanescens johanidesi*, 5.0 mm; 3) *A. thibetanus*, lectotype 6.8 mm; 4) *A. bidentulus*, 6.7 mm; 5) *A. asahinai*, 6.2 mm; 6) *A. dali* **sp. n.**, paratype, 6.9 mm; 7) *A. zhongdian* **sp. n.**, paratype, 7.1 mm; 8) *A. arsenevi* **sp. n.**, holotype, 6.9 mm.

Agrilus sulcaticeps Abeille de Perrin, 1869: 79–80.

Type specimens. We could not locate in MNHN either of two syntypes of *Agrilus sulcaticeps*.

Type locality: "Briançon (Hautes-Alpes) ".

Remarks. Stein & Weise (1877) were probably the first who proposed conspecifity of *A. sulcaticeps* and *A. caeruleus*.

Agrilus acuticornis Abeille de Perrin, 1897.

Type specimens. Lectotype (designated by Niehuis & Tezcan, 1993): ♂, MNHN: **"**Caucasus Armen. Geb..Leder Reitter [p] \ acuticornis Ab. [h] Type [h] [red ink] \ MUSÉUM PARIS Coll. ABEILLE de PERRIN 1919 [p] \ Agrilus cyanescens Ratzb. det. Niehuis 1992 [p] \ Muséum Paris Coll. Générale [p] [yellow label]".

Type locality: "Caucase arménien".

Remarks. The original description of *A. acuticornis* neither implies nor requires that there were syntypes. Niehuis & Tezcan (1993) by mentioning "the type" validly fixed the lectotype (ICZN, 1999, Article 74.6.)]. The lectotype of *A. acuticornis* differs from *A. cyanescens* only by having the hind pronotal angles sharply acute, while other characters are within the variability of *A. cyanescens*. The name was placed in synonymy of *A. cyanescens* by Niehuis & Tezcan (1993).

FIGURES 9–17. Median lobe of the aedeagus of 9) *A. cyanescens* from France; 10) *A. cyanescens* from Russia, Primorsky Kray; 11) *A. cyanescens johanidesi*; 12) *A. thibetanus*; 13) *A. bidentulus*; 14) *A. asahinai*; 15) *A. dali* **sp. n.**; 16) *A. zhongdian* **sp. n.**; 17) *A. arsenevi* **sp. n.** Scale bar = 1 mm.

Agrilus fissifrons Abeille de Perrin, 1897: 3, 9–10.

Type specimens. Holotype by monotypy: ♂, MNHN: **"**Karpates ..ostenī–Molda.. [label is cut from sides] [p] \ fissifrons Ab. [h] Type [h] [red ink] \ MUSÉUM PARIS 1919 Coll. A. DE PERRIN [p]".

Type locality: "Karpathes".

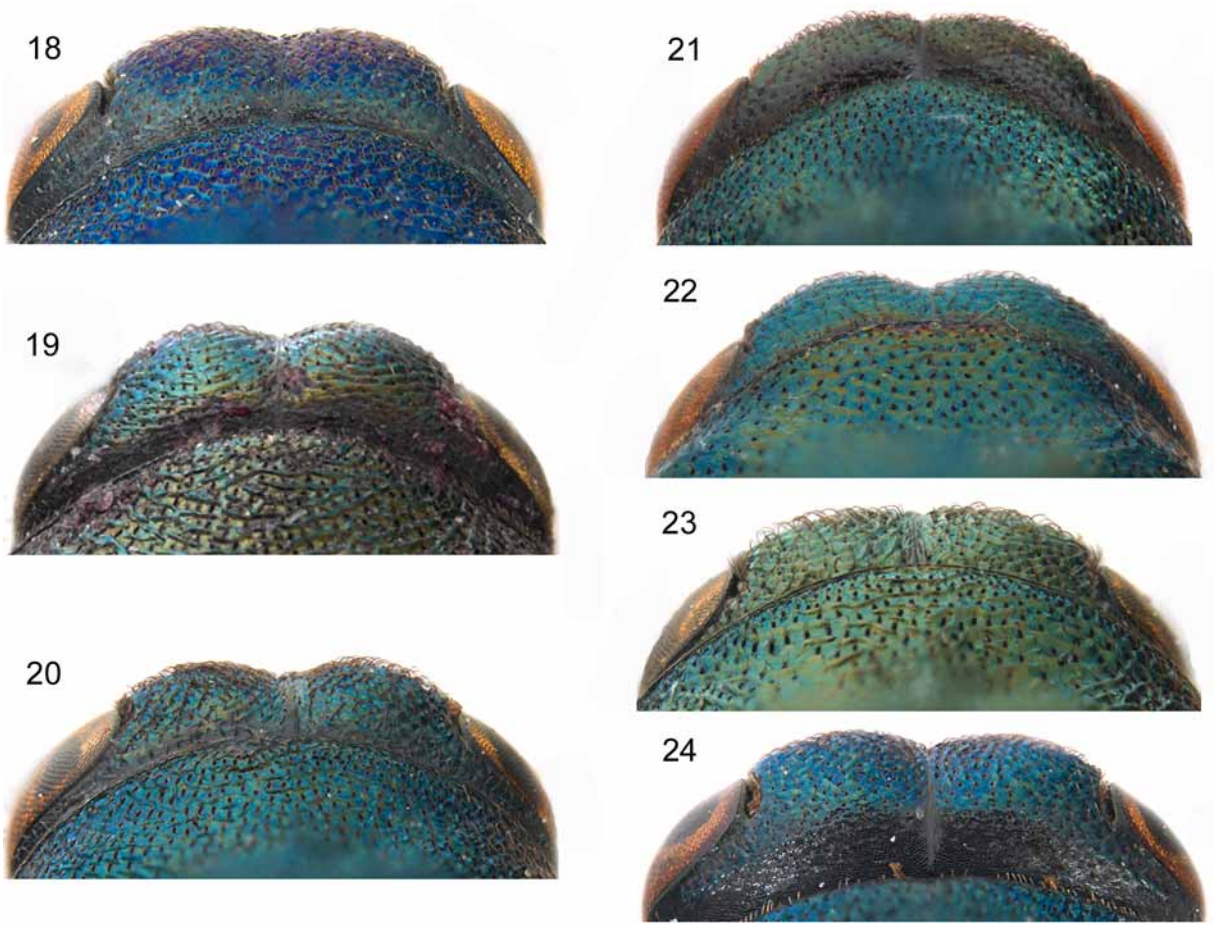
Remarks. The name *fissifrons* Abeille de Perrin is a junior primary homonym of *fissifrons* Fairmaire, 1849. Obenberger (1924) proposed the replacement name *kyselyi* for the name *fissifrons* Abeille de Perrin. Curletti (1985, 1994) placed the names *fissifrons* Abeille de Perrin and *kyselyi* Obenberger in synonymy of *A. italicus*. Bílý (1982) listed them in the synonymy of *A. cyanescens*. Rikhter & Alexeev (1965) cited *kyselyi* in the synonymy of *A. caeruleus*.

Agrilus artemisiae teriolensis Obenberger, 1916: 275.

Type specimens. Holotype by monotypy: ♀, NMPC: **"**Tirolis [p] \ Unicum – Typus! [h] \ TYPUS [p] [red label] \ Agrilus artemisiae v. teriolensis m. [p] Det. Obenberger [p] \ Mus. Nat. Pragae [p] 24 967 [h] [orange label]".

Type locality: "Tirol".

Remarks. The name *teriolensis* was originally proposed for a subspecies of *A. artemisiae*. Curletti (1994) placed it in synonymy of *A. cyanescens*.



FIGURES 18–24. Vertex in postero-dorsal aspect of 18) *A. cyanescens*; 19) *A. thibetanus*; 20) *A. bidentulus*; 21) *A. asahinai*; 22) *A. dali* **sp. n.**; 23) *A. zhongdian* **sp. n.**; 24) *A. arsenevi* **sp. n.**

Agrilus italicus Obenberger, 1920: 212 **syn. n.**

Type specimens. Lectotype (designated by Curletti, 1985): ♀♀, NMPC: **"**Italia Livorno [h] \ TYPUS [p] [red label] \ A. italicus m. Type [h] Det. Dr. Obenberger [p] \ Mus. Nat. Pragae Inv. [p] 26333 [h] [orange label]".

Type locality: "Italie: Livorno".

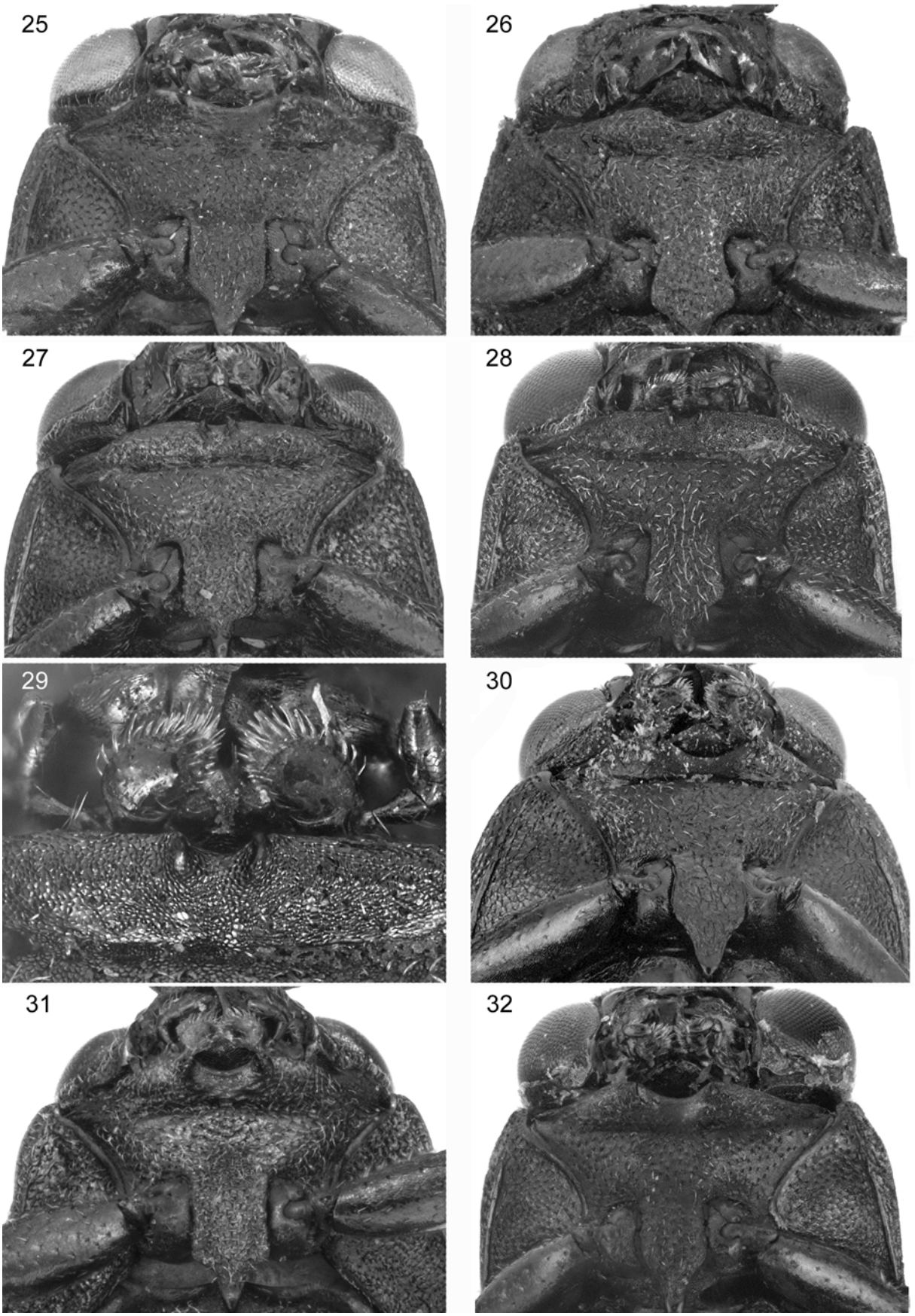
Remarks: The original description of *A. italicus* neither implies not requires that there were syntypes. Curletti (1985), by mentioning "the type", validly fixed the lectotype (ICZN, 1999, Article 74.6.)]. The lectotype of *Agrilus italicus* differs from *A. cyanescens* only by the bronze color of the dorsal surface. Similarly colored specimens were found in Slovakia and east Turkey.

Agrilus cockerelli Fisher, 1925: 4–6 **syn. n.**

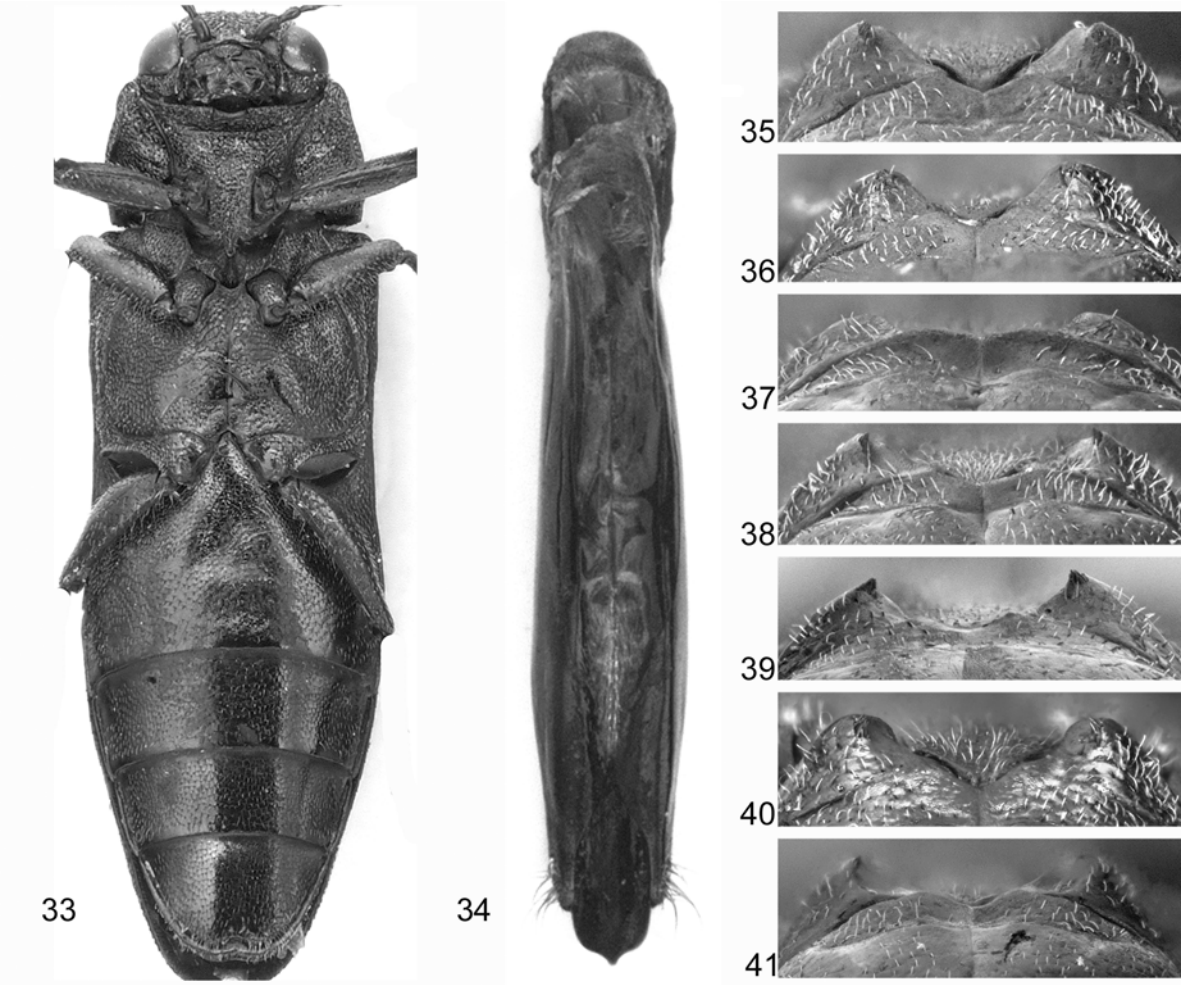
Type specimens. Holotype by monotypy, ♀, USNM: **"**Vladivostok Siber [sic!] 1923 V. Prinada [p] \ TypeNo. [p] 2756 [h] U.S.N.M. [p] red label] \ Agrilus amurensis Fisher [h] \ Holotype [p] [red ink] \ Agrilus cockerelli Fisher [h] [white label with red border]".

Type locality: "Vladivostok, Siberia" [Russia: Primorsky Kray].

Remarks. The holotype of *A. cockerelli* is conspecific with *A. cyanescens*..



FIGURES 25–32. Prosternum of 25) *A. cyanescens*; 26) *A. thibetanus*; 27) *A. bidentulus*; 28) *A. asahinai*; 29) *A. asahinai*, details of prosternal lobe; 30) *A. dali* **sp. n.**; 31) *A. zhongdian* **sp. n.**; 32) *A. arsenevi* **sp. n.**



FIGURES 33–41. *A. zhongdian* **sp. n.** 33) ventral side, 7.6 mm; 34) aedeagus, 2.2 mm. Metacoxal plates in antero-ventral aspect of 35) *A. cyanescens*; 36) *A. thibetanus*; 37) *A. bidentulus*; 38) *A. asahinai*; 39) *A. dali* **sp. n.**; 40) *A. zhongdian* **sp. n.**; 41) *A. arsenevi* **sp. n.**

Agrilus pooli Théry, 1936: 120–121 **syn. n.**

Type specimens. Holotype by monotypy, ♀, MNHN: **"**Siberia [p] \ Agrilus Pooli [h] Type [p] [red ink] \ MUSÉUM PARIS 1935 coll. A. THÉRY [p]".

Type locality: "Sibérie".

Remarks. The holotype of *A. pooli* is conspecific with *A. cyanescens.*

Material examined. Asia: China: Shaanxi: 2♀ (EJCB): "China–Shaanxi, Čun Čan, 26.5.–1.6.2000, leg. E. Kučera"; Shanxi: 3♀ (EJCB): "China, Shanxi prov, 9.VI.2000, Lüliang Shan, 1000 m, road Fangshan–Jiaocheng, Hengjian env., Zd. Jindra". **Kazakhstan:** 1♂ (EJCB): "Kazakhstan vii.1983 Tarbagatai Mts."; 1♀ (EJCB): "r. Tainty, 15 km VSV Targyna, Altai, V–Kazakh. obl. 1–2.vii.983"; 1♀ (EJCB): "Kazakhstan NE, 100 km SEE Ust' Kamenogorsk, 5 km NE Panteleymonovka, Kaiyndy forest, 16–20.6.93, Napolov leg.". **Korea South:** 1 ex (LJSK): "Mt. Sangseongsan, Yongtae–ri, Hail–myeon, Goseong–gun, Korea, 5.v.2000, coll. Yeong–ju"; 1 ex (LJSK): "Mt. Gajisan, Icheon–ri, Sangbuk–myeon, Ulju–gun, Gyeongsangnam–do, Korea, 28–30.vi.–1.vii.1990, coll. Myeong–ja Kang". **Russia:** Primorsky Kray: 1♂ (EJCB): "Russia, Primorsk. reg. 18–21.7.1992 Rezanovka E. Kučera leg. ex Lonicera"; ♂, 2♀ (ZIN): "Russia, Primorsk, Krasnoarm. r–n, 14–vi–1951g, V. I. Stepanov, na zhimolosti maaka"; 1♀ (EJCB): "Sib. or. –m., Primorje, Sichote–Alin Mts., Sokolči, 1–15.7.1990, Kadlec + Voříšek lg."; 3♂ (EJCB): "Russia, Primorsk, Krasnoarmeyskiy rayon, 9.vii.1971, Mt. Armu, on Lonicera". Sverdlovsk**:** 4♂, 1♀ (EJCB): "Sverdlovsk obl., st. Khrustal'naya, Sverdl. zh.d. 19–vi–1953 iz zhimolosti". Tuva**:** 2♂ (EJCB): "Tuvinskaja ASSR, Chadya 29–30.94 Z. Kletečka lgt.". **Turkey:** 1♂, 1♀ (EJCB): "NE Türkey, Kösedagi Gecidi pass W Bayburt, N40°18

E39°34, 1973 m, 26.VI.2006, lgt. P. Kabátek". 1♂ (EJCB): "Anatolien, Prov. Erzincan, 40 km östlich Imranli, Gemecik, 3.6.1975, 1630 m, leg. Holzschuh & Ressl"; 1♂, 1♀ (EJCB): "Prov. Ordu 28.5. Melet Fluß n. Mesudiye 800 m, Turkei 1985, leg. Schönmann et Schillhalmmer". **Europe**. **Czech Republic:** 1 ex (EJCB): "Bohemia centr. Prag D. Šárka 18.i.1995, lgt. P. Kabátek ex larv."; 1 ex (EJCB): "Bohemia centr. Krč–hospital, 17.vi.1986 lgt. M. Škorpík"; 1 ex (EJCB): "Ždánice, 15.5.1962 Hladil". **France:** Ile–del–France**:** 3♂, 1♀ (EJCB): "France Montmorency 29.v.1959". Rhône–Alpes: 8 exs (EJCB): "Charbonières (Rh) L. Schaefer, Lonicera xylosteum"; 5 exs (EJCB): "Chalamont (Ain) 19.6.1942 L. Schaefer, Lonicera xylosteum". **Germany:** 1♂ (EJCB): "Dessau, Anh. 24.6.1955 E. Heidenreich". **Italy:** 1♂ (NMPC): "Tosc. Livorno Antignano 9.V.953 F. Gerini"; 1♂, 1♀ (NMPC): "Tosc. Livorno Antignano 26.V.949 F. Gerini"; 1♂, 1♀ (NMPC): "Tosc. Livorno Antignano 13.V.953 F. Gerini". **Netherlands:** Gelderland: 1♂ (EJCB): "Leuvenum Juli–1926 H. Klaasen". **Poland:** 1 ex (EJCB): "Sebrna Góra 1.vii.1948"; 1 ex (EJCB): "LZD Krynica 18.vi.1988 L...ctno [illegible] Kopciona leg. A. Zabjdzlni". **Slovakia:** 5 exs (EJCB): "Slovakia, 29–31.v.1979 Devínska Kobyla, M. Štrba leg."; 1 ex (EJCB): "Devínska Kobyla, 5–6. 1984–1996"; 1 ex (EJCB): "Trenčín, Č.S.R., V. Steidl"; 1 ex (EJCB): "Trenčín, ČSR., L.K. 4.VII.37"; 4 exs (EJCB): "Slovakia occ., D.Vestenice, DFS 7276c, 21.V.–1.VII.2001, Malaise trap, O. Majzlan leg."; 1♀ (EJCB): "Slovakia centr. Malaise, Brusno, 7182c, 1.8.05, O. Majzlan lgt."; 1♂ (EJCB): "Slovakia–Napant, Veľký Bok 23.6.2005, P. Szomody"; 1♂, 1 ♀ (EJCB): "Slovakia, 7.vii.1983 Bystrička na Orave, M. Štrba leg."; 2♂ (EJCB): "N Slovakia 24.vi.2005, Nízke Tatry Mts, ±850m, Jánska–Stanišovská dolina, 49°00'25"N, 19°41'00"E, E. Jendek leg."; 1 ex (EJCB): "SW Slovakia 23.vi.2006, 2 km S of Prievaly, 48°32'33"N, 17°21'17"E, E. Jendek leg. 250 m"; 1 ex (EJCB): "Slovakia, Báb, 2.5.68, L. Korbel lgt."; 1♂, 1♀ (EJCB): "N Slovakia 23.vi.2005, S of Svarín, ±1000m, Svarínska dolina–Ústredok, 48°57'40"N, 19°52'15"E, E. Jendek leg."; 3 exs (EJCB): "Tatry, Matliary, Slovak, Čepelák"; 4 exs (EJCB): "N Slovakia 25.vi.2005, Nízke Tatry Mts, ±900m, Ipoltická dolina, 48°58'05"N, 19°58'50"E, E. Jendek leg."; 1 ex (EJCB): "CHKO Poľana, Drábovka, 1251 m"; 6 exs (EJCB): "Vys. Tatry, Kež. Žlaby, 5.7.1937, L. Korbel."; 1 ex (EJCB): "Muráň, štúdijná plocha Paseky"; 2 exs (EJCB): "Muráň, štúdijná plocha Paseky". **North America** (introduced). **Canada:** Ontario: 1 ex (CNC): "Gore Bay, ONT 10.VII.1961 G. Brumpton"; 1 ex (CNC): "Vittoria Ont. 6/12/ 1956 W. J. Brown"; 1 ♂ (EJCB): "Ontario–London, Strathroy, vi. 1995, D. Čatloš leg."; 2♂, 3♀ (EJCB): "Canada, Ontario, Ottawa, on Lonicera, 12.vi.2008, E. Jendek leg."; Quebec: 1 ex (CNC): "Lac. Taylor, Parc Gatineau, Que. June 22/74, humid soil, col. R. Sexton". **United States:** Massachusetts: 3 exs (CNC): "Nantick Mass. VI–18–1948 C. A. Frost"; Michigan: 4 exs (UMMZ): Washtenaw Co. Mich. Ann Arbor VI–18–1927 N. K. Bigelow; 4 exs (UMMZ): Washtenaw Co. Mich. Ann Arbor VI–12–1927 N. K. Bigelow; 1 ex (CNC): "Midland Co., Michigan, 6–17–45, R. R. Dreisbach"; 2♀ (EJCB): "Michigan, East Lansing, Inghan Co. VI–4, 1971, J. A. Jackman"; New York**:** 1 ex (EJCB): "USA–4/973 Commack Fairfield"; Ohio: 4 exs (CNC): "Delaware Co. V–21 o. D.J. & J.J. Knull Collrs."; 1 ex (CNC): "Franklin Co. VI–49 O., E. L. Sleeper Collr.".

Distribution. Selected list of references: ASIA: Armenia – Abeille de Perrin (1897) [type locality of *A. acuticornis*]; Turkey – Niehuis & Tezcan (1993). EUROPE: Austria – Franz (1974); Belarus – Alexandrovitch et al (1996); Belgium – Hastir & Gaspar (2002); Bulgaria – Sakalian (2003); Czech Republic – Bílý (1996); Denmark – Hansen (1964); France – Forel & Leplat (2000); Greece – Mühle, Brandl & Niehuis (2000); Hungaria – Muskovits & Hegyessy (2002); Italy – Gobbi (1973), Curletti (1994); Kazakhstan – Kostin (1973); Latvia – Barsevskis (1997); Liechtenstein – Brandstetter & Kapp (1998); Luxembourg – Mousset (1979) ; Netherlands – Everts (1903); Norway – Olberg (2007); Poland – Gutowski (2004); Portugal – Arnáiz Ruiz et al (2002); Romania – Ruicanescu (1998); Russia – Rikhter & Alexeev (1965), Alexeev (1959, 1989); Slovakia – Lukáš & Majzlan (1997); Spain – Arnáiz Ruiz et al (2002); Sweden – Klefbeck (1962); Switzerland – Barbalat (2002). NORTH AMERICA: Bright 1987; Davies 1991; Downie & Arnett 1996; Frost 1922; Fisher 1928; Maier 2005; Nelson, Westcott & MacRae 1996; Sikes 2004; Wellso *et al*. 1976; Westcott 1991). Older records were often reported under the name *A. caeruleus* or *A. coeruleus*. New records from China (Hunan, Jiangxi) without detailed data published by Peng Zhongliang (1992) or Hua Li Zhong (2002) were not taken into consideration. **Asia**: Armenia; China (Shaanxi, Shanxi); Kazakhstan; Korea North; Korea South; Russia (Siberia and Far East except extreme north); Turkey. **Europe**: Albania; Austria; Belarus; Belgium; Bosnia & Herzegovina; Bulgaria; Croatia; Czech republic; Denmark; Estonia;

France; Germany; Greece; Hungary; Italy; Latvia; Liechtenstein; Lithuania; Luxembourg; Macedonia; Moldova; Netherlands; Norway; Poland; Portugal; Romania; Russia (whole European part except extreme north); Serbia & Montenegro; Slovakia; Slovenia; Spain; Sweden; Switzerland; Ukraine. **North America** (introduced): Canada: Ontario, Quebec; USA: Colorado, Connecticut, Illinois, Indiana, Maine, Massachusetts, Michigan, New Hampshire, Ohio, Pennsylvania, Rhode Island, Utah, Virginia, West Virginia, Wisconsin.

Biology. Reliable host plant records include *Lonicera*, *Symphoricarpos* and *Rhamnus* (Bílý 2002; Lauterbach 1992; Nelson *et al*. 1996; Niehuis & Tezcan 1993). Other published host plants such as species of *Quercus*, *Fagus*, *Betula*, *Alnus*, *Fraxinus*, *Rosa* etc., are dubious. The life cycle was described in details by Kubáň (1978). He reported that normally several larvae bore under the bark and in the wood of living branches or twigs often causing these parts to die. Larval development takes one or two years, the pupal chamber is situated diagonally at a distance close to the bark surface. Symptoms of infestation are fissures or swellings of attacked parts.

Agrilus cyanescens johanidesi Niehuis
(Figs. 2, 11)

Agrilus cyanescens johanidesi Niehuis, 1999: 35–40.

Type specimens. 4 paratypes (EJCB) from the type locality and 1 paratype (EJCB) from Syria, Jabal ash Shaykh were examined. Described from nineteen specimens.

Type locality: "Syria mer., Quatana–Burgush".

Material examined. Syria: 2 ♀ (EJCB): "Syria mer. occ., Burqush, 33°28'44'N', 35°59'32", 1360 m, 24–25.vi.1998, leg. P. Kabátek, ex lavae Lonicera".

Diagnosis. *Agrilus cyanescens johanidesi* differs from the nominotypical subspecies by the sparsely whitish pubescence of the elytra and by the bronze or brassy color of the dorsal surface, which is rare in the nominotypical subspecies. The median lobe of the aedeagus (Fig. 11) is similar to that of *A. cyanescens cyanescens.*

Distribution. So far known only from Syria.

Biology. Adult beetles were collected on (Niehuis 1999), or reared from, species of *Lonicera*.

Remarks. Specimens of *A. cyanescens cyanescens* from east Turkey might be similarly colored but they differ from those of *A. cyanescens johanidesi* which has glabrous elytra.

Agrilus thibetanus Obenberger
(Figs. 3, 12, 19, 26, 36)

Agrilus thibetanus Obenberger, 1928: 70.

Type specimens. See lectotype designation by Jendek (2000).

Type locality: "Thibet, Vrionatong" [Site unlocated].

Material examined. 1 ♂, 3 ♀ (MNHN): "Thibet, Vrionatong".

Diagnosis. *Agrilus thibetanus* is most similar to *A. cyanescens* in body shape and form of the prosternal lobe (Fig. 26) and can by distinguished by the distinctly enlarged prosternal process (Fig. 26) in the male and by the shape of the median lobe of the aedeagus with the apex more acute and dentate sides (Fig. 12).

Distribution. Known only from the type locality.

Biology. Unknown.

***Agrilus bidentulus* Ganglbauer**
(Figs. 4, 13, 20, 27, 37)

Agrilus bidentulus Ganglbauer, 1890: 22, 31.

Type specimens. Holotype by monotypy, examined by Jendek (2002).

Type locality: "China, Kan-ssu, Dorf Ter-ga".

Material examined. China: Gansu: 1 ♂ (EJCB): "China, Gansu 20 km W Wu–du, 1800–2600, 1–6.6.97 A. Shamajev leg."; 1 ♂, 1 ♀ (EJCB): "China Gansu prov. 120 km SW Lanzhou Ponggartang 30.VI.–2.VII.1992 Jaroslav Turna leg."; 1 ♀ (EJCB): "China 17.viii.1918 Kansou Hasitai"; 4 ♂ (EJCB): "China Kansu Ponggartang 30.Jun 1992 M. Bok lgt."; Sichuan: 2 ♂ (EJCB): "China–Gansu Juizhaigon [sic!] 12–17.6.2000 leg. E. Kučera".

Diagnosis. *Agrilus bidentulus* is the only species of this group having flat metacoxal plates in males (Fig. 37), while in other species the metacoxae protrude sharply outward (Figs. 35–36, 38–41). This species is similar to *A. asahinai* in the conspicuously modified prosternal lobe armed in the male with two small spinules (Fig. 27). Females of both species have the prosternal lobe narrow and without spinules. Externally *A. bidentulus* resembles *A. cyanescens* with which it was considered conspecific (see Remarks), but differs from it by the form of the prosternal lobe, and by the shape of the median lobe of the aedeagus lacking denticulate sides (Fig. 13).

Distribution. China (Gansu, Sichuan).

Biology. Unknown.

Remarks. *Agrilus bidentulus* was considered conspecific with *A. caeruleus* by Alexeev (1959) and with *A. cyanescens* by Hastir & Gaspar (2002). Type examination revealed (Jendek 2002) that the former is a discrete species.

***Agrilus asahinai* Kurosawa**
(Figs. 5, 14, 21, 28, 38)

= *pseudorotundicollis* Kurosawa, 1956
= *stepanovi* Alexeev, 1979

Agrilus asahinai Kurosawa, 1956: 38–40.

Type specimens. Holotype examined by Jendek (2000)

Type locality: "S. Saghalien, Shirakaba".

Agrilus asahinai pseudorotundicollis Kurosawa, 1956: 40

Type specimens. Holotype examined by Jendek (2000)

Type locality: "Serio, Kyôto, Japan"

Remarks. The name of this subspecies was synonymised with the nominotypical subspecies by Jendek (2000).

Agrilus (*Dentagrilus*) *stepanovi* Alexeev, 1979: 134–136

Type specimens. Holotype examined by Jendek (2000)

Type locality: "Primorskii kraj, Lazovskii r-n, pritok r. Kievka" [Russia: Primorsky Kray]

Remarks. *Agrilus stepanovi* and *A. asahinai* were considered conspecific by Jendek (2000).

Material examined. China: Hebei: 1 ♂, 1 ♀ (EJCB): "China, Hebei (Nei Mongol) pass Chengde–Chifeng 41.6N, 118.2E, 30–31.V. J. Turna leg. 2002". **Korea North:** 1 ♀ (EJCB): "Korea, Sujang–san bei Hedzu, 4.6.1975, Josifov". **Korea South:** 2 exs (LJSK): "Aanmyeondo, Chungnam Prov., Korea, 23.v.2004, S. L. An leg.". **Russia:** Primorsky Kray: 1 ex (MNAG): "Russia: Primorskiy Kray, Ussuriysky Zapovednik, 33 km SE Ussuriysk, 43.37N, 132.18E, 10/11.VI.1993, 300 m, leg. L. Zerche et al.";

17 exs (EJCB): “Sib. or. Primorje, Komarovka flum., Kamenushka env. 300 m, Voříšek, J. leg. VI.1992”; 1 ♂, 1 ♀ (ZIN): “Primorskii kr. Lazovskii r-n., d. Ta-chin-go-za. 2–vi–1951, V. N. Stepanov”.

Diagnosis. *Agrilus asahinai* is similar to *A. bidentulus* in the shape of the prosternal lobe (Fig. 28), but it differs from it by the denticulate sides of the median lobe of the aedeagus (Fig. 14) and the sharply protruding metacoxal plates (Fig. 38).

Distribution. China (Hebei, Heilongjiang (Alexeev 1979)); Japan (Honshu); Korea North; Korea South; Russia (Primorsky Kray, Sakhalin).

Biology. Alexeev (1979, 1989) cited *Lonicera maackii* as the host plant for *A. asahinai*.

***Agrilus dali* Jendek sp. n.**
(Figs. 6, 15, 22, 30, 39)

Type specimens. Holotype ♂, (EJCB): “China CW, Yunnan prov., Dali, 19–21.v.1993 R. Červenka leg.”. Paratypes (22 ♂, 14 ♀): 11 ♂, 7 ♀ (EJCB), same data as holotype; 2 ♂ (EJCB): “China - Yunnan, 28.5.–9.6. 1994, Dali, lgt. E. Kučera”; 2 ♀ (EJCB): “China, Yunnan Dali 1–7.vi.1994 leg. B.Šiška & T. Spevár”; 1 ♂ (EJCB): “China N–Yunnan Yulongshan Mts. 2500–2800 m Ganhaizi / Lijiang road lgt. D. Král 24–26/7'90”; 4 ♂, 2 ♀ (EJCB): “Yunnan 2600–3100 m, 25.38N 100.09E Cangshan Mts. 5–6/6 Vít Kubáň leg. 1993”; 2 ♂ (EJCB): “China,Yunnan, 22.V.–2.VI., 100 km W of Kunming, 1993, Diaolin Nat. Reservation, E. Jendek & O. Šauša leg.”; 1 ♂ (EJCB): “China-Yunnan, Ningjing Shan, Wei-Shi, 2200 m, 12–13.6.2006, Vladimír Major leg.”; 1 ♀ (EJCB): “China, W Sichuan, Ganzi Tibetian Auton. Pref., Daxue Shan, river valley, 15 km S Kangding, 2800 m, 29.56 N, 101.58E, 26.6.1999, leg. A. Pütz”; 1 ♀ (EJCB): “China, Sichuan pr., Liziping 28.vi.–3.vii.1991, R. Dunda leg.”; 1 ♀ (EJCB): “Sichuan, VII. 1992, Gonggashan Mts., Hailougou vall., Sauer leg.”. 1 ♂ (MNHN): “Siao–Lou–Lou–Chan, Chasseurs Thibétains 1896”;

Type locality: China CW, Yunnan province, Dali [25°41'N, 100°09'E]”.

Description of the holotype. Medium sized, greenish-blue, brightly lustrous. Head distinctly narrower than pronotum at widest point. Eyes markedly convex, distinctly projecting beyond head outline. Frons and vertex with obvious median longitudinal impression (Fig 22). Pronotum markedly convex, widest at anterior third, sides clearly arcuate, slightly emarginate before obtuse hind angles, anterior lobe weak, subtriangular; pronotal disc with small, well-defined semi-foveolate depression antero-laterally, prehumerus absent; marginal and submarginal carinae markedly convergent, submarginal carina is vestigial just before merging point with marginal one at hind angles. Scutellum with transverse carina interrupted medially. Elytral apices widely separately arcuate.

Prosternal lobe (Fig. 30) robust, markedly protrusive outward, deeply arcuately emarginate with sharply pointed sides; prosternal process (Fig. 30) finely, sinuately enlarged between coxae, feebly impressed on disc, sides with blunt angles; metacoxae sharply protruding outward (antero-ventral view) (Fig. 39); basal ventrite deeply, subtriangularly impressed between metacoxae.

Aedeagus with median lobe distinctly pointed at apex and with edentate sides (Fig. 15). Metatarsi distinctly shorter than metatibiae; tarsomere 1 subequal in length to following two tarsomeres combined.

Sexual dimorphism. Females are larger and more robust; eyes smaller and less convex; prosternal lobe narrower, with margin only shallowly emarginate, sides of emargination arcuate, not spinate; metacoxae flat, not protruding; basal ventrite without impression between metacoxae; last ventrite less arcuate at apex.

Variability. The specimens studied differ in the depth of the emargination of the prosternal lobe, the form of the prosternal process (from parallel to slightly arcuately enlarged), the depth and extent of the antero-lateral pronotal impressions in some females, the degree of obliteration of the prehumerus which is sometimes indicated as a gibbosity, the depth of the impression of the basal ventrite and the emargination of the apex of the last ventrite in males.

Measurements. Holotype: 5.8 mm, Paratypes 5.1–7.9 mm.

Differential diagnosis. This species is distinctive by the bluish-green, brightly lustrous color; by the markedly convex pronotum with obviously arcuate sides; by the deep semi-foveolate depression situated antero-laterally on each side of pronotal disc and by the form of median lobe of aedeagus (Fig. 15).

Etymology. Specific epithet is a noun in apposition referring to the city of Dali, the type locality of the new species.

Distribution. China (Sichuan, Yunnan).

Biology. Unknown.

***Agrilus zhongdian* Jendek sp. n.**
(Figs. 7, 16, 23, 31, 33, 34, 40)

Type specimens. Holotype ♂, (EJCB): "China, Yunnan 1994 Zhongdian 16–20.vi. leg. Šiška T. Spevár". Paratypes (4 ♂, 4 ♀): 2 ♂, 4 ♀ (EJCB), same data as holotype; 2 ♂ (EJCB): "China–NW, Yunnan, cca 3600 m, road Deqen–Yanjing, 10 km W of Deqen, 1997, 28°28'N 98°53'E, 21–22.vi. M. Trýzna et O. Šafránek lgt.".

Type locality: China, Yunnan province, Zhongdian [25°48'N, 99°42'E].

Description of the holotype. Body medium-sized, golden-green, with silky lustrous, without distinct pubescence. Head large; eyes convex, not protruding beyond head outline. Frons and vertex moderately convex with feeble median impression, vertex distinctly spirally rugoso-punctate. Pronotum widest in middle, anterior lobe distinct but not projecting beyond anterior angles, sides evenly arcuate, posterior angles feebly obtuse. Disc flat, with two shallow median impressions, first one transverse at anterior margin, second one smaller and oval in basal half. Sides of disc obviously impressed; prehumerus absent. Marginal and submarginal carinae markedly convergent, joined at posterior angles, submarginal carina obsolete at both ends. Scutellum impressed on disc, with obliterated transverse carina. Elytral apices widely separately arcuate. Prosternal lobe (Fig. 31) robust, markedly protrusive outward, deeply, arcuately emarginate with sharply pointed sides; prosternal process (Fig. 31) narrow, with sharp angles, subparallel between coxae and clearly impressed on disc; metacoxae sharply protruding outward (antero-ventral view) (Fig. 40); basal ventrite distinctly, subtriangularly impressed between metacoxae. Aedeagus with median lobe distinctly pointed at apex and with smooth sides (Fig. 16). Legs long and relatively thin, metatarsi distinctly shorter than metatibiae; tarsomere 1 subequal in length to following two tarsomeres combined.

Sexual dimorphism. Females are generally larger and more robust with smaller, less convex eyes; prosternal lobe arcuately emarginate, without spines alongside emargination; metacoxae flat; basal ventrite without impression between metacoxae.

Variability. Maximum width of pronotum is around basal third in one paratype; prosternal process in one paratype has sides slightly expanding.

Measurements. Holotype: 7 mm, Paratypes 5.8 – 7.9 mm.

Differential diagnosis. This species is characterized by golden-green and robust body, flat pronotal disc; long legs; markedly protruding and spinate prosternal lobe (Fig. 31), form of prosternal process (Fig. 31) which is subparallel and narrow with, sharp angles, and most notably by the form of the median lobe of the aedeagus (Fig. 16).

Etymology. The specific epithet is a noun in apposition referring to the city of Zhongdian, the type locality of the new species.

Distribution. China (Yunnan).

Biology. Unknown.

***Agrilus arsenevi* Jendek sp. n.**
(Figs. 8, 17, 24, 32, 41)

Type specimens. Holotype ♂, (EJCB): "SU, Ussuri reg., Jasnoe, 12–19.vii.1989, R.Červenka leg". Paratypes: 1 ♂ (EJCB): "SU, Ussuri reg., Jasnoe, 500 m, 12–19.vii.1989, M. Nikodým leg".

Type locality: "SU, Ussuri region, Jasnoe [= Yasnoe, 43°40'N, 134°00'E (precised by collector)]".

Description of the holotype. Body medium-sized, robust, blue, with silky lustrous, without distinct pubescence. Head large; frons and vertex moderately convex with distinct median longitudinal impression (Fig. 24), vertex distinctly spirally rugoso-granulate. Pronotum widest in middle, anterior lobe absent, sides evenly arcuate, posterior angles obtuse. Disc flat, with large, weak, lateral impressions; prehumerus missing. Marginal and submarginal carinae slightly convergent, submarginal carina obsolete at both ends. Scutellum with obsolete transverse carina. Elytral apices widely separately arcuate. Prosternal lobe (Fig. 32) robust, markedly protrusive outward, deeply, arcuately emarginate with sharply pointed sides; prosternal process (Fig. 32) narrow, with blunt angles, subparallel between coxae, flat on disc; metacoxae sharply protruding outward (antero-ventral view) (Fig. 41); basal ventrite distinctly impressed between metacoxae. Aedeagus with median lobe sharply pointed at apex, and with obviously dentate sides (Fig. 17). Metatarsi distinctly shorter than metatibiae; tarsomere 1 subequal in length to following two tarsomeres combined.

Sexual dimorphism. Not assessed.

Variability. No appreciable variability was observed, except in body length.

Measurements. Holotype: 6.9 mm, Paratype 6.6 mm.

Differential diagnosis. *Agrilus arsenevi* Jendek **sp. n.** resembles by the color and by the body form specimens of *A. cyanescens*, *A. bidentulus* or *A. asahinai*, but it can be distinguished mainly by the peculiar form of the median lobe of the aedeagus (Fig. 17). In addition, it differs from *A. cyanescens* by the granulate sculpture of the frons and pronotum, and from *A. bidentulus* and *A. asahinai* by having the prosternal lobe deeply arcuately emarginate.

Etymology. The specific epithet is a patronymic, in honour of Vladimir Klavdievich Arsenev, 1872–1930, an early explorer and topographer of the Sikhote-Alin mountain range where this new species has been discovered.

Distribution. Russia (Primorsky Kray).

Biology. Unknown.

Discussion

Monophyly and relationships of A. cyanescens species-group

In this and previous papers of the first author a concept of informal species-groups is employed, as a pragmatic alternative to the subgeneric classification proposed by Alexeev (1979, 1989). The reason for this decision was substantiated by Jendek (2006). It therefore appears adequate to temporarily ignore formal subgeneric names in *Agrilus* and re-deploy them later, once the internal classification of *Agrilus* reaches an adequate level of understanding. Much like that of *Agrilus*, monophyly of the *A. cyanescens* species-group is currently a working hypothesis yet to be tested. The group is defined by a combination of the diagnostic characters (see the respective "Diagnosis" above), none of which is unique. Assuming that the group is likely monophyletic, it is currently impossible to indicate its relationships within the genus, of which the internal classification has never been adequately addressed.

Distribution A. cyanescens species-group

The distribution of *Agrilus cyanescens* was markedly extended by its introduction to North America in, arguably, the first quarter of the 20th century, likely, from Europe. The first North American records for Wisconsin and Massachusetts (under the name *Agrilus coeruleus*) were published by Frost (1922) and Fisher (1928); we examined eight specimens (UMMZ) collected in 1927 in Ann Arbor, Michigan in 1927. Currently this species is widely distributed through most of the western parts of both the USA and Canada (see distribution above).

Host plants of A. cyanescens species-group

Information on the biological requirements of the *A. cyanescens* species-group is scarce with only two of seven species, *A. cyanescens* and *A. asahinai*, having some data on host plant preferences. The nominotypical

subspecies of *A. cyanescens* was recorded in its both native and introduced distribution areas developing in honeysuckles and snowberries (Caprifoliaceae: *Lonicera* and *Symphoricarpos*, respectively), as well as buckthorns (Rhamnaceae: *Rhamnus*) (Bílý 2002; Lauterbach 1992; Nelson *et al.* 1996; Niehuis & Tezcan 1993); other published records of *Quercus*, *Fagus*, *Betula*, *Alnus*, *Fraxinus*, *Rosa* etc., appear of doubtful validity. *Agrilus asahinai* was reported (Alexeev, 1979, 1989) to develop on Amur Honeysuckle (*Lonicera maackii*), a shrub native to the Asia Pacific Region introduced to North America as an ornamental plant in late 19th century and currently considered as an invasive species (Miller & Gorchov, 2004).

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