

Review of the genus *Plutothrix* Förster, 1856 (Hymenoptera, Pteromalidae) with a key to Palearctic species

Ekaterina V. Tselikh¹, Gergely Várkonyi², Natalie Dale-Skey³

1 Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia **2** Finnish Environment Institute, Biodiversity Centre, Lenttiirantie 342B, FI-88900 Kuhmo, Finland **3** Natural History Museum, London, UK

Corresponding authors: Ekaterina V. Tselikh (tselikhk@gmail.com), Gergely Várkonyi (gergely.varkonyi@syke.fi), Natalie Dale-Skey (n.dale-skey@nhm.ac.uk)

Academic editor: Petr Janšta | Received 6 May 2022 | Accepted 24 August 2022 | Published 31 October 2022

<https://zoobank.org/42FFC606-F210-4BAA-ADF5-A9197F4B970B>

Citation: Tselikh EV, Várkonyi G, Dale-Skey N (2022) Review of the genus *Plutothrix* Förster, 1856 (Hymenoptera, Pteromalidae) with a key to Palearctic species. Journal of Hymenoptera Research 93: 1–32. <https://doi.org/10.3897/jhr.93.86238>

Abstract

The species of *Plutothrix* Förster, 1856 are reviewed. *Plutothrix gribanovi*, **sp. nov.**, is described from Russia, *P. longigaster*, **sp. nov.**, and *P. zerovae*, **sp. nov.**, are described from Finland and Russia. The male of *P. canariensis* Hedqvist, 1974 is described for the first time. The species *Plutothrix transdanuviana* (Erdős, 1946), **syn. nov.**, is synonymized under *Seladerma antennatum* (Walker, 1833). The following new records are reported: *Plutothrix nudicoxa* Graham, 1993 and *P. perelegans* Graham, 1993 from Finland, *P. obtusiclava* Graham, 1993 and *P. zhangyiensis* Yang, 1996 from Russia, and *P. perelegans* Graham, 1993 from Ukraine. An identification key to females of all Palearctic species of *Plutothrix* is provided.

Keywords

Fauna, key, new species, parasitoids, Pteromalinae, taxonomy

Introduction

The pteromalid genus *Plutothrix* (type species *Plutothrix foersteri* Mayr, 1904) belongs to the family Pteromalidae, subfamily Pteromalinae. Up to now, it comprised twentyeight species worldwide (Noyes 2019). However, this figure also includes the species *Plutothrix transdanuviana* (Erdős, 1946), **syn. nov.**, which was examined in

the present study and identified as *Seladerma antennatum* (Walker, 1833). Fifteen of the known species, *P. bicolorata* (Spinola), *P. canariensis* Hedqvist, *P. coelius* (Walker), *P. kuboii* Kamijo, *P. kusigematii* Kamijo, *P. narendrani* Kamijo, *P. nudicoxa* Graham, *P. obtusiclava* Graham, *P. pallidiclava* Graham, *P. perelegans* Graham, *P. pilicoxa* Graham, *P. rugosa* Kamijo, *P. scrobicula* Kamijo, *P. trifasciata* (Thomson) and *P. zhangyieensis* Yang, inhabit the Palaearctic region (Spinola 1811; Walker 1839; Thomson 1878; Graham 1969, 1993; Hedqvist 1974; Yang 1996; Kamijo 2004; Noyes 2019). Ten species, *P. aerata* Heydon, *P. ascita* Heydon, *P. ceonotalis* Heydon, *P. glareosa* Heydon, *P. ligyptera* Heydon, *P. pilosiclava* Heydon, *P. recula* Heydon, *P. smithi* Heydon, *P. uncutta* (Girault) and *P. uncuttella* Heydon, are distributed in the Nearctic region (Heydon 1997; Noyes 2019). Only a single species, *P. acuminata* (Thomson), has a Holarctic distribution (Heydon 1997; Noyes 2019). One extinct species, *Plutothrix minutissima* Meunier, 1905 was described from Zanzibar copal (Meunier 1905).

Unfortunately, the biology is unknown for most of the species, but available records suggest they are mostly primary parasitoids of coleopterans in the families Anobiidae, Ciidae, Curculionidae and dipterans in the family Platypezidae (Graham 1969; Herting 1973; Yang 1996; Heydon 1997; Noyes 2019).

The aim of this work is to describe new species of *Plutothrix* from Finland and Russia. An identification key to females of all Palaearctic species of *Plutothrix* is also provided.

Material and methods

The material used in this review is deposited in the Hymenoptera collections of the Finnish Natural History Museum, Helsinki, Finland (**ZMUH**), Zoological Institute of the Russian Academy of Sciences, St. Petersburg, Russia (**ZISP**), Natural History Museum, London, United Kingdom (**NHMUK**), Zoological Museum of the Lund University, Lund, Sweden (**LUZN**), Hungarian Natural History Museum, Budapest, Hungary (**HNHM**), Naturalis Biodiversity Center, Leiden, Netherlands (**NBC**), Ehime University Museum, Matsuyama, Japan (**EUM**), Entomological Laboratory of Hokkaido University, Sapporo, Japan (**EIHU**), Yeungnam University, Gyeongsan, South Korea (**YNU**), Northwestern College of Forestry, Yangling Shaanxi, People's Republic of China (**NWCF**).

Morphological terminology, including sculpture and wing venation nomenclature, follows Bouček and Rasplus (1991) and Gibson (1997). The flagellum consists of two anelli, the funiculus composed of six funicular segments, and the clava. The following abbreviations are used: **POL** – posterior ocellar line, the minimum distance between the posterior ocelli; **OOL** – ocello–ocular line, the minimum distance between a posterior ocellus and compound eye; **C1–C3** – claval segments; **PST** – parastigma; **M** – marginal vein; **S** – stigmal vein; **PM** – postmarginal vein; **F1–F6** – funicular segments; **Mt2–Mt8** – metasomal tergites (Mt1 – petiole). The scape is measured without the radicle; the pedicel is measured in lateral view. The distance between the clypeal lower

margin and the toruli is measured from the lower margins of the toruli. Eye height is measured as maximum diameter, eye length as minimum diameter. The mesosoma and metasoma are measured in lateral view, the latter including the ovipositor sheaths.

Observations were made using MC-2 ZOOM and Leica MZ16 stereomicroscopes, and images were acquired using a combination of Olympus SZX 10 stereomicroscope and digital camera EOS 70D, Micromed 3 microscope and digital camera TouPCam UCMOS 5.1MP (ZISP specimens), and a Canon 5DsR camera + Mitutoyo 10× lens or Canon MPE ultra macro lens (65 mm), Canon MT-24ex flash and Cognysis Stack-shot, and Helicon remote software (NHMUK specimens). The acquired images were then processed with Helicon Focus.

Taxonomy

Plutothrix Förster, 1856

Plutothrix Förster, 1856: 46. Type species by subsequent monotypy *Plutothrix foersteri* Mayr, 1904.

Anoglyphis Förster, 1878: 49. Type species by original designation *Anoglyphis nubilosa* Förster, 1878. Synonymy by Kerrich and Graham (1957: 296).

Diagnosis. Clypeal margin with angular median tooth (*e.g.*, Figs 4, 37, 43, 75); tentorial pits indistinct; antennal formula 11263; male antennae with distinct adpressed setae (*e.g.*, Figs 13, 27); pronotum with collar margin carinate; notauli complete (*e.g.*, Figs 8, 15, 24, 29, 40, 72); prepectus bare and smooth or coriaceous sculpture (*e.g.*, Figs 17, 45, 67); scutellum with distinct frenal area (*e.g.*, Figs 8, 15, 24, 29, 40, 72); fore wing with speculum reaching cubital line (*e.g.*, Figs 3, 5, 12, 16, 22, 31, 34, 39, 50, 58, 66, 73, 76, 82); petiole inconspicuous; (Graham 1969; Bouček and Rasplus 1991).

Distribution. Palaearctic, Nearctic.

Key to Palaearctic species of *Plutothrix* Förster based on females

- 1 Clava yellow (Fig. 62). Propodeum with costula (Fig. 61). Hind tibia with median white ring (Figs 60, 63) ***P. pallidiclava* Graham**
- Clava brown or black (*e.g.*, Figs 6, 11, 26, 32, 33, 41, 49, 55, 57, 65, 69, 80, 92). Propodeum without costula (*e.g.*, Figs 2, 8, 15, 24, 46, 86, 88). Hind tibia without median white ring (*e.g.*, Figs 1, 9, 19, 30, 36, 38, 48, 77, 84, 87) **2**
- 2 Fore wing with three or four fuscous clouds (*e.g.*, Figs 12, 22, 82) **3**
- Fore wing with two fuscous clouds (*e.g.*, Figs 5, 50, 53, 66, 68), or with one fuscous cloud touching stigma (*e.g.*, Figs 16, 31, 94), or hyaline (*e.g.*, Figs 3, 34, 39, 58, 73, 76, 85) **5**

- 3 M as long as PM (Fig. 12). Dorsellum reticulate. Basal cell setose (Fig. 12) ..
 ***P. canariensis* Hedqvist**
- M 0.73–0.90× as long as PM (*e.g.*, Figs 22, 82). Dorsellum alutaceous (*e.g.*,
 Figs 24, 80). Basal cell bare (Fig. 22) or with some setae on upper part
 (Fig. 82)..... **4**
- 4 Basal cell with some hairs on upper part (Fig. 82). Cubital vein setose
 (Fig. 82). Scutellum strongly convex (Fig. 81). Metasoma 3.70–3.80× as
 long as broad, basal part brown with metallic violet and coppery lustre, Mt8
 1.72–1.80× as long as broad (Fig. 83) ***P. trifasciata* (Thomson)**
- Basal cell bare (Fig. 22). Cubital vein bare (Fig. 22). Scutellum less convex
 (Fig. 23). Metasoma 4.47–5.15× as long as broad, basal part yellowish-brown,
 Mt8 1.90–2.10× as long as broad (Fig. 25) ***P. gribanovi* sp. nov.**
- 5 Fore wing with two fuscous clouds, one median and the other subapical (*e.g.*,
 Figs 5, 50, 53, 66, 68)..... **6**
- Fore wing with one fuscous cloud touching stigma (*e.g.*, Figs 16, 31, 94) or
 hyaline(*e.g.*, Figs 3, 34, 39, 58, 73, 76, 85)..... **10**
- 6 Combined length of pedicel and flagellum 1.35–1.45× breadth of head.
 Clava with micropilosity on C3 or rarely C3 and small part of C2 (Fig. 6).
 Fore wing with S slightly curved (Fig. 5) ***P. bicolorata* (Spinola)**
- Combined length of pedicel and flagellum 1.20–1.30× breadth of head. Clava
 with micropilosity on C3, C2 and sometimes distal half C1 (*e.g.*, Figs 49, 65).
 Fore wing with S straight (*e.g.*, Figs 50, 53, 66, 68)..... **7**
- 7 Hind coxa dorsally and ventrally thickly setose, (*e.g.*, Fig. 67). Clava with
 micropilosity on C3, C2 and distal half C1 (*e.g.*, Fig. 49)..... **8**
- Hind coxa with some setae dorsally but far less than ventrally (*e.g.*, Fig. 54).
 Clava with micropilosity on C3 and C2 (*e.g.*, Fig. 65)..... **9**
- 8 Scutellum with deep median furrow (Fig. 51). Pedicel and anelli yellowish
 (Fig. 49). Stigma 1.50–1.55× as long as broad (Fig. 50)
 ***P. narendrani* Kamijo**
- Scutellum without deep median furrow (Fig. 70). Pedicel and anelli brown
 (Figs 68, 70). Stigma 2.50–2.60× as long as broad (Fig. 68).....
 ***P. pilicoxa* Graham**
- 9 Antenna with F1 2.30–2.80× as long as broad, F2 1.70–2.00× as long as
 broad (Fig. 65). Head dark metallic blue (Fig. 64). Mt2 and Mt3 yellowish-
 brown or red (Fig. 64)..... ***P. perelegans* Graham**
- Antenna with F1 2.00–2.15× as long as broad, F2 1.50–1.60× as long as
 broad (Fig. 55). Head dark metallic green with diffuse coppery lustre (Figs 52,
 53). Mt2 and Mt3 dark brown (Fig. 52) ***P. nudicoxa* Graham**
- 10 Fore wing with PST longer than M (Fig. 58). Antenna with clava obtuse api-
 cally, C3 short and thickly setose (Fig. 57) ***P. obtusiclava* Graham**
- Fore wing with PST shorter than or as long as M (*e.g.*, Figs 3, 16, 31, 34, 39,
 73, 76, 85, 94). Antenna with clava acute, C3 not short and not thickly setose
 (*e.g.*, Figs 32, 33, 41, 92)..... **11**

- 11 Metapleuron alutaceous, upper mesepimeron with lower part alutaceous, upper part smooth (*e.g.*, Fig. 45). Metasoma 1.65–1.97× as long as head plus mesosoma (*e.g.*, Figs 36, 38, 40, 71). Mt8 2.90–5.25× as long as broad (*e.g.*, Figs 35, 42, 71)..... **12**
- Metapleuron reticulate, upper mesepimeron reticulate or smooth, upper part smooth (*e.g.*, Fig. 91). Metasoma 1.15–1.50× as long as head plus mesosoma (*e.g.*, Figs 1, 14, 29, 78, 84, 87). Mt8 1.26–2.50× as long as broad (*e.g.*, Figs 14, 29, 78, 93)..... **14**
- 12 Combined length of pedicel and flagellum 1.06–1.15× breadth of head. Scutellum irregular rugose (Fig. 72). Fore wing with PST 0.9–1.0× as long as M (Fig. 73)..... ***P. rugosa* Kamijo**
- Combined length of pedicel and flagellum 1.30–1.57× breadth of head. Scutellum reticulate (*e.g.*, Figs 35, 46). Fore wing with PST 0.65–0.70× as long as M (*e.g.*, Figs 34, 39)..... **13**
- 13 Antenna with F1 2.50–2.80× as long as broad, with 4–5 rows of sensilla (Fig. 33). Fore wing with M 1.70–1.80× as long as S (Fig. 34). All coxae metallic green with diffuse coppery lustre, all femora dark (Fig. 36). Mt8 2.90–3.50× as long as broad (Fig. 35)..... ***P. kusigematii* Kamijo**
- Antenna with F1 2.15–2.35× as long as broad, with 3 rows of sensilla (Fig. 41). Fore wing with M 2.00–2.30× as long as S (Fig. 39). All coxae yellowish-brown, all femora yellow (Fig. 38). Mt8 4.30–5.25× as long as broad (Fig. 42)..... ***P. longigaster* sp. nov.**
- 14 Antenna with F1 2.20–2.45× as long as broad (*e.g.*, Figs 32, 92). Mt8 1.85–2.50× as long as broad (*e.g.*, Figs 29, 93)..... **15**
- Antenna with F1 2.00–2.10× as long as broad (*e.g.*, Figs 15, 75, 84). Mt8 1.26–1.75× as long as broad (*e.g.*, Figs 14, 78)..... **16**
- 15 Scutellum coarsely reticulate (Fig. 29). Fore wing with elongate stigma (Fig. 31). Clava rounded (Fig. 32). Metasoma 3.20–3.70× as long as broad (Fig. 29), Mt8 1.84–2.0× as long as broad (Fig. 29)..... ***P. kuboii* Kamijo**
- Scutellum finely reticulate (Fig. 88). Stigma less elongate (Fig. 94). Clava acute (Fig. 92). Metasoma 4.30–6.25× as long as broad (Fig. 93), Mt8 2.20–2.50× as long as broad (Fig. 93)..... ***P. zerovae* sp. nov.**
- 16 Frenum of scutellum coarsely reticulate (Fig. 15). Metapleuron strongly reticulate (Fig. 17). Fore wing with one fuscous cloud touching stigma (Fig. 16)..... ***P. coelius* (Walker)**
- Frenum of scutellum finely reticulate (*e.g.*, Figs 2, 78, 86). Metapleuron weakly reticulate (*e.g.*, Fig. 84). Fore wing immaculate (*e.g.*, Figs 3, 76, 85)..... **17**
- 17 Head black (Fig. 75). Clypeus with blunt tooth (Fig. 75). Basal cell of fore wing with dense pubescence (Fig. 76). Propodeum alutaceous.....
- ***P. scrobicula* Kamijo**
- Head metallic green or dark green with diffuse coppery lustre (*e.g.*, Figs 4, 84). Clypeus with sharp tooth (*e.g.*, Fig. 4). Basal cell of fore wing with sparse pubescence (*e.g.*, Figs 3, 85). Propodeum smooth (*e.g.*, Figs 2, 86)..... **18**

- 18 Fore wing with M 1.55–1.60× as long as S (Fig. 3). Eye height 3.00–3.10× as long as malar space. Scutellum finely reticulate, dorsellum smooth (Fig. 2)...
 *P. acuminata* (Thomson)
- Fore wing with M 1.80–1.85× as long as S (Fig. 85). Eye height 2.10–2.16× as long as malar space. Scutellum coarsely reticulate, dorsellum alutaceous (Fig. 86).....*P. zhangyiensis* Yang

***Plutothrix acuminata* (Thomson, 1878)**

Figs 1–4

Trigonoderus acuminatus Thomson, 1878: 13. Lectotype female (LUZN, not examined) designated by Kerrich and Graham 1957: 297.

Plutothrix cisae Hedqvist, 1966: 194. Holotype female missing (Forshage et al. 2016).
 Synonymy by Graham (1993: 117).

Material examined. *Paratype* female (ZMUH): “Suomi [Finland], EH, Luopioinen, 7.8.1963, E. Kangas”, “Paratypus *Plutothrix cisae* Hedqvist, 1966”. **Other material:** FINLAND (in ZMUH): 1 female, **Ta** [biogeographical province Tavastia australis], Aitolahti, 22.VII.1932, coll. V. Saarinen, *Plutothrix acuminata* (Thom.) det. Koponen 2009. RUSSIA (all in ZISP): **Belgorod Prov.**, 1 female, 1 male, 10 km S Novy Oskol City, 50°40.683'N, 37°48.551'E, 15.VIII.2020, coll. S. Belokobylskij and O. Kosheleva.

Distribution. Belgium, Canada, Croatia, Czech Republic, Finland, France, Hungary, Netherlands, Russia (European part), Slovakia, Spain, Sweden, United Kingdom (Noyes 2019; Tselikh 2019).

Biology. Primary parasitoid of *Cis boleti* (Scopoli, 1763) (Coleoptera, Ciidae) in tree fungus Graham (1969), and *Platypeza* sp. (Diptera, Platypezidae) (Heydon 1997).

***Plutothrix bicolorata* (Spinola, 1808)**

Figs 5–8

Diplolepis bicolorata Spinola, 1808: 221–222. Type specimens probably lost (Graham 1993: 117).

Plutothrix bicolorata (Spinola, 1808) new combination in Graham 1993: 116–117.

Pteromalus invenustus Walker, 1836: 11. Lectotype male (NHMUK, not examined). Designated by Kerrich and Graham (1957: 294). Synonymy by Graham (1993: 116).

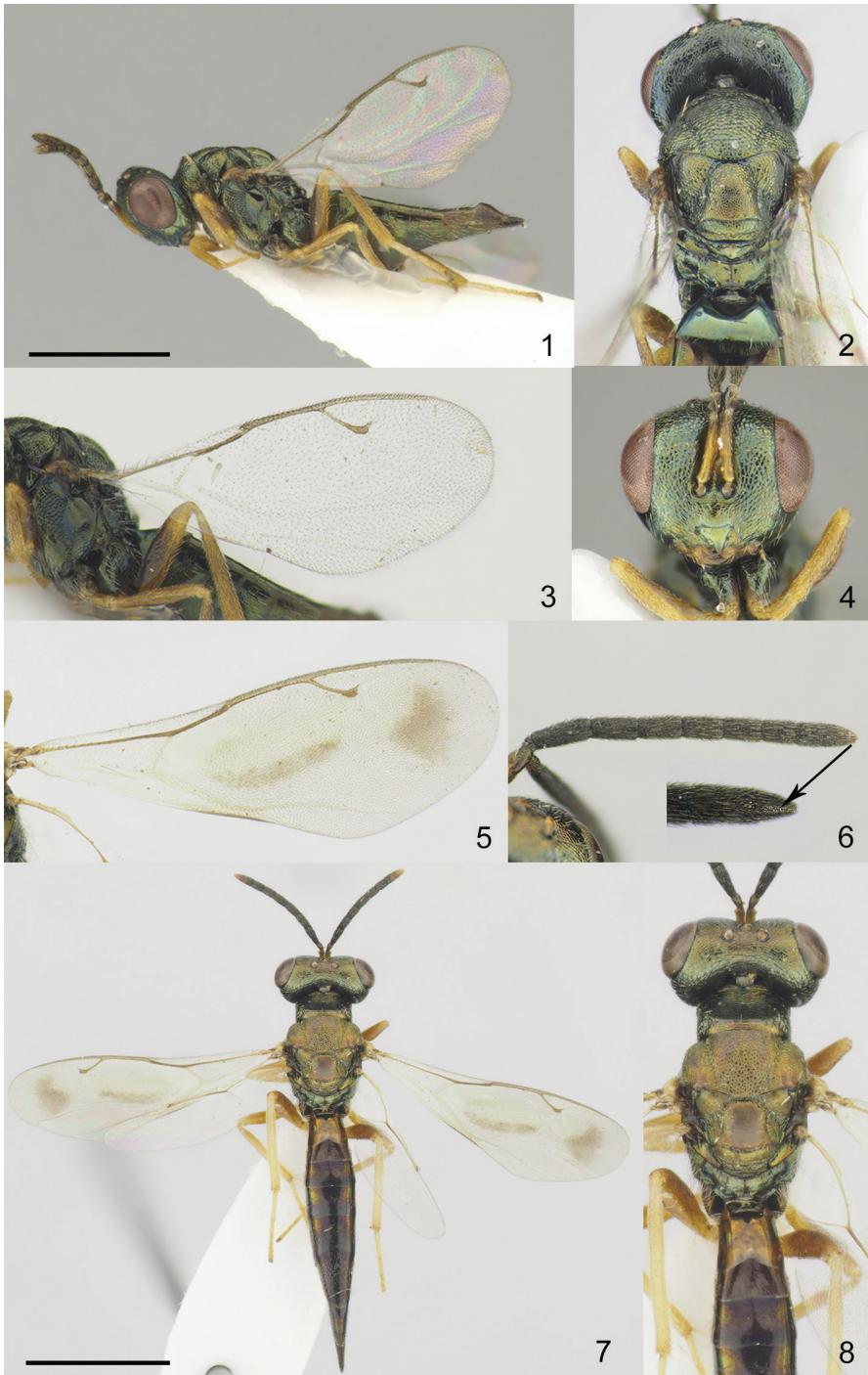
Pteromalus praepileus Walker, 1836: 12. Lectotype female (NHMUK, not examined). Designated by Kerrich and Graham (1957: 295). Synonymy by Graham (1993: 116).

Pteromalus scenicus Walker, 1836: 10. Lectotype female (NHMUK, not examined). Designated by Kerrich and Graham (1957: 294). Synonymy by Graham (1993: 116–117).

Trigonoderus apicalis Thomson, 1878: 12–13. Lectotype female (LUZN, not examined). Designated by Kerrich and Graham (1957: 294). Synonymy by Graham (1993: 116).

Trigonoderus vittiger Thomson, 1878: 12. Lectotype female (LUZN, not examined). Designated by Kerrich and Graham (1957: 294). Synonymy by Graham (1993: 116).

Material examined. Other material: FINLAND (all in ZMUH): **A** [Alandia], 1 female, “Lemland, Nordman, 5375, coll. Nordman”, “*Plutothrix scenicus* (Walk.) det. Hedqvist, 1973”; **Ab** [Regio aboënsis], 1 female, “Finland, 669:25, Sauvo, Karuna, 23.VII–9.VIII.2000, Malaise trap, coll. R. Jussila”, “*Plutothrix bicolorata* (Spinola) det. Tselikh 2021”; 1 female, “Finland, 669370:323763, V, Parainen, Malaise 1A, 19.07–02.08.2020, coll. S. Väänänen, J. Paukkunen”, “*Plutothrix bicolorata* (Spinola) det. Tselikh 2021”; 1 female, 1 male, “Äppelö, E. Ölund”, “*Plutothrix bicolorata* (Spinola) det. Tselikh 2021”; **N** [Nylandia], 1 female, “Borgå, Fennia, Hellén”, “*P. scenicus* Thom. Det. Kerrich 1956”, “*Plutothrix bicolorata* (Spin.) det. Koponen 09”. RUSSIA (all in ZISP): **Smolensk Prov.**, 1 female, 1 male, near Smolensk City, 54°49'10"N, 32°05'09"E, 23.VIII.2020, coll. E. Tselikh; **Belgorod Prov.**, 13 females, 17 males, Roven'skii Distr., Roven'ki Vill., “Roven'ki Nature Park,” “Aydar,” 49°59'01"N, 38°53'23"E, 12–13.VIII.2020, coll. S. Belokobylskij, K. Fadeev and E. Tselikh; 8 females, 5 males, Novooskolskii Distr., 10 km S of Novy Oskol City, “Belogorie” Reserve, “Stenki Izgor'ya,” 50°40'41"N, 37°48'33"E, 15.VIII.2020, coll. S. Belokobylskij and O. Kosheleva; 15 females, 32 males, Borisovskii Distr., Borisovka Vill., “Belogorie” Reserve, “Les na Vorskle,” 50°36'34"N, 35°58'55"E, 17.VIII.2020, coll. S. Belokobylskij, K. Fadeev and O. Kosheleva; 16 females, 45 males, Borisovka Vill., “Melkiy les,” 55°39'20"N, 36°00.38'E, coll. S. Belokobylskij, K. Fadeev, O. Kosheleva and E. Tselikh; **Voronezh Prov.**, 20 females, 24 males, Bogucharskii Distr., 20 km SW of Boguchar City, “Khripunskaya Steppe,” 49°35'58"N, 40°23'56"E, 8–9.VIII.2020, coll. S. Belokobylskij, O. Kosheleva, E. Tselikh; 6 females, Kantemirovskii Distr., 20 km SW of Rossosh' City, Zhilino Vill., 49°49'58"N, 39°19'48"E, 10–11.VIII.2020, coll. S. Belokobylskij, O. Kosheleva and E. Tselikh; **Krasnodar Reg.**, 4 females, Sochi City, Lazarevskoe, 27.V.1979, 18.VI.1979 coll. V. Tobias; 3 females, 1 male, Sochi City, Soloniki Vill., 20.X.1980, coll. V. Tobias; 1 female, Goryachij kluch City, Kesukh River, 44°26'19"N, 39°01'52"E, 25.VIII.2015, coll. D. Rachin and E. Tselikh; 4 females, 1 male, Sochi City, “Mamedova Shchel”, 43°57'20"N, 39°18'39"E, 28.VII.2020, coll. S. Belokobylskij, K. Fadeev and E. Tselikh; 3 females, 4 males, 5 km SEE Aderbeevka Vill., 44°37'30"N, 38°09'16"E, 26.VII.2020, coll. E. Tselikh; 3 females, 1 male, Sochi City, Kalezh Vill., 44°00'25"N, 39°22'03"E, 30.VII.2020, coll. O. Kosheleva and



Figures 1–8. *Plutothrix acuminata* (Thomson, 1878), non-type female (1–4) 1 body, lateral view 2 head and mesosoma, dorsal view 3 fore wing 4 head, frontal view. *Plutothrix bicolorata* (Spinola, 1808), non-type female (5–8) 5 fore wing 6 antenna 7 body, dorsal view 8 head, mesosoma and part of metasoma, dorsal view. Scale bars: 0.8 mm (1); 2.1 mm (7).

E. Tselikh; **Adygea Rep.**, 1 female, Guzeripl' Vill., Kavkazsky Reserve, 21.VI.1976, coll. D. Kasparyan; **Karachay-Cherkess Rep.**, 1 female, 1 male, Teberda, 8.VI.1976, coll. D. Kasparyan; **Ingushetia Rep.**, 1 female, 14 km E Verkhny Alkun Vill., 10.VI.1972, coll. D. Kasparyan.

Distribution. Belgium, Croatia, Czech Republic, Finland, Germany, Hungary, Italy, Moldova, Netherlands, Romania, Russia (European part), Serbia, Slovakia, Spain, Sweden, Switzerland, United Kingdom (Noyes 2019; Tselikh 2019).

Biology. Primary parasitoid of *Anobium punctatum* (De Geer, 1774) and *Ernobius abietis* (Fabricius, 1792) (Coleoptera, Anobiidae) (Graham 1969).

Plutothrix canariensis Hedqvist, 1974

Figs 9–13

Plutothrix canariensis Hedqvist, 1974: 26–28. Holotype female (NHMUK, examined).

Description. Male. Body length 2.60 mm. Fore wing length 2.40 mm.

Head, mesosoma, metasoma Mt2 metallic green with diffuse coppery lustre, Mt3–Mt6 yellowish-brown, Mt7–Mt8 brown. Antenna with scape yellowish-brown, pedicel and flagellum brown. Fore and hind coxa basally metallic green with diffuse coppery lustre, apically yellowish-brown, mid coxa yellowish-brown; all femora, tibiae, and tarsi yellowish-brown. Fore wing with brownish tint and fuscous cloud touching stigma, venation yellowish-brown.

Head in dorsal view 2.20× as broad as long and 1.36× as broad as mesoscutum; in frontal view 1.40× as broad as high. POL as long as OOL. Eye height 1.25× eye length and 2.35× as long as malar space. Distance between antennal toruli and lower margin of clypeus 0.92× distance between antennal toruli and median ocellus. Antenna with scape 0.80× as long as eye height and as long as eye length; pedicel 1.80× as long as broad and 0.37× as long as F1; combined length of pedicel and flagellum 2.36× breadth of head; F1 4.80× as long as broad, F3–F6 longer than broad; clava 4.50× as long as broad.

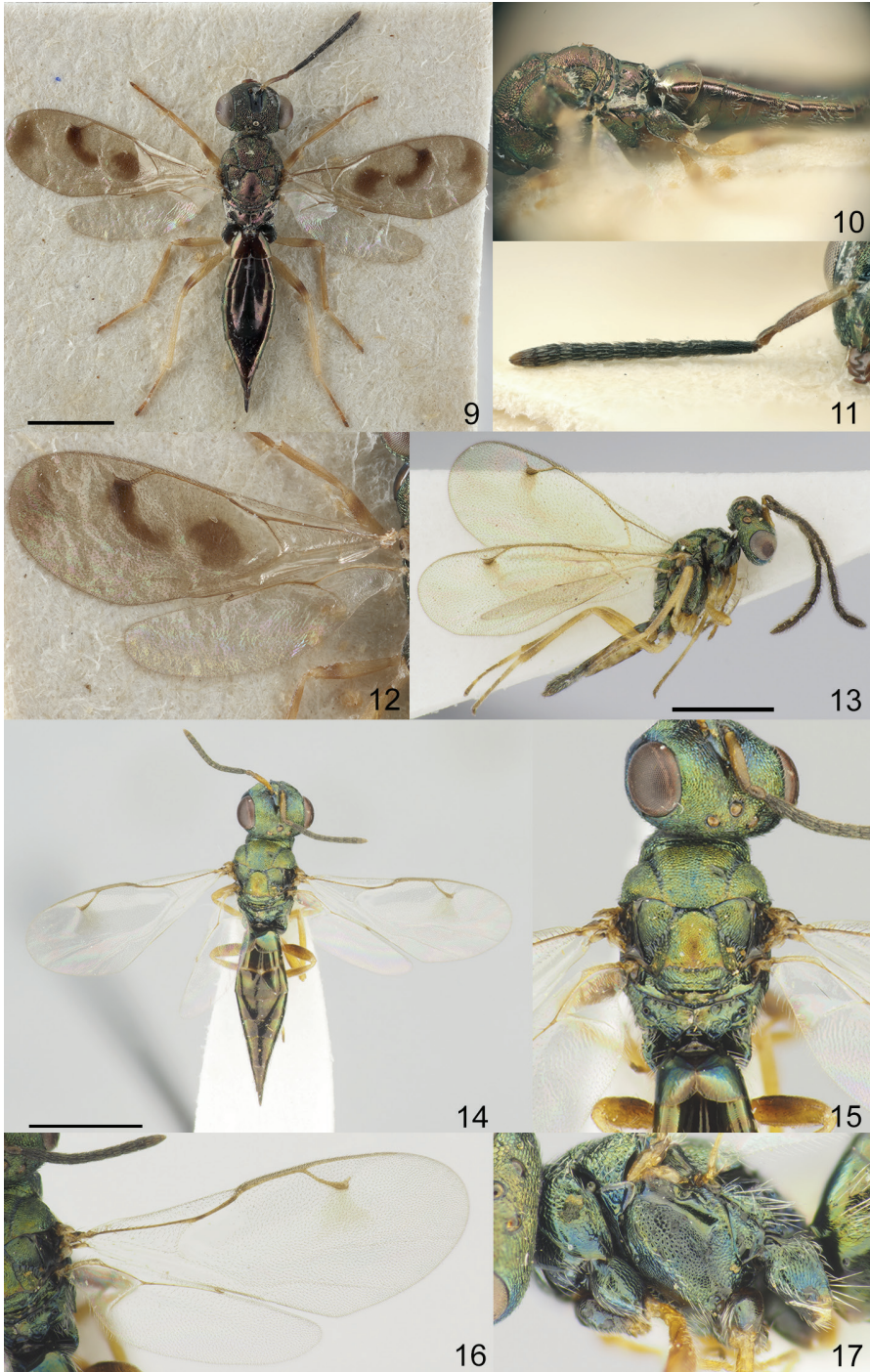
Mesosoma 1.87× as long as broad. Scutellum finely reticulate, 1.2× as long as broad. Propodeum without nucha, 0.65× as long as scutellum; median carina present. Metapleuron alutaceous, upper mesepimeron smooth. Fore wing 2.40× as long as maximum width; basal cell, cubital vein, basal vein setose; speculum closed; PST 0.43× as long as M, M 0.97× as long as PM and 2.30× as long as S.

Metasoma 2.60× as long as broad, 1.15× as long as mesosoma and 0.89× as long as mesosoma and head.

Material examined. Holotype female (NHMUK): “Tenerife IV 1967 leg. T. Palm”, “HOLOTYPUS *Plutothrix canariensis* ♀ sp.n. K.J. Hedqvist det. 1970”, “Hedqvist coll. BMNH(E) 2011-27”, “HOLOTYPE”, “B.M. TYPE HYM 5.4754”, NHMUK 013457290. **Other material:** SPAIN, CANARY ISLANDS (all in ZMUH): 1 female, 1 male, Tenerife, Los Silos Monte del Aqua, 16.XI.2000, coll. M. Koponen.

Distribution. Canary Islands.

Biology. Unknown.



Figures 9–17. *Phutothrix canariensis* Hedqvist, 1974, holotype female (9–12), non-type male (13) 9 body, dorsal view 10 mesosoma and metasoma, lateral view 11 antenna 12 wings 13 body, lateral view. *Phutothrix coelius* (Walker, 1839), non-type female (14–17) 14 body, dorsal view 15 head and mesosoma, dorsal view 16 wings 17 mesosoma, lateral view. Scale bars: 1.05 mm (9); 0.85 mm (13); 1.3 mm (14).

***Plutothrix coelius* (Walker, 1839)**

Figs 14–17

Anoglyphis nubilosa Förster, 1878: 49. Type female (possibly in Berlin University Museum, not examined). Synonymy by Kerrich and Graham (1957: 296).

Pteromalus britannicus Morley, 1910: 47 (*n.n. pro coelius* Walker 1848 *non* 1839). Lectotype female (not located in NHMUK collection). Designated by Graham (1969:105). Synonymy by Graham (1969: 105).

Pteromalus coelius Walker, 1839: 272. Lectotype female (NHMUK, not examined). Designated by Kerrich and Graham (1957: 297).

Pteromalus eleuthera Walker, 1848: 193. Lectotype female (NHMUK, not examined). Designated by Kerrich and Graham (1957: 298). Synonymy by Kerrich and Graham (1957: 296).

Material examined. Other material: FINLAND (all in ZMUH): **Ab**, 1 female, Nystad, M. Hellén, 1841, *Plutothrix coelius* (Walker) det. M. Koponen 2009; 1 female, Suomi, V. Karjalohja, 16.07.1964, coll. Jonny Perkiömäki, *Plutothrix coelius* (Walker) det. M. Koponen 1982; 1 female, Nystad, M. Hellén, 609, *Plutothrix coelius* (Walker) det. Tselikh, 2021; **Ka** [Karelia australis], 1 female, Fennia, Virolahti, 671:53, 16–21.07.1974, coll. V.J. Karvonen, *Plutothrix coelius* (Walker) det. M. Koponen; 1 female, Fennia, Vehkalahti, 01.07.1961, leg. E. Valkeila, *Plutothrix scenicus* (Walker) det. E. Valkeila, *Plutothrix coelius* (Walker) det. Tselikh 2021; **St** [Satakunta], 1 female, Suomi, Suoniemi, 28.06.1947, *Plutothrix coelius* (Walker) det. Tselikh 2021; **Ta**, 1 female, Tampere, Grönblom, 15.05.57, coll. Th. Grönblom, *Plutothrix coelius* (Walker) det. M. Koponen; 1 female, Pirkkala, Grönblom, coll. Th. Grönblom, *Trigonoderus acuminatus* Thomson det. Hellén, *Plutothrix coelius* (Walker) det. M. Koponen; 1 female, Fennia, Hämeenlinna, 67736, 26.06.1970, coll. Erkki Valkeila, *Plutothrix coelius* (Walker) det. M. Koponen 1982; 1 female, Fennia, Hämeenlinna, 67736, 27.06.1971, coll. Erkki Valkeila, *Plutothrix coelius* (Walk.) det. Valkeila; 1 female, Fennia, Pälkäne, 680:35, e.l.1976, leg. Esko Saarela, *Plutothrix coelius* (Walker) det. M. Koponen; **Sa** [Savonia australis], 1 female, Suomi, Mikkelin mlk., 6830:501, 22.06.1979, leg. M. Koponen, *Plutothrix coelius* (Walker) det. M. Koponen; 1 female, Suomi, Mikkelin mlk., 6830:501, 10.07.1981, leg. M. Koponen, *Plutothrix coelius* (Walker) det. M. Koponen; 1 female, Suomi, ES, Ristiina, 6826:502, 06.07.1947, leg. M. Koponen, *Plutothrix coelius* (Walker) det. M. Koponen; 1 female, Suomi, Mikkelin mlk, 6830:501, 12.07.1981, leg. M. Koponen, *Plutothrix coelius* (Walker) det. M. Koponen; 2 females, Finland, Sa, Mikkeli, 6835:3503, 12.06.2011, leg. M. Koponen, *Plutothrix coelius* (Walker) det. M. Koponen 2011; 1 female, Suomi, Mikkelin mlk, 6830:501, 17.08.1976, leg. M. Koponen, *Plutothrix coelius* (Walker) det. M. Koponen; 1 female, Finland, Ristiina, 6826:502, 25.07.1985, leg. M. Koponen, *Plutothrix coelius* (Walker) det. M. Koponen; 1 female, Suomi, Mikkelin mlk, 6830:501, 30.06.1975, leg. Koponen, *Plutothrix coelius* (Walker) det. M. Koponen; 1 female, Suomi, ES, Ristiina, 6826:502, 24.06.1976, leg. Koponen, *Plutothrix coelius* (Walker) det. M. Koponen; 2 females, Finland, 6826:502, Ristiina, 22.07.1996, leg. M. Koponen, *Plutothrix coelius*

(Walker) det. Tselikh 2021; **Oa** [Ostrobothnia australis], 1 female, Helsinki, Nordman, 427, *Plutothrix coelius* (Walker) det. M. Koponen; **Kb** [Karelia borealis], 1 female, Suomi, PK, Tohmajärvi, 6908:660, 22.07.1982, leg. M. Koponen, *Plutothrix coelius* (Walker) det. M. Koponen, 1982. RUSSIA (all in ZISP): **Novgorod Prov.**, 2 females, Tychkino, 20 km NW Pestovo Vill., 25.VI.1991, coll. V. Tobias; **Altai Rep.**, 1 female, 20 km SE Onguday Vill., 16.VII.2007, coll. S. Belokobylskij; **Kamchatka Reg.**, 1 female, 8 km S Kozyrevsk Vill., 16.VIII.1985, coll. D. Kasparyan; 1 male, Kozyrevsk Vill., 17.VIII.1985, coll. S. Belokobylskij.

Distribution. Belgium, Croatia, Finland, Germany, Hungary, Moldova, Netherlands, Norway, Russia (European part of Russia, Western Siberia, Russian Far East), Romania, Sweden, United Kingdom (Noyes 2019; Tselikh 2019).

Biology. Primary parasitoid of coleopterans *Anobium punctatum* (De Geer, 1774) (Anobiidae) Graham (1969) and *Xylechinus pilosus* (Ratzeburg, 1837) (Curculionidae) (Herting 1973).

***Plutothrix gribanovi* Tselikh, Várkonyi & Dale-Skey, sp. nov.**

<https://zoobank.org/78437246-CA0E-40DF-9503-72FBD29DC951>

Figs 18–28

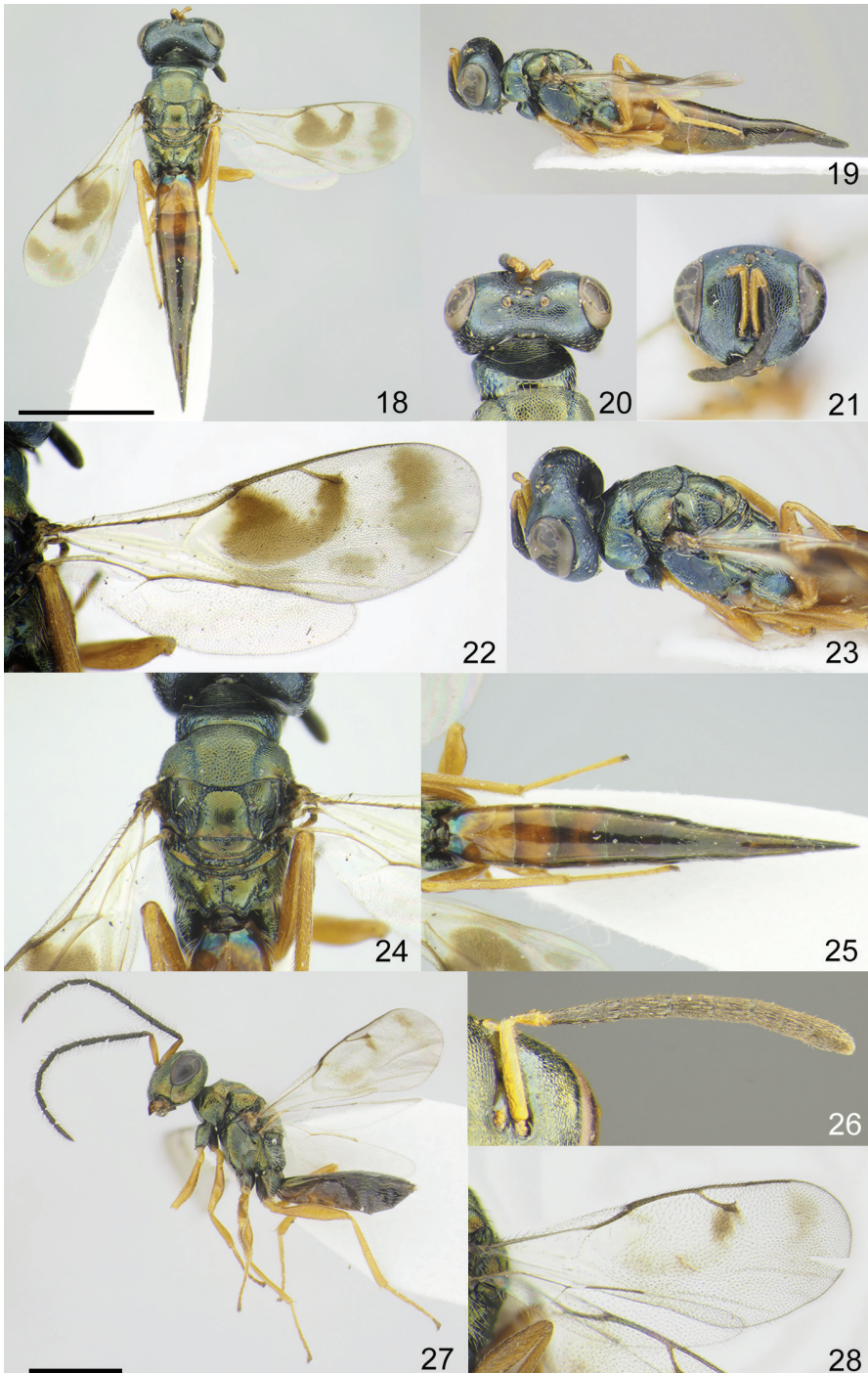
Comparison. *Plutothrix gribanovi* is similar to *P. canariensis* Hedqvist and *P. trifasciata* (Thomson); the differences between these species are given in the key.

Description. Female. Body length 4.90–7.20 mm. Fore wing length 3.00–3.90 mm.

Head dark metallic blue; mesosoma metallic green with diffuse coppery lustre; metasoma with Mt2 basally metallic bluish-green, apically yellowish-brown, Mt3, Mt4, sometimes Mt5 yellowish-brown, Mt6–Mt8 dark brown; ovipositor sheath black. Antenna with scape and pedicel yellow, flagellum brown. All coxae metallic green with diffuse coppery lustre; all femora, tibiae and tarsi yellow except last segment yellowish-brown. Fore wing with three or four fuscous clouds, venation yellowish-brown.

Head in dorsal view 2.10–2.20× as broad as long and 1.25–1.35× as broad as mesoscutum; in frontal view 1.30–1.40× as broad as high. POL 0.96–1.00× OOL. Eye height 1.42–1.45× eye length and 2.60–2.70× as long as malar space. Distance between antennal toruli and lower margin of clypeus 0.75–0.76× distance between antennal toruli and median ocellus. Antenna with scape 0.80–0.85× as long as eye height and 1.15–1.20× as long as eye length; pedicel 2.00–2.16× as long as broad and 0.46–0.52× as long as F1; combined length of pedicel and flagellum 1.33× breadth of head; F1 2.85–3.10× as long as broad, F3–F6 longer than broad; clava 2.35–2.44× as long as broad.

Mesosoma 1.65–1.70× as long as broad. Scutellum finely reticulate, 1.0–1.05× as long as broad. Propodeum without nucha, 0.86–0.90× as long as scutellum; median carina present; sculpture alutaceous. Metapleuron alutaceous, upper mesepimeron smooth. Fore wing 2.67–2.85× as long as maximum width; basal cell bare; cubital vein bare; basal vein setose; speculum partly open; PST 0.53–0.66× as long as M, M 0.78–0.80× as long as PM and 1.68–1.70× as long as S.



Figures 18–28. *Plutothrix gribanovi* sp. nov., holotype female (18–26), paratype male (27, 28) 18 body, dorsal view 19 body, lateral view 20 head, dorsal view 21 head, frontal view 22 wings 23 head and mesosoma, dorso-lateral view 24 mesosoma, dorsal view 25 metasoma, dorsal view 26 antenna 27 body, lateral view 28 fore wing. Scale bars: 2.1 mm (18), 1.1 mm (27).

Metasoma 4.47–5.15× as long as broad, 1.90–2.02× as long as mesosoma and 1.45–1.48× as long as mesosoma and head; Mt2 deeply emarginate medially, Mt8 1.90–2.10× as long as broad. Ovipositor sheath projecting beyond apex of metasoma.

Male. Body length 3.1–4.0 mm. Fore wing length 2.7–3.1 mm.

Head metallic green with diffuse coppery lustre; metasoma brown with diffuse coppery or metallic green lustre. Fore wing with four fuscous clouds, venation yellowish-brown.

Head in dorsal view 1.20–1.31× as broad as mesoscutum. Eye height 1.50–1.60× eye length and 2.10–2.30× as long as malar space. Distance between antennal toruli and lower margin of clypeus 1.28–1.40× distance between antennal toruli and median ocellus. Pedicel 1.60–1.63× as long as broad and 0.30–0.32× as long as F1; combined length of pedicel and flagellum 2.34× breadth of head; F1 5.60–7.00× as long as broad; clava 4.66× as long as broad.

Metasoma 4.60–5.30× as long as broad, 1.12–1.16× as long as mesosoma and 0.86–0.87× as long as mesosoma and head. Otherwise, similar to female.

Etymology. The species is named in honour of the senior author's brother, Sergej Gribanov.

Material examined. *Holotype* female (deposited in ZISP): "RUSSIA, **Altai Rep.**, 30 km S Kuray, 31.VII.2007, coll. A. Khalaim".

Paratypes (ZISP): RUSSIA: **Krasnodar Reg.**, 1 male, Sochi City, Lazarevskoe, 28.V.1974, coll. Tobias; 1 female, same locality, 3–6.VI.1974, coll. V. Tobias; 3 females, same locality, 14–26.VI.1979, coll. Tobias; 1 female, Sochi City, Golovinka, 9.IV.1975, coll. V. Tobias; 1 female, Sochi City, Lazarevskoe, Polkovnich'ya balka, 43°53'48"N, 39°21'18"E, 31.VII.2020, coll. Tselikh; 1 male, Sochi City, Mamedova shchel', 43°57'11"N, 39°18'27"E, 29.VII.2020, coll. K. Fadeev.

Distribution. Russia (European part, Western Siberia).

Biology. Unknown.

Plutothrix kubo Kamijo, 2004

Figs 29–32

Plutothrix kubo Kamijo, 2004: 297–299. Holotype female (EIHU, examined).

Material examined. *Holotype* female (EIHU): JAPAN: **Kanagawa Pref.**, "Kanazawa-ku, Yokohama, Honshu, 19.iii.1995, coll. K. Kubo", "Holotype *Plutothrix kubo* Kamijo". *Paratype* female (EIHU): **Kanagawa Pref.**, "Nishi tanzawa, 16.V.1993, coll. K. Kubo", "Paratype *Plutothrix kubo* Kamijo". **Other material:** JAPAN (EUM): **Shimane Pref.**, 1 female, Honshu, Hirose Town, Nogi-gun, 8.IV.1980, coll. Seiyama. RUSSIA (ZISP): **Kamchatka Reg.**, 1 female, Mil'kovo Town, 7.VIII.1985, coll. S. Belokobylskij.

Distribution. Russia (Far East), Japan.

Biology. Unknown.

***Plutothrix kusigematii* Kamijo, 2004**

Figs 33–37

Plutothrix kusigematii Kamijo, 2004: 299–300. Holotype female (EIHU, examined).

Material examined. *Holotype* female (EIHU): JAPAN: **Hokkaido Pref.**, “Sapporo, Hokkaido, 13.ix.1968, coll. K. Kusigemati”, “Holotype *Plutothrix kusigematii* Kamijo”. *Paratype* female (EIHU): **Kanagawa Pref.**, “Japan: Ishikawa, Fujisawa, 11.V.2001, coll. I. Waki”, “Paratype *Plutothrix kusigematii* Kamijo”. **Other material:** RUSSIA (all in ZISP): **Sakhalin Prov.**, 1 female, Kunashir, Severyanka River, 24–28.IX.2013, coll. Yu. Sundukov; **Tyumenskaya Prov.**, 2 females, Tyumen’ City, Andreevskoe Lake, 57°01'13"N, 65°46'16"E, 9.VII.2021, coll. S Belokobylskij and E. Tselikh.

Distribution. Russia (Eastern Siberia, Far East), Japan.

Biology. Unknown.

***Plutothrix longigaster* Tselikh, Várkonyi & Dale-Skey, sp. nov.**

<https://zoobank.org/BF2FF3E5-AA81-4A27-819F-A449D531B887>

Figs 38–46

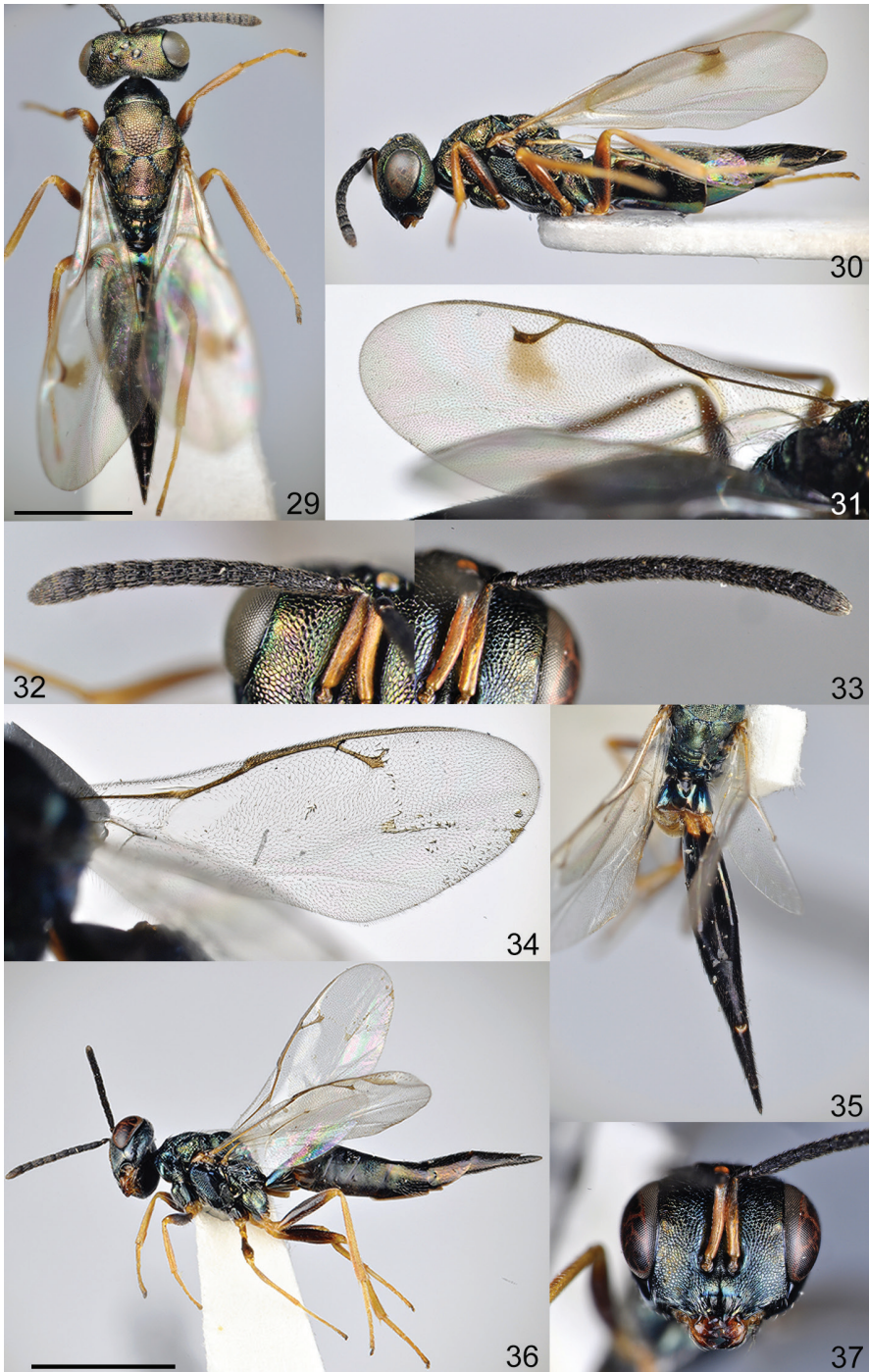
Comparison. *Plutothrix longigaster* is similar to *P. kusigematii* Kamijo and *P. rugosa* Kamijo; the differences between these species are given in the key.

Description. Female. Body length 5.10–6.70 mm. Fore wing length 3.20–3.80 mm.

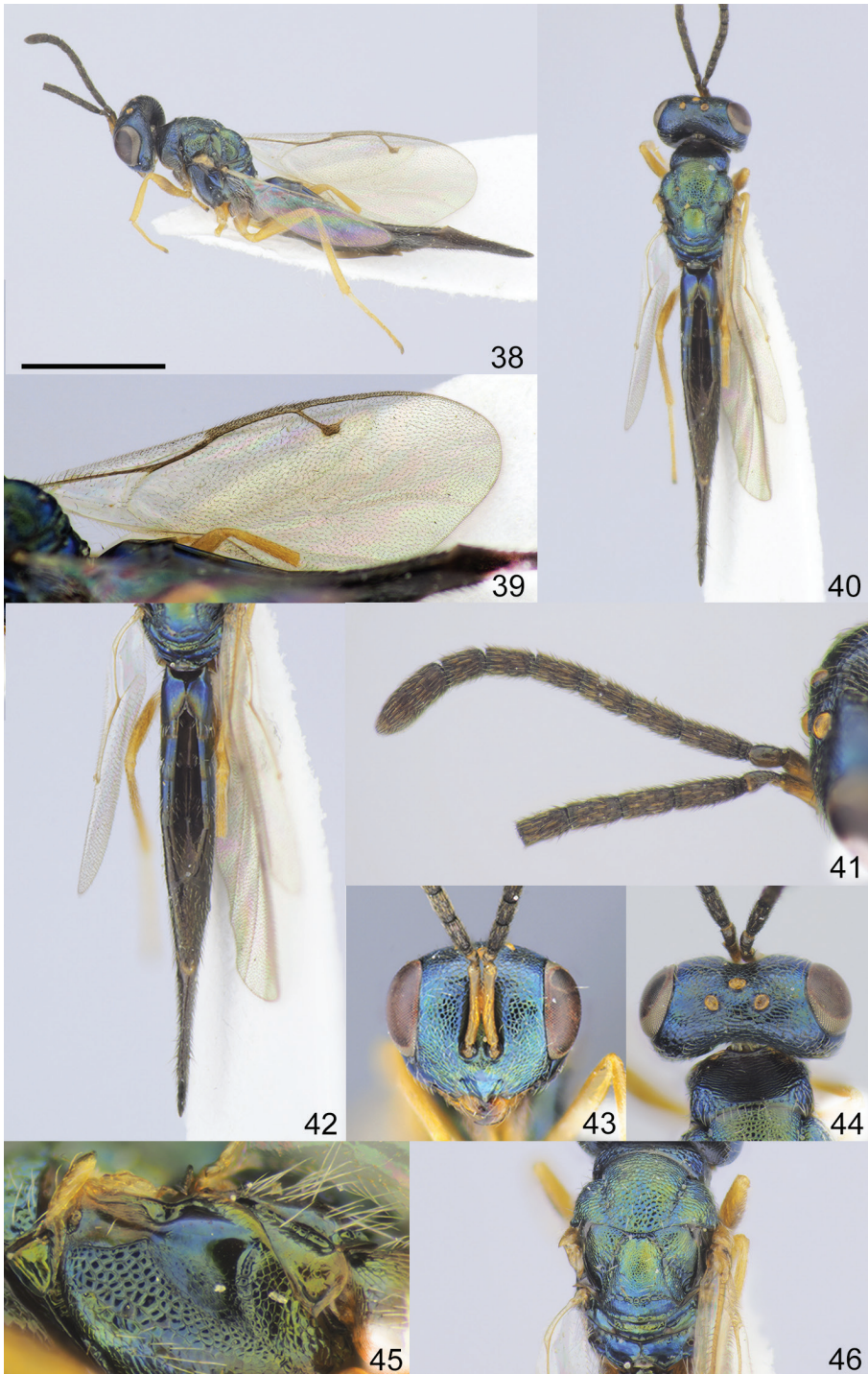
Head, mesosoma and Mt2–Mt4 metallic bluish-green with diffuse coppery lustre; Mt5–Mt8 brown; ovipositor sheath black. Antenna with scape yellowish-brown, pedicel and flagellum brown. Fore and hind coxae yellowish-brown, mid coxa yellow; all femora, tibiae and tarsi yellow except last segment yellowish-brown. Fore wing with light brownish tint, venation yellowish-brown.

Head in dorsal view 2.10–2.17× as broad as long and 1.25–1.30× as broad as mesoscutum; in frontal view 1.05–1.20× as broad as high. POL 0.89–1.05× OOL. Eye height 1.38–1.47× eye length and 2.80–3.00× as long as malar space. Distance between antennal toruli and lower margin of clypeus 0.6× distance between antennal toruli and median ocellus. Antenna with scape 0.80–0.85× as long as eye height and 1.15–1.20× as long as eye length; pedicel 1.70–1.95× as long as broad and 0.55–0.65× as long as F1; combined length of pedicel and flagellum 1.40–1.57× breadth of head; F1 2.15–2.35× as long as broad, F3–F6 longer than broad; clava 2.70–2.90× as long as broad.

Mesosoma 1.65–1.70× as long as broad. Scutellum weakly and finely reticulate, 1.00–1.05× as long as broad. Propodeum without nucha, 0.40–0.55× as long as scutellum; median carina present; sculpture smooth. Metapleuron alutaceous, upper mesepimeron with lower part alutaceous, upper part smooth. Fore wing 2.95–3.25× as long as maximum width; basal cell, cubital vein and basal vein setose; speculum closed; PST 0.66–0.68× as long as M, M 0.75–0.80× as long as PM and 2.0–2.2× as long as S.



Figures 29–37. *Plutothrix kuboii* Kamiyo, 2004, paratype female (**29–32**) **29** body, dorsal view **30** body, lateral view **31** fore wing **32** antenna. *Plutothrix kusigematii* Kamiyo, 2004, paratype female (**33–37**) **33** antenna **34** fore wing **35** metasoma, dorsal view **36** body, lateral view **37** head, frontal view. Scale bars: 1.25 mm (**29**); 2.5 mm (**36**).



Figures 38–46. *Plutothrix longigaster* sp. nov., holotype female (38–46) 38 body, lateral view 39 fore wing 40 body, dorsal view 41 antenna 42 metasoma, dorsal view 43 head, frontal view 44 head, dorsal view 45 mesosoma, lateral view 46 mesosoma, dorsal view. Scale bar: 1.7 mm (38).

Metasoma 8.50–9.00× as long as broad, 2.50–2.70× as long as mesosoma and 1.84–1.94× as long as mesosoma and head; Mt2 deeply emarginate medially, Mt8 4.40–5.25× as long as broad. Ovipositor sheath projecting beyond apex of metasoma.

Male unknown.

Etymology. The name of the species refers to its long gaster (metasoma); noun in apposition.

Material examined. *Holotype* female (deposited in ZISP): RUSSIA: **Altai Rep.**, Chermal Vill., 20.VII.2007, coll. S Belokobylskij. *Paratypes* 1 female, (ZISP): RUSSIA: **Amur Reg.**, 10 km E Arkhary, Arkhara River, 24.VII.2003, coll. S Belokobylskij; 1 female (ZMUH): FINLAND: **Kb**, Ilomantsi, 20.VII.1865, on *Populus tremula*, coll. Woldstedt, 2466.

Distribution. Finland (single West Palaearctic record of this species), Russia (Western Siberia, Far East).

Biology. Unknown.

Plutothrix narendrani Kamijo, 2004

Figs 47–51

Plutothrix narendrani Kamijo, 2004: 300–302. Holotype female, (EIHU, examined).

Material examined. *Holotype* female (EIHU): JAPAN: **Hokkaido Pref.**, “Jozankei, Sapporo, Hokkaido, 20.vi.1967, coll. K. Kusigemati”, “Holotype *Plutothrix narendrani* Kamijo”. *Paratype* female (EIHU): “JAPAN: **Hokkaido Pref.**, Jozankei, 20.VI.1967, coll. K. Kusigemati”, “Paratype *Plutothrix narendrani* Kamijo”; male (EIHU): “**Hokkaido Pref.**, Sapporo, 21.V.1967, coll. K. Kusigemati”, “Paratype *Plutothrix narendrani* Kamijo”. **Other material:** RUSSIA (all in ZISP): **Sakhalin Prov.**, 1 female, Kunashir, Alekhino Vill., 11–13.VI.1973, coll. D. Kasparyan; 1 male, Kunashir, Treť yakovo Vill., 29.VII.2011, coll. D. Rachin and E. Tselikh; 1 female, Kunashir, Stolbchatiy, 01.VIII.2011, coll. D. Rachin and E. Tselikh; 1 female, Kunashir, Ivanovskiy Cape, 17–20.IX.2013, coll. Yu. Sundukov.

Distribution. Russia (Far East), Japan.

Biology. Unknown.

Plutothrix nudicoxa Graham, 1993

Figs 52–55

Plutothrix nudicoxa Graham, 1993: 115. Holotype female (NHMUK, examined).

Material examined. *Holotype* female (NHMUK): “CROATIA: Krapina. Prunus 22.7.1909 Hensch”, “Holotype”, “*Plutothrix nudicoxa* sp. n. M. de V. Graham det. 1993”, “B.M. TYPE HYM 5.3682”, “NHMUK 013457265”. **Other material:** FINLAND (ZMUH): 1 female, “**Ab**, Nystad, Hellén, 13”, “*P. scenicus vittiger* Thom. Det. Kerrich 1956”, “*Plutothrix bicolorata* (Spin.) det. Koponen 09”, “*Plutothrix nudicoxa* Graham det. Tselikh, 2021”.



Figures 47–55. *Plutothrix narendrani* Kamijo, 2004, paratype female (47–51) 47 body, dorsal view 48 body, lateral view 49 antenna 50 fore wing 51 scutellum, dorsal view. *Plutothrix nudicoxa* Graham, 1993, holotype female (52–55) 52 body, lateral view 53 body, dorsal view 54 hind coxa 55 antenna. Scale bars: 1.4 mm (47); 1.8 mm (53).

Distribution. Croatia, Czech Republic, Finland (**new record**), United Kingdom (Graham 1993; Noyes 2019).

Biology. Unknown.

***Plutothrix obtusiclava* Graham, 1993**

Figs 56–59

Plutothrix obtusiclava Graham, 1993: 116. Holotype female (NHMUK, not examined).

Material examined. Other material: RUSSIA (ZISP): **Voronezh Prov.**, 1 female, Khopersky Reserve, VI.1969, coll. T. Gur'yanova.

Distribution. England, Switzerland, Russia (**new record**) (Graham 1993; Noyes 2019).

Biology. Unknown.

***Plutothrix pallidiclava* Graham, 1993**

Figs 60–63

Plutothrix pallidiclava Graham, 1993: 112–114. Holotype female, (NBC, examined).

Material examined. Holotype female (NBC): GREECE: “Ellàs Lésvos A.C. & W. N. Ellis”, “3 km NW Ayia Paraskevi, 7.XI.1973”, “*Plutothrix pallidiclava* sp.n. M. de V. Graham det. 1993 HOLOTYPE”, “collective Zoölogisch Museum Amsterdam”, “ZMA.INS. 5107052”.

Distribution. Greece.

Biology. Unknown.

***Plutothrix perelegans* Graham, 1993**

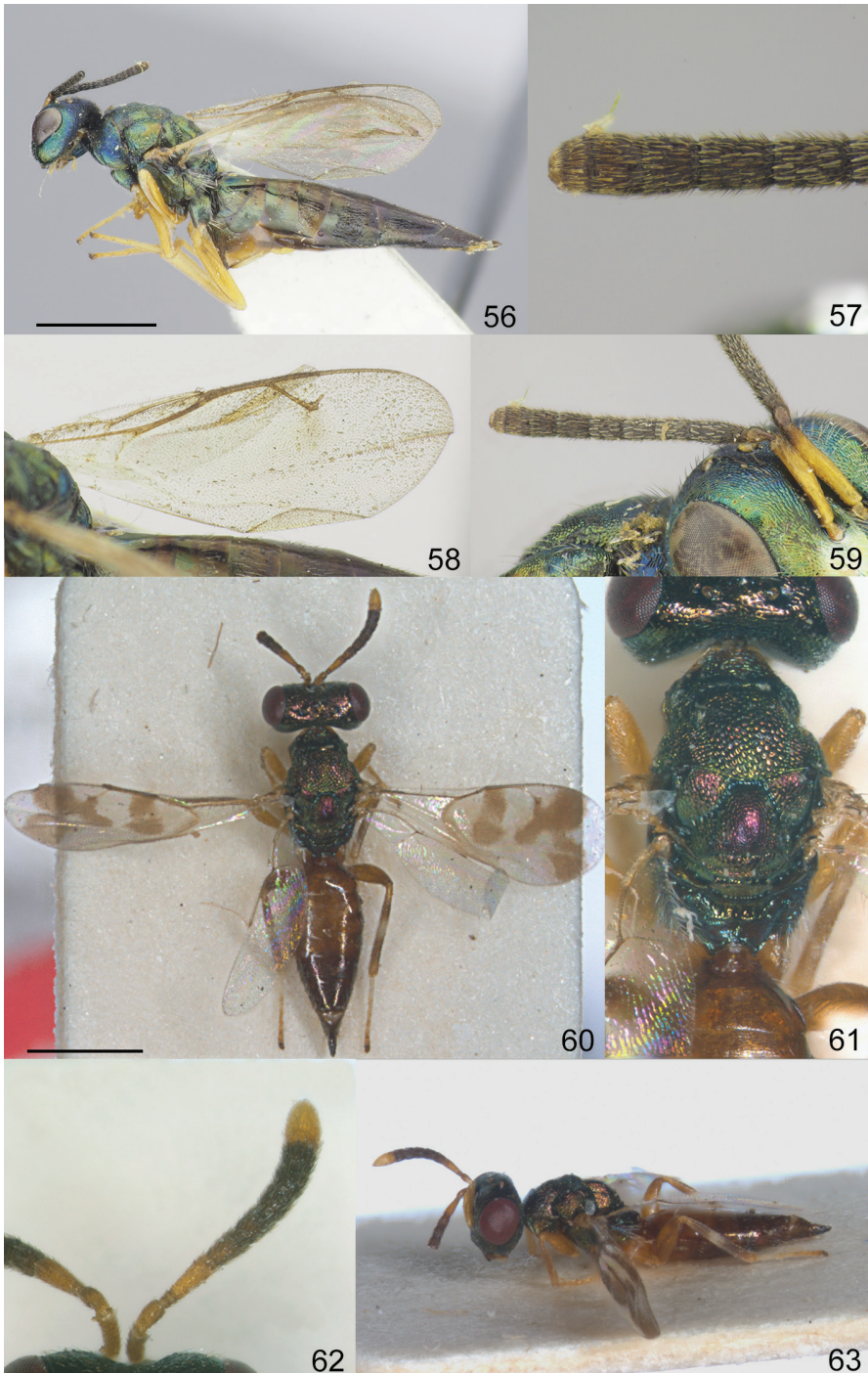
Figs 64–66

Plutothrix perelegans Graham, 1993: 112–114. Holotype female (NHMUK, not examined).

Material examined. Other material: FINLAND (all in ZMUH): **A**, 1 female, “Föglö, Hellén, 2123”, “*P. scenicus vittiger* Thom. Det. Kerrich 1956”, “*Plutothrix bicolorata* (Spin.) det. Koponen 09”; “*Plutothrix perelegans* Graham det. Tselikh 2021”; **N**, 1 female, “Suomi, U, Espoo, 6684:363, 8.8.1965, leg. M. Koponen”, “*Plutothrix scenicus* (Walk.) det. M. Koponen 1975”; “*Plutothrix perelegans* Graham det. Tselikh 2021”. UKRAINE (ZISP): **Khar'kov Prov.**, 1 female, Kupyansk City, 5.VIII.1897, coll. Yaroshevsky.

Distribution. Austria, Croatia, Finland (**new record**), France, Sweden, Ukraine (**new record**) (Graham 1993; Noyes 2019).

Biology. Unknown.



Figures 56–63. *Plutothrix obtusiclava* Graham, 1993, non-type female (56–59) 56 body, lateral view 57 antennal clava 58 fore wing 59 antenna. *Plutothrix pallidiclava* Graham, 1993, holotype female (60–63) 60 body, dorsal view 61 mesosoma, dorsal view 62 antenna 63 body, lateral view. Scale bars: 1.9 mm (56); 1.0 mm (60).

***Plutothrix pilicoxa* Graham, 1993**

Figs 67–70

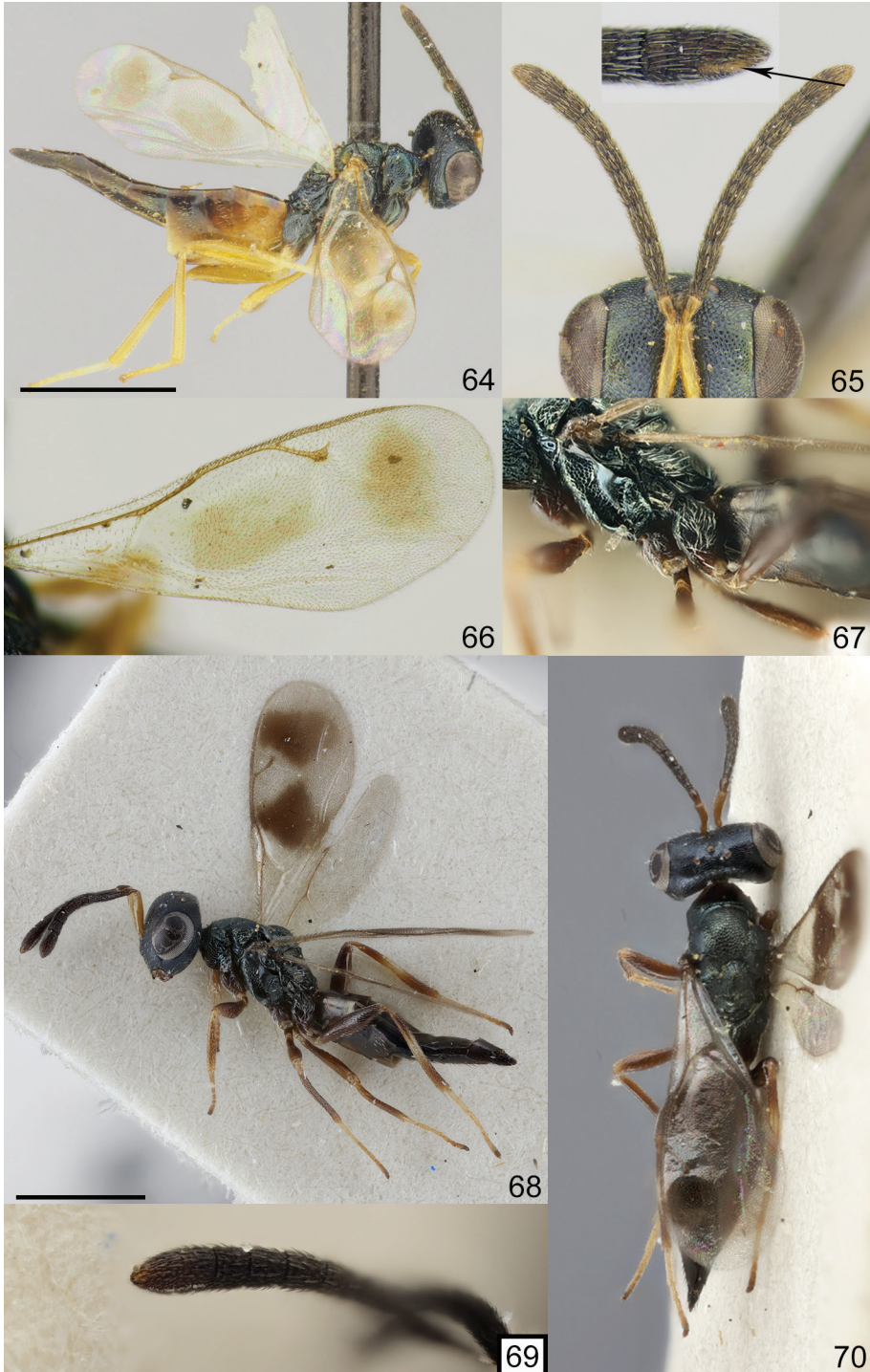
Plutothrix pilicoxa Graham, 1993: 115–116. Holotype female (NHMUK, examined).**Material examined. Holotype** female (NHMUK): “FRANCE: Vaucluse nr. Bédoin (1), 29.5.1985, M. de V. Graham”, “*Plutothrix pilicoxa* sp. n. Graham det. 1993 HOLOTYPE”, “Holotype”, “B.M. TYPE HYM 5.3683”, “NHMUK 013457266”.**Other material:** RUSSIA (all in ZISP): **Belgorod Prov.**, 1 female, 1 male, Borisovskii Distr., Borisovka Vill., “Belogorie” Reserve, “Les na Vorskle,” 50°36'34"N, 35°58'55"E, 17.VIII.2020, coll. K. Fadeev; **Krasnodar Reg.**, 1 female, Sochi City, Lazarevskoe, 18.VI.1979, coll. Tobias; 3 females, 2 males, Sochi City, “Mamedova Shchel”, 43°57'20"N, 39°18'39"E, 28.VII.2020, coll. S. Belokobylskij and E. Tselikh; 2 females, 2 males, Kalezh Vill., Ashe River, 44°01'25"N, 39°22'03"E, 30.VII.2020, coll. O. Kosheleva and E. Tselikh.**Distribution.** France, Russia.**Biology.** Unknown.***Plutothrix rugosa* Kamijo, 2004**

Figs 71–73

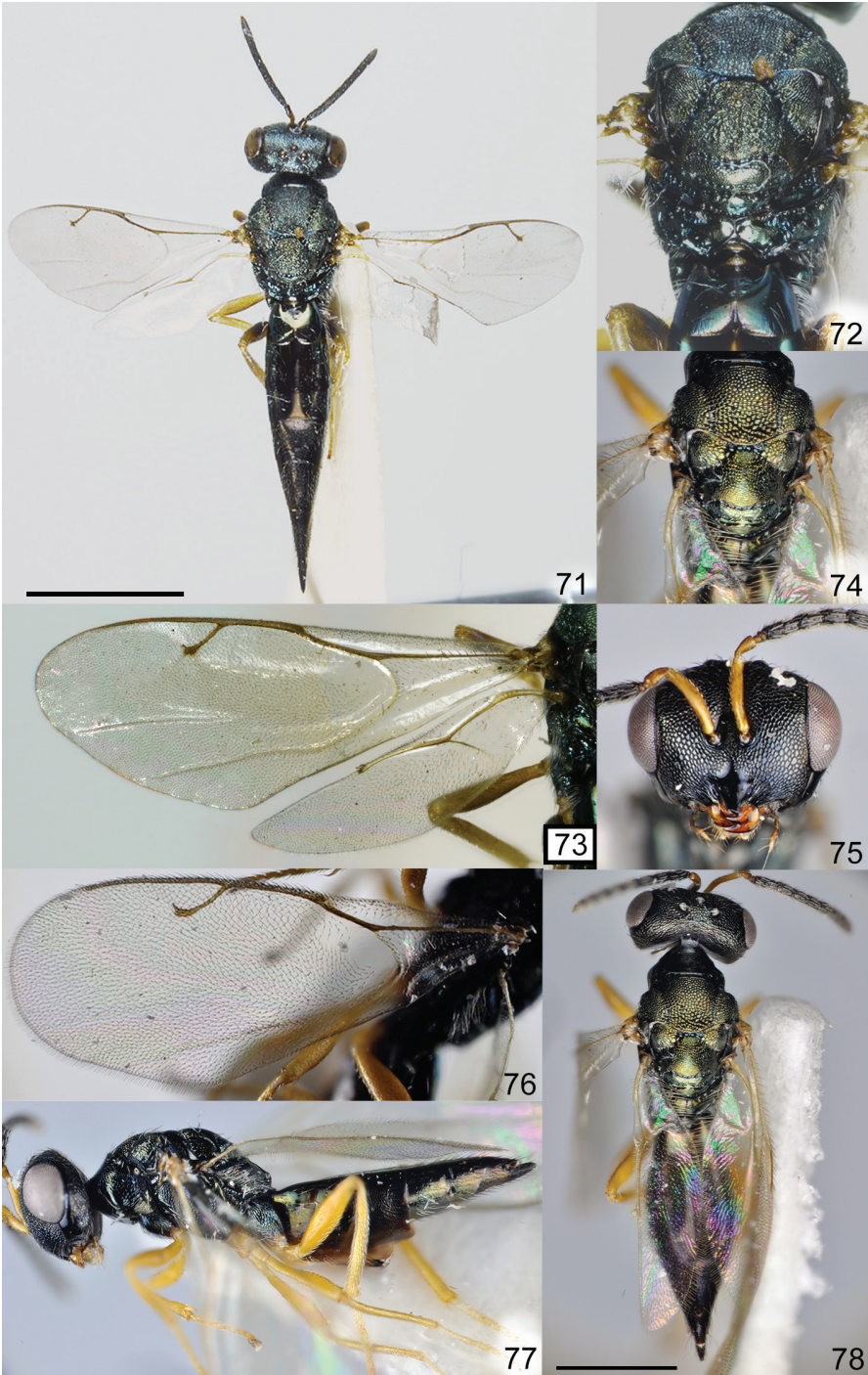
Plutothrix rugosa Kamijo, 2004: 303–304. Holotype female (EIHU, examined).**Material examined. Holotype** female (EIHU): “JAPAN: **Tokyo**, Higashiyamato”, “3.VI.1994, K. Kamijo”, “Holotype *Plutothrix rugosa* Kamijo”. **Other material:** JAPAN (EUM): **Ehime**, 1 female, Shikoku, Sugitate, 25.IV.1959, coll. M. Sato. RUSSIA (all in ZISP): **Primorskii Reg.**, 1 female, 20 km SE Spassk-Dal'ny, Evseevka Vill., 09.VI.1989, coll. S. Belokobylskij; 1 female, 1 male, 40 km NE, Dukhovskoe Vill., 01.VIII.1996, coll. S. Belokobylskij.**Distribution.** Russia (Far East), Japan.**Biology.** Unknown.***Plutothrix scrobicula* Kamijo, 2004**

Figs 74–78

Plutothrix scrobicula Kamijo, 2004: 306–307. Holotype female (EIHU, examined).**Material examined. Holotype** female (EIHU): “JAPAN: **Ehime Pref.**, Koya-yama, Oda-miyama, Oda-cho, Shikoku, 2.viii.1994, E. Yamamoto”, “Holotype *Plutothrix scrobicula* Kamijo”. **Paratype** female (EIHU): “JAPAN: Kyushu, Mt. Hikosan Soeda, Fukuoka, 5.VIII.1992, E. Ikeda leg.”, “Paratype *Plutothrix scrobicula* Kamijo”. **Other material:** RUSSIA (all in ZISP): **Primorskii Reg.**, 1 female, Spassk-Dal'ny Town,



Figures 64–70. *Plutothrix perelegans* Graham, 1993, non-type female (**64–66**) **64** body, lateral view **65** antenna **66** fore wing. *Plutothrix pilicoxa* Graham, 1993, holotype female (**67–70**) **67** hind coxa **68** body, lateral view **69** antennal clava **70** body, dorsal view. Scale bars: 1.4 mm (**64**); 1.2 mm (**68**).



Figures 71–78. *Plutothrix rugosa* Kamijo, 2004, holotype female (71–73) 71 body, dorsal view 72 mesosoma, dorsal view 73 wings. *Plutothrix scrobicula* Kamijo, 2004, paratype female (74–78) 74 mesosoma, dorsal view 75 head, frontal view 76 fore wing 77 body, lateral view 78 body, dorsal view. Scale bars: 2.7 mm (71); 1.0 mm (78).

17.VIII.1993, coll. S Belokobylskij; 1 male, same locality, 08.VIII.1996, coll. S Belokobylskij. SOUTH KOREA (YNU): **GW**, 1 female, Wonju-si, Socho-myeon, Hakgongri, Mt. Chiak, 37°22'18"N, 128°03'02"E, 20.VI–19.VII.2013, coll. J.W. Lee.

Distribution. Russia (Far East), South Korea, Japan.

Biology. Unknown.

***Plutothrix transdanuviana* (Erdős, 1946), syn. nov.**

Figs 95–97

Anoglyphis transdanuviana Erdős, 1946: 158. Lectotype female (HNHM, examined).

Material examined. Lectotype female (HNHM): HUNGARY: “Kőszegi h. 1944.V.22. dr. Erdős”, “Hym. Typ. No. 5742 Mus. Budapest”, “Cotypus”, “♀”, “*Alnus glutinosa* L.”, “Lectotypus *Anoglyphis transdanuviana* Erd. 946”, “*Seladerma antennatum* (Walk.)”; “Kőszegi h 1944.VI.26. dr. Erdős”, “Hym. Typ. No. 5743 Mus. Budapest”, “Cotypus”, “♂”, “rét”, “Paralectotypus *Anoglyphis transdanuviana* Erd. 946”.

Distribution. Hungary.

Biology. Unknown.

Remarks. Erdős (1946) described the species *Anoglyphis transdanuviana* Erdős from the Kőszegi Hills, West Hungary. Kerrich et Graham (1957) synonymized the genus *Anoglyphis* Förster, 1878 with *Plutothrix* Förster, 1856. As a result, *A. transdanuviana* was transferred to the genus *Plutothrix*. Subsequently, Graham (1969) suggested that *A. transdanuviana* might belong to *Seladerma* Walker, 1834. Examination of the types showed they belong to the species *Seladerma antennatum* (Walker) based on the following character states. Head 2.05× as long as broad. Clypeal margin with asymmetric teeth. Funicular segments of antenna with one row of sensilla. Mesosoma with complete notauli. Fore wing with speculum, basal vein incomplete, PM longer than M. Propodeum 0.37× as long as scutellum. Petiole transverse. Metasoma longer than mesosoma and head, 2.33× as long as broad. *Plutothrix transdanuviana* (Erdős, 1946) is thus hereby synonymized under *Seladerma antennatum* (Walker, 1833).

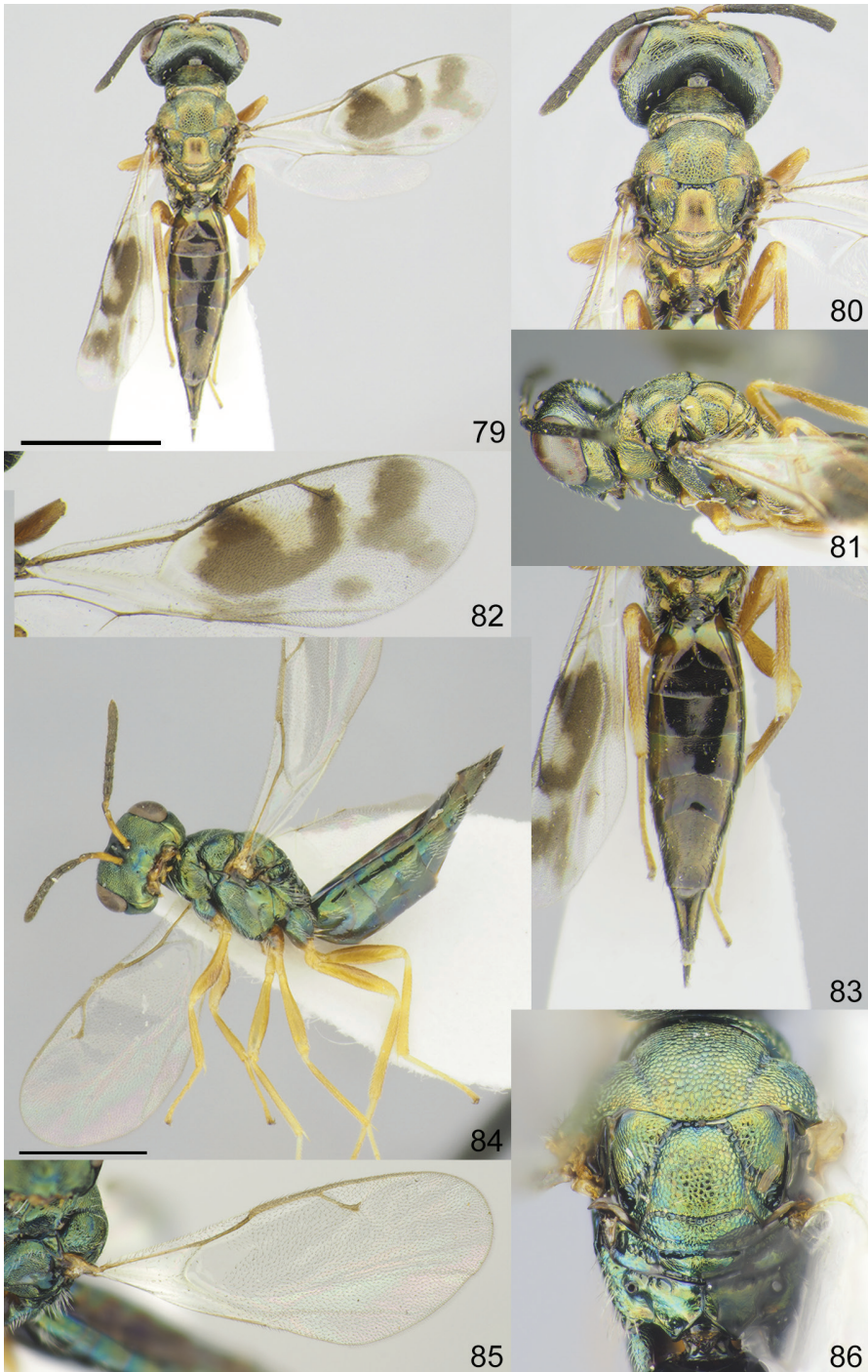
***Plutothrix trifasciata* (Thomson, 1878)**

Figs 79–83

Plutothrix foersteri Mayr, 1904: 586. Male type, lost. Synonymy by Ferrière and Novitzky (1955: 31).

Trigonoderus trifasciatus Thomson, 1878: 11. Lectotype female (LUZN, examined). Designated by Kerrich and Graham (1957: 293).

Material examined. Lectotype female (LUZN): SWEDEN: “Fardhem 3.Jli 41”, “*Trigonoderus trifasciatus* Thoms. LECTOTYPE G.J. Kerrich & M.W. Graham 1955”, “Type”, “TYPE NO. 134:1 Pteromalidae Zool. Mus. Lund Sweden”. **Other material:**



Figures 79–86. *Plutothrix trifasciata* (Thomson, 1878), non-type female (**79–83**) **79** body, dorsal view **80** head and mesosoma, dorsal view **81** head and mesosoma, lateral view **82** fore wing **83** metasoma, dorsal view. *Plutothrix zhangyiensis* Yang, 1996, non-type female (**84–86**) **84** body, lateral view **85** fore wing **86** mesosoma, dorsal view. Scale bars: 1.6 mm (**79**); 1.0 mm (**84**).

FINLAND (all in ZMUH): 1 female, **Ab**, “669370:323763, V, Parainen, Malaise 1A, 19.07–02.08.2020, leg. S. Väänänen, J. Paukkunen”, “*Plutothrix trifasciata* (Thomson) det. Tselikh 2021”; **Ta**, 1 female, “Fennia, Ta, Vanaja, 25.07.1957, leg. Valkeila”, “*Plutothrix trifasciata* (Thomson) det. Valkeila”; **Sa**, 1 female, “Fennia, ES, Joutseno, Marttila raidat, 676950: 58854, 05.08.2012, leg. M. Raekunnas”, “*Plutothrix trifasciatus* det. M. Koponen”; 1 female, “Finland, 669370:323763, V, Parainen, Malaise 1A, 19.07–02.08.2020, leg. S. Väänänen, J. Paukkunen”, “*Plutothrix trifasciata* (Thomson) det. Tselikh 2021»; 1 female, “154, Fennia, Snappert., 15.07.1933, Klingstedt, coll. Klingstedt”, “*Plutothrix trifasciata* (Thomson) det. Tselikh 2021”; **Om** [Ostrobothnia media], 1 female, “Fennia, Pyhäjärvi, 27.07.1957, leg. V. Vikberg”, “*Plutothrix trifasciatus* Ths, det. V. Vikberg”. MOLDOVA (all in ZISP): 2 females, “Bendery City, 08.VI.1974, coll. D. Kasparyan”. RUSSIA (all in ZISP): **Voronezh Prov.**, 1 female, Saval’skoe forestry, 08.VI.1954, coll. V. Stark; 1 female, 20 km SW of Rossosh’ City, Zhilino Vill., 49°49’58”N, 39°19’48”E, 11.VIII.2020, coll. Tselikh; **Kostroma Prov.**, 1 female, Vasil’evskoe Vill., 21.VII.1935, coll. V. Gussakovsky; **Samara Prov.**, 1 female, Krasny Yar Vill., 53°31’23”N, 50°22’28”E, 23.VIII.2020, coll. K. Samartsev; **Krasnodar Reg.**, 1 female, Kubanskaya Vill. 20.VI.1933, coll. Shestakov; **Orenburg Prov.**, 2 females, Kondurovka Vill., 07.VIII.2021, coll. K. Fadeev; **Primorskii Reg.**, 1 female, Novokachalinsk Vill., Khanka Lake, 04–07.VIII.2006, coll. S. Belokobylskij. Tajikistan (ZISP): 1 female, “Kondara, 30.V.1939, coll. V. Gussakovsky”. SOUTH KOREA (all in YNU): **GB** [Gyeongsangbuk-do], 1 female, Dalseo-gu, Daegok-dong, Daegu Arboretum, 35°48’3.26”N, 128°31’15.3”E, 12.IX.–4.X.2012, coll. S.G. Gang; 1 male, Gyeongsan-si, Daehak-ro 280, Yeungnam Univ., 35°49’30”N, 128°45’39”E, 30.VII.–25.X.2013, coll. J.W. Lee; 1 female, Cheongdo-gun, Gakbuk-myeon, Namsan-ri, 15.IX.–21.X.2013, J.W. Lee; **GN** [Gyeongsangnam-do], 1 female, Jinju-si, Ibanseong-myeon, Daecheon-ri, Gyeongsangnam-do, For. Env. Res. Inst., 35°9’39.7”N, 128°17’41.3”E, 16.IX.–1.X.2013, coll. J.H. Hwang; **GW** [Gangwon-do], 1 female, Wonju-si, Heungeop-myeon, Maeji-ri 234, Yonsei University, 5–26.IX.2014, coll. H.Y. Han; 1 female, Seoul, Dongdaemun-gu, Cheongnyangni-dong, 29.VIII.–05.IX.2005, coll. W.L. Choi.

Distribution. Croatia, Czech Republic, Denmark, Finland, Germany, Hungary, Kazakhstan, Korea, South, Lithuania, Moldova, Netherlands, Romania, Russia, Slovakia, Spain, Sweden, United Kingdom (Noyes 2019; Tselikh 2019).

Biology. Unknown.

***Plutothrix zerovae* Tselikh, Várkonyi & Dale-Skey, sp. nov.**

<https://zoobank.org/EBE2A581-F111-4BBE-9343-BDB7A4663E91>

Figs 87–94

Comparison. *Plutothrix zerovae* is similar to *P. kuboi* Kamijo, 2004; the differences between these species are given in the key.

Description. Female. Body length 5.60–6.50 mm. Fore wing length 4.10–4.50 mm.

Head, mesosoma and Mt2–Mt6 metallic bluish-green with diffuse coppery lustre, Mt8 brown; ovipositor sheath black. Antenna with scape yellow, pedicel yellowish-

brown, flagellum brown. All coxae metallic green with diffuse coppery lustre; all femora, tibiae and tarsi yellow except last segment yellowish-brown. Fore wing hyaline with one fuscous cloud touching stigma, venation yellowish-brown.

Head in dorsal view $2.10\text{--}2.26\times$ as broad as long and $1.16\text{--}1.19\times$ as broad as mesoscutum; in frontal view $1.24\text{--}1.26\times$ as broad as high. POL $0.90\text{--}1.00\times$ OOL. Eye height $1.43\text{--}1.46\times$ eye length and $2.10\text{--}2.22\times$ as long as malar space. Distance between antennal toruli and lower margin of clypeus $0.58\text{--}0.65\times$ distance between antennal toruli and median ocellus. Antenna with scape $0.85\text{--}0.89\times$ as long as eye height and $1.20\text{--}1.30\times$ as long as eye length; pedicel $2.00\text{--}2.07\times$ as long as broad and $0.72\text{--}0.80\times$ as long as F1; combined length of pedicel and flagellum $1.12\text{--}1.18\times$ breadth of head; F1 $2.20\text{--}2.35\times$ as long as broad, F3–F6 longer than broad; clava $2.45\text{--}2.60\times$ as long as broad.

Mesosoma $1.55\text{--}1.60\times$ as long as broad. Scutellum finely reticulate, $1.18\text{--}1.20\times$ as long as broad. Propodeum without nucha, $0.86\text{--}0.90\times$ as long as scutellum; median carina present; sculpture weakly reticulate. Metapleuron reticulate, upper mesepimeron alutaceous. Fore wing $2.50\text{--}2.70\times$ as long as maximum width; basal cell, cubital vein, basal vein setose; speculum closed; PST $0.75\text{--}0.86\times$ as long as M, M $0.74\text{--}0.76\times$ as long as PM and $1.80\text{--}1.93\times$ as long as S.

Metasoma $4.30\text{--}4.40\times$ as long as broad, $1.80\text{--}1.95\times$ as long as mesosoma and $1.45\text{--}1.56\times$ as long as mesosoma and head; Mt2 emarginate medially, Mt8 $2.20\text{--}2.50\times$ as long as broad. Ovipositor sheath projecting beyond apex of metasoma.

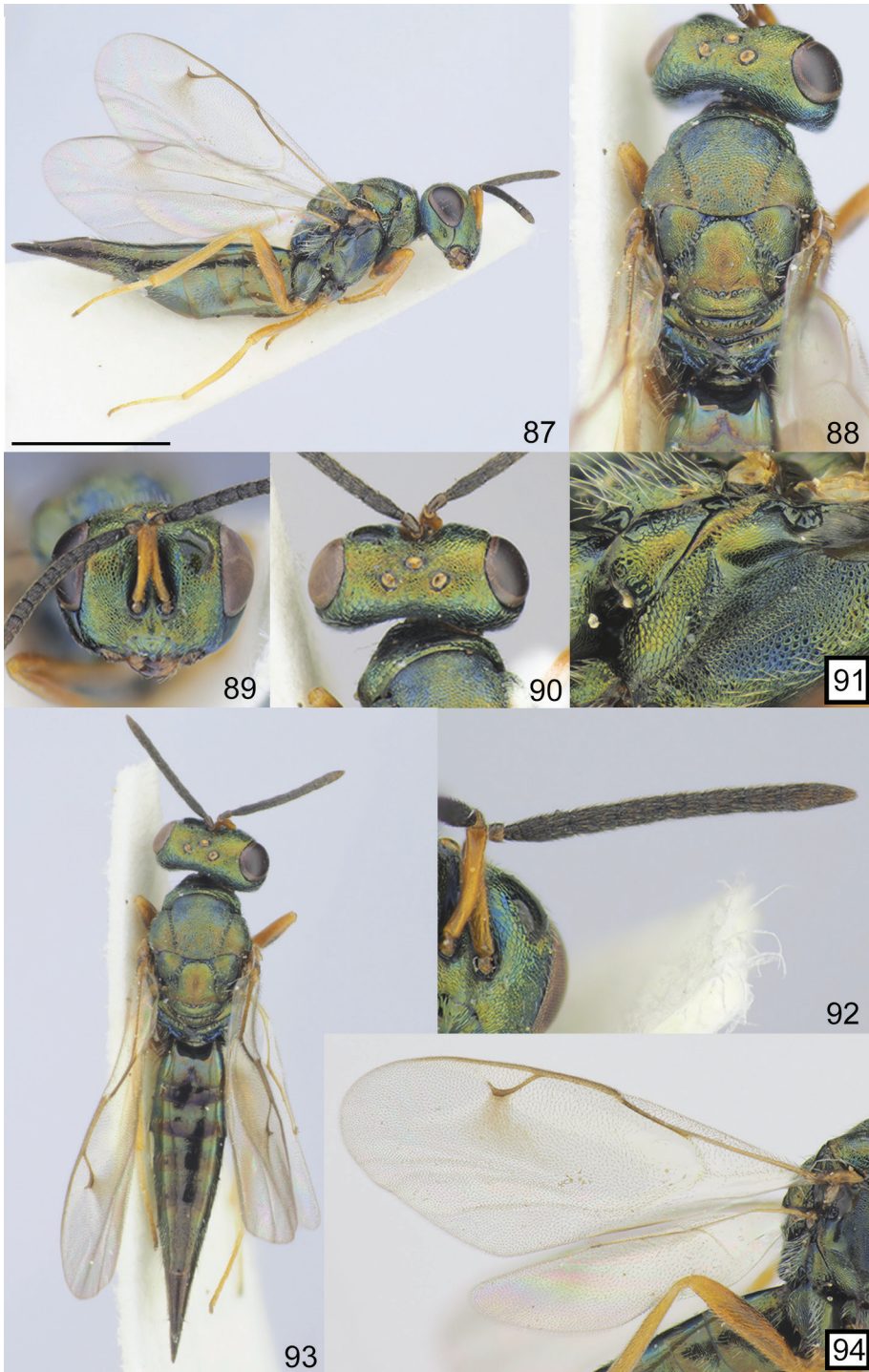
Male unknown.

Etymology. The species is named in honour of the prominent entomologist, Dr M.D. Zerova (1934–2021), an expert on Eurytomidae, Torymidae and Ormyridae (Hymenoptera).

Material examined. *Holotype* female (ZMUH): FINLAND: “Suomi, ES, Mikkelin mlk., 6830:501, 05.07.1987, leg. M. Koponen”, “*Plutothrix coelius* (Walker) det. M. Koponen”, “Holotype *Plutothrix zerovae* sp.n. Tselikh”. **Paratypes.** FINLAND (all in ZMUH): **N**, 1 female, “Suomi, Kauniainen, 09.07.1946, leg. A. Saarinen”; **Ta**, 1 female, “Suomi, EH, Luopioinen, 07.08.1976, leg. E. Kangas”; 1 female, “Suomi, EH, Luopioinen, 21.07.1956, leg. E. Kangas”, “*Plutothrix coelius* (Walker) det. M. Koponen”; 1 female, “Finland, Loppi, 03.07.1937, leg. C. Ahnger”; **Sa**, 1 female, “Finland, Ristiina, 6826:502, 28.06.1992, leg. M. Koponen”, “*Plutothrix coelius* (Walker) det. M. Koponen”; 1 female, “Suomi, ES, Ristiina, 6826:502, 08.07.1978, leg. M. Koponen”, “*Plutothrix coelius* (Walker) det. M. Koponen”; 1 female, “Suomi, ES, Mikkelin mlk, 6830:501, 03.09.1974, leg. M. Koponen”, “*Plutothrix coelius* (Walker) det. M. Koponen”; 1 female, “Finland, Ristiina, 6826:502, 03.07.1995, leg. M. Koponen”; **Tb**, 1 female, “Jyväskylä, Hellén, 208”; **Kb**, 1 female, “Suomi, PK, Tohmajärvi, 6908:660, 18.07.1982, leg. M. Koponen”. RUSSIA: (ZMUH) **Leningrad Prov.**, 1 female, “Viipuri, Linnaniemi, 610, MUS., ZOOLOG. UNIV. TURKU”; (ZISP) **Smolensk Prov.**, 1 female, near Smolensk City, $54^{\circ}49'01''\text{N}$, $32^{\circ}04'50''\text{E}$, 22.VIII.2020, coll. S Belokobylskij.

Distribution. Finland, Russia (European part of Russia).

Biology. Unknown.



Figures 87–94. *Plutothrix zerovae* sp. nov., holotype female (**87–94**) **87** body, lateral view **88** head and mesosoma, dorsal view **89** head, frontal view **90** head, dorsal view **91** mesosoma, lateral view **92** antenna **93** body, dorsal view **94** wings. Scale bar: 2.1 mm (**87**).



Figures 95–97. *Plutothrix transdanuviana* (Erdős, 1946) syn. nov. to *Seladerma antennatum* (Walker, 1833), holotype female (**95–97**) **95** body, dorsal view **96** head and antenna, dorsal view **94** fore wing. Scale bar: 0.75 mm (**95**).

Plutothrix zhangyeensis Yang, 1996

Figs 84–86

Plutothrix zhangyeensis Yang, 1996: 125–127. Holotype female (NWCF, not examined).

Material examined. Other material: RUSSIA (all in ZISP): **Primorskii Reg.**, Vladivostok City, Okeanskaya, 30.VII.2001, coll. S. Belokobylskij; 1 female, Lazovsky Reserve, Proselochny, 11.VII.2008, coll. A. Khalaim; **Kuril Islands**, Kunashir, Alekhino Vill., 30–31.VII.1981, coll. S. Belokobylskij.

Distribution. People's Republic of China (Gansu), Russia (Far East) (**new record**) (Yang 1996).

Biology. Primary parasitoid of *Polygraphus poligraphus* (Linnaeus, 1758) (Coleoptera, Curculionidae) (Yang 1996).

Conclusion

The present study considerably supplements our knowledge of the genus *Plutothrix* Förster. After the inclusion of the three new species (*Plutothrix gribanovi*, sp. nov., *P. longigaster*, sp. nov., and *P. zerovae*, sp. nov.) from the Palearctic region described in this paper, and the exclusion of *P. transdanuviana*, syn. nov., the genus *Plutothrix* now consists of thirty valid species.

Acknowledgements

The authors are very thankful to Frederique Bakker (NBC for checking and imaging the holotype of *Plutothrix pallidiclava* Graham for this study, and Dr Masahiro Ohara (EIHU) and Dr Christer Hansson (LUZN) for providing type material for this study. The authors are grateful to employees of the Belogor'e Nature Reserve for their help in organising scientific research on the Reserve's territory.

This work was supported by funding from the Ministry of the Environment of Finland (to the Finnish Expert Group on Hymenoptera) and of the Russian state: research project No. 122031100272-3 (to E. Tselikh).

References

- Bouček Z, Rasplus J-Y (1991) Illustrated key to West-Palaeartic genera of Pteromalidae (Hymenoptera: Chalcidoidea). Institut National de la Recherche Agronomique, Paris, 140 pp.
- Erdős J (1946) Genere nova et species novae chalcidoidarum (Hym.). Annales Historico-Naturales Musei Nationalis Hungarici 39: 131–165.
- Forshage M, Broad GR, Dale-Skey Papilloud N, Vårdal H (2016) Insect species described by Karl-Johan Hedqvist. Journal of Hymenoptera Research 51: 101–158. <https://doi.org/10.3897/jhr.51.9296>
- Förster A (1856) Hymenopterologische Studien. 2. Chalcidiae und Proctotrupii. Aachen: 1–152.
- Förster A (1878) Kleine monographien parasitischer Hymenopteren. Verhandlungen des Naturhistorischen Vereins der Preussischen Rheinlande und Westfalens, Bonn 35: 42–82.
- Gibson G (1997) Morphology and Terminology. In: Gibson GAP, Huber JT, Woolley JB (Eds) Annotated Keys to the Genera of Nearctic Chalcidoidea (Hymenoptera). NRC Research Press, Ottawa, 16–44.
- Graham MWRDV (1969) The Pteromalidae of North-Western Europe (Hymenoptera: Chalcidoidea). Bulletin of the British museum (Natural history) Entomology, Supplement 16: 1–908. <https://doi.org/10.5962/p.258046>
- Graham MWRDV (1993) Revision of European species of the genera *Trigonoderus* Westwood and *Plutothrix* Förster (Hym., Pteromalidae). Entomologist's Monthly Magazine 129: 107–118.
- Hedqvist KJ (1966) Notes on some reared chalcid flies from Finland (Hym., Chalcidoidea). Suomen Hyönteistieteellinen Aikakauskirja 32: 194–199.
- Hedqvist KJ (1974) Notes on Chalcidoidea from Canary Islands (Hymenoptera). I. A new species of *Plutothrix* Först (Pteromalidae). Vieraea, La Laguna 3(1/2): 26–28.
- Herting B (1973) Coleoptera to Strepsiptera. A catalogue of parasites and predators of terrestrial arthropods. Section A. Host or Prey/Enemy. Commonwealth Agricultural Bureaux, Institute of Biological Control, 185 pp.

- Heydon SL (1997) A review of the world genera of the Trigonoderini, with a revision of the species of North America north of Mexico (Hymenoptera: Pteromalidae). *Contributions of the American Entomological Institute* 30(2): 1–84.
- Kamijo K (2004) Five new species of *Plutothrix* (Hymenoptera: Pteromalidae) from Japan. In: Rajmohana K, Sudheer K, Girish Kumar P, Santhosh S (Eds) *Perspectives on biosystematics and biodiversity. Prof. T.C. Narendran commemoration volume. Systematic Entomology Research Scholars Association (SERSA), Kerala, India, 295–308.*
- Kerrich GJ, Graham MWRDV (1957) Systematic notes on British and Swedish Cleonymidae, with description of a new genus (Hym., Chalcidoidea). *Transactions of the Society for British Entomology* 12: 265–311.
- Mayr G (1904) Hymenopterologische Miscellen. III. *Verhandlungen der Zoologisch-Botanischen Gesellschaft in Wien* 54: 559–598. <https://doi.org/10.5962/bhl.part.27687>
- Meunier F (1905) Nouvelles recherches sur quelques Diptères et Hyménoptères du Copal fossile «dit de Zanzibar». *Revue Scientifique du Bourbonnais* 18: 204–216.
- Morley C (1910) *Catalogue of British Hymenoptera of the family Chalcididae*. London, 74 pp.
- Novitzky S von (1955) Bemerkungen zu den Gattungen *Trigonoderus* Westw. und *Pterobycus* Ratz. (Hym. Chalc. Cleon.). *Entomologisches Nachrichtenblatt Österreichischer und Schweizer Entomologen* 7(2): 26–34.
- Noyes JS (2019) *Universal Chalcidoidea Database – World Wide Web Electronic Publication*. <https://www.nhm.ac.uk/our-science/data/chalcidoids/database/> [Accessed on 10.05.2021]
- Spinola M (1808) *Insectorum Liguria species novae aut rarioris, quas in agro ligustico nuper detexit, descripsit, et iconibus illustravit* 2(2–4): 1–261.
- Spinola M (1811) *Essai d'une nouvelle classification générale des Diplolépaires*. *Annales du Muséum National d'Histoire Naturelle, Paris* 17: 138–152.
- Thomson CG (1878) *Hymenoptera Scandinaviae* 5. *Pteromalus* (Svederus) continuation. Lund, 307 pp.
- Tselikh EV (2019) 38. Family Pteromalidae. In: Belokobylskij SA, Samartsev KG, Il'inskaya AS (Eds) *Annotated catalogue of the Hymenoptera of Russia. Volume II, Apocrita: Parasitica*. *Proceedings of the Zoological Institute, Russian Academy of Sciences. Supplement* 8: 83–111. <https://doi.org/10.31610/trudyzin/2019.supl.8.5>
- Walker F (1833) *Monographia Chalciditum*. (Continued.) *Entomological Magazine* 1(5): 455–466.
- Walker F (1836) *Monographia Chalciditum*. (Continued.) *Entomological Magazine* 4(1): 9–26.
- Walker F (1839) *Monographia Chalciditum* 1. London, 333 pp. <https://doi.org/10.5962/bhl.title.67725>
- Walker F (1848) *List of the specimens of Hymenopterous insects in the collection of the British Museum, part 2*. Newman, London, 99–237.
- Yang ZQ (1996) *Parasitic wasps on bark beetles in China (Hymenoptera)*. Science Press, Beijing, 363 pp.