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A new species of bristletails of the genus *Coryphophthalmus* Verhoeff, 1910 (Microcoryphia: Machilidae) from Krasnodar Region, Russia

© V.G. Kaplin, A.G. Koval

All-Russian Institute of Plant Protection, Podbelskiy Roadway, 3, St Petersburg, Pushkin 196608 Russia. E-mails: ctenolepisma@mail.ru, agkoyal@yandex.ru

Abstract. The Southern European-Caucasian genus *Coryphophthalmus* Verhoeff, 1910 with relatively long and thin ovipositor, lacking long setae, includes two subgenera, *Coryphophthalmus* s. str. and *Verhoeffius* Kaplin, 2019 with 2 + 2 eversible vesicles on urites II–IV and II–V, respectively. A new bristletail species, *Coryphophthalmus aureoocellus* Kaplin, **sp. n.**, is described from Sochi National Park (Russia) and belongs to the subgenus *Coryphophthalmus* s. str. including 36 species. *Coryphophthalmus aureoocellus* **sp. n.** differs from other species of this subgenus by the colouration and the structure of paired ocelli, the ratio of length of cerci and body, the chaetotaxy of male labial and maxillary palps, the ratio of length of the 3rd tarsomere of the hind tarsus to its total length, the ratio of the length of urostyli to urocoxites.

Key words: Microcoryphia, Machilidae, *Coryphophthalmus*, new species, Caucasus.

Новый вид щетинохвосток рода *Coryphophthalmus* Verhoeff, 1910 (Microcoryphia: Machilidae) из Краснодарского края, Россия

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Всероссийский институт защиты растений, шоссе Подбельского, 3, Санкт-Петербург, Пушкин 196608, Россия. E-mails: ctenolepisma@mail.ru, agkoyal@yandex.ru

Резюме. Южноевропейско-кавказский род *Coryphophthalmus* Verhoeff, 1910 со сравнительно длинным и тонким яйцекладом, лишенным длинных тонких щетинок, включает два подрода – *Coryphophthalmus* s. str. и *Verhoeffius* Kaplin, 2019 с двумя парами выпячивающихся мешочков, соответственно на II–IV и II–V сегментах брюшка. Новый вид, *Coryphophthalmus aureoocellus* Kaplin, **sp. n.**, описан из Сочинского национального парка и относится к подроду *Coryphophthalmus* s. str., включающему 36 видов. *Coryphophthalmus aureoocellus* **sp. n.** отличается от других видов этого подрода цветом и строением парных глазков, хетотаксией нижнегубного и нижнечелюстного щупиков самца, отношением длины церок к длине тела, длины третьего членика задней лапки к ее общей длине, длины брюшных грифельков и кокситов брюшка.

Ключевые слова: Microcoryphia, Machilidae, *Coryphophthalmus*, новый вид, Кавказ.

The Southern European-Caucasian genus *Coryphophthalmus* Verhoeff, 1910 comprises 41 described species, that are distributed in mountainous landscapes within the subtropical and temperate belts from Albania and Greece in the south to Austria and Hungary in the north and from Azores Islands in the west to North Ossetia – Alania in the east [Kaplin, 2019a, b, 2020; Kaplin et al., 2020; Kaplin, Vargovitsh, 2020]. This genus belongs to the *Trigoniophthalmus* group of the subfamily Machilinae, which includes three genera: *Trigoniophthalmus* Verhoeff, 1910, *Coryphophthalmus* and *Trigoniomachilis* Stach, 1937. Paired ocelli of the bristletail genus *Coryphophthalmus* are submedian, subtriangular to pyriform, with white borders. The angle between the axis along the line of contact of compound eyes and the transverse axis of the paired ocellus less than 90°. Urocoxites II–IV or II–V with 2 + 2 eversible vesicles. Urosternites acutely angled. Fore femora of male are without sensorial fields. The ovipositor is long, thin, without fossorial spines and long chaetae. Among them the species with 2 + 2 eversible vesicles on urocoxites II–IV belong to the subgenus *Coryphophthalmus* s. str., and with 2 + 2 eversible vesicles on urocoxites II–V to the subgenus *Verhoeffius* Kaplin, 2019, including 36 and 5 species, respectively [Kaplin, 2019b].

Material and methods

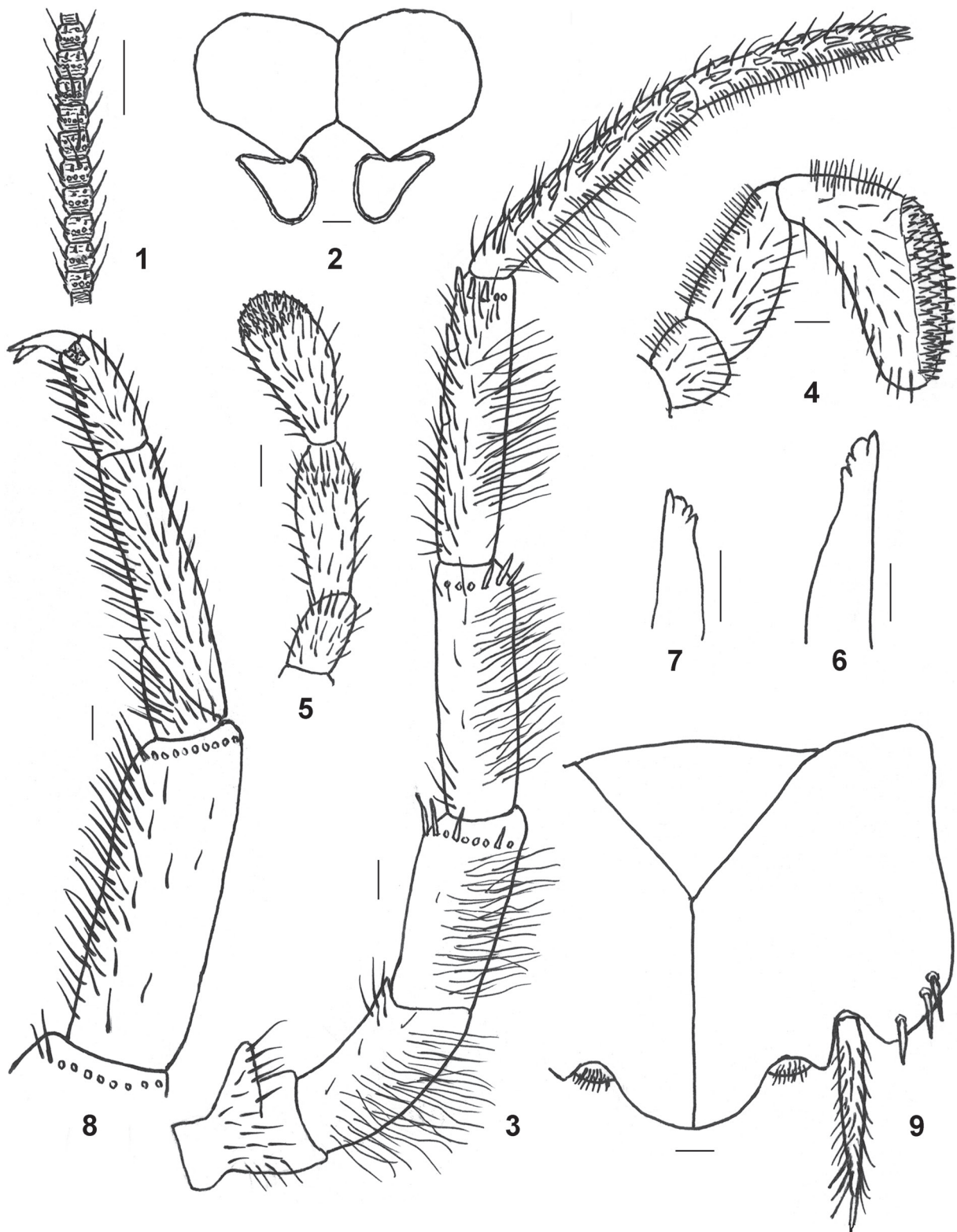
Examination of the bristletails collected by A.G. Koval in Sochi National Park (Krasnodar Region, Russia) has revealed a new species of the genus *Coryphophthalmus*; its description is given below. The holotype (male) and the paratype (female) were dissected and mounted on glass microscope slides in the Berlese Fluid. Figures were made using microscope and drawing tool. The types of a new species are deposited in the collection of the All-Russian Institute of Plant Protection (St Petersburg, Pushkin, Russia).

Order Microcoryphia Verhoeff, 1904 Family Machilidae Grassi, 1888 Genus *Coryphophthalmus* Verhoeff, 1910

Type species: *Coryphophthalmus banaticus* Verhoeff, 1910.

Coryphophthalmus aureoocellus Kaplin, **sp. n.** (Figs 1–13)

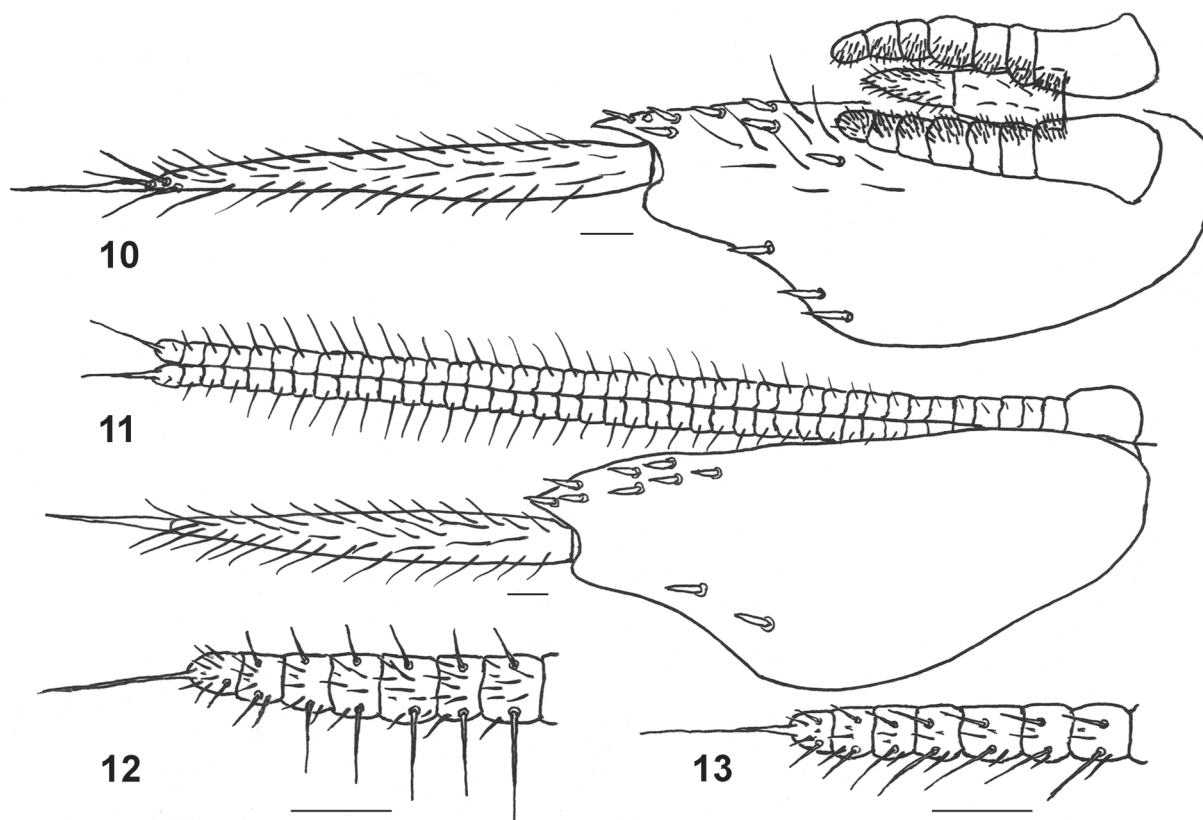
Material. Holotype, ♂ (in slides): Russia, Krasnodar Region, Sochi National Park, NW Caucasus, Dzykhra Mountain Range, 43°34'N / 40°04'E, 840 m, 14.09.2019 (A.G. Koval). Paratype: 1 ♀ (in slides), same data as for holotype.



Figs 1-9. *Coryphophthalmus aureaocellus* sp. n., details of structure.
 2-4, 6, 8 - male, holotype; 1, 5, 7, 9 - female, paratype; 1 - distal chain of antennal flagellum; 2 - eyes and paired ocelli; 3 - maxillary palp; 4-5 - labial palp; 6-7 - distal part of mandible; 8 - tarsi and tibia of hind leg; 9 - urosternite and urocoxites VII. Scale bars 0.1 mm.

Рис. 1-9. *Coryphophthalmus aureaocellus* sp. n., детали строения.

2-4, 6, 8 - самец, голотип; 1, 5, 7, 9 - самка, паратип; 1 - дистальная цепочка жгутика усика; 2 - глаза и парные глазки; 3 - нижнечелюстной щупик; 4-5 - нижнегубной щупик; 6-7 - дистальная часть верхней челюсти; 8 - лапка и голень задней ноги; 9 - стернит и кокситы VII сегмента брюшка. Масштабные линейки 0.1 мм.

Figs 10–13. *Coryphophthalmus aureaoCELLUS* sp. n., details of structure.

10 – male, holotype; 11–13 – female, paratype; 10 – male genitalia with urocoxite IX; 11 – anterior gonapophyses of ovipositor with urocoxite IX; 12 – apex of anterior gonapophysis of ovipositor; 13 – apex of posterior gonapophysis of ovipositor. Scale bars 0.1 mm.

Рис. 10–13. *Coryphophthalmus aureaoCELLUS* sp. n., детали строения.

10 – самец, голотип; 11–13 – самка, паратип; 12 – половой аппарат самца с кокситом IX сегмента брюшка; 13 – передние гонапофизы яйцеклада с кокситом IX сегмента брюшка; 14 – вершина передней створки яйцеклада; 15 – вершина задней створки яйцеклада. Масштабные линейки 0.1 мм.

Description. Body length 9–9.5 mm, width 2.2–2.6 mm; cerci length about 4.5 mm (male, apical article slightly broken); total eyes width of male 0.99 mm, female 1.09 mm, eye length 0.51 mm (male) and 0.56 mm (female); paired ocelli width and length 0.27 and 0.23 mm, in both sexes, respectively; coxal styli length about 0.9 mm (male) or 0.7 mm (female); ovipositor length 1.4 mm. Antennae slightly longer than body, cerci of female broken. General body colouration whitish or light brownish, with brown and violet hypodermal pigment of weak or medium intensity on head (frons, gena, occiput, maxillae, mandibulae), coxae. Scale colour on upper and lower surface of body whitish, brown or dark brown. Distal chains of flagellum divided into 8–10 annuli (Fig. 1). Clypeus of male and female missing long thin chaetae.

Compound eyes dark or almost black (in ethanol). Ratio of length to width ratio of compound eye about 1.03–1.04; ratio of

contact line to length of eye 0.51–0.53, in both sexes (Fig. 2). Paired ocelli submedian, pyriform, golden-light brown with narrow white borders. Ratio of width to length of paired ocellus 1.2. Ratio of distance between inner and outer margins of ocelli to total width of compound eyes, respectively 0.16 (male) or 0.18 (female) and 0.61 (male) or 0.68 (female). Frons between the paired ocelli is convex.

Apical palpomere of maxillary palp 0.75–0.76 times length of preceding one, in both sexes; ratio of lengths of 5th and 4th palpomeres about 1.15 (male) or 1.42 (female). Dorsal surface of 7th, 6th and 5th palpomeres of maxillary palp with 11–12, 13–14 and 4–5 (male) or 16, 17–20 and 5 (female) hyaline spines, respectively (Fig. 3). Undersurface of 2nd–5th palpomeres and basal part of 6th palpomere of male maxillary palp with relatively numerous and long thin chaetae, missing on its labial palpomeres. Undersurface of apical palpomere and distal part of 6th palpomere of maxillary palp

Table 1. Ratios of length to width of main leg segments of *Coryphophthalmus aureaoCELLUS* sp. n.
Таблица 1. Отношения длины к ширине сегментов ног *Coryphophthalmus aureaoCELLUS* sp. n.

Segments Сегменты	Sex, pair of legs Пол, пара ног					
	male / самец			female / самка		
	fore передняя	middle средняя	hind задняя	fore передняя	middle средняя	hind задняя
Tarsa / Лапка	4.81	5.04	6.08	5	4.52	5.62
Tibia / Голень	2.32	2.52	3.63	2.37	2.20	3.08
Femur / Бедро	2.24	2.51	2.86	2.21	2.66	2.68

Table 2. Length ratios of urosternites and urocoxites of *Coryphophthalmus aureaocellus* sp. n.
Таблица 2. Отношения длины стернитов и кокситов брюшка *Coryphophthalmus aureaocellus* sp. n.

Urites / Сегменты брюшка	Urosternite : urocoxite Стернит : кокситы брюшка		Urostyli (not including apical spines) : urocoxites / Грифельки (не включая апикальные иглы) : кокситы брюшка		Apical spines : styli Апикальные иглы : грифельки	
	male / самец	female / самка	male / самец	female / самка	male / самец	female / самка
II	0.56	0.6	0.64	0.51	0.43	0.47
III	0.58	0.62	0.62	0.51	0.4	0.5
IV	0.58	0.63	0.62	0.5	0.44	0.46
V	0.58	0.63	0.62	0.51	0.45	0.48
VI	0.56	0.62	0.61	0.54	0.34	0.5
VII	0.46	0.5	0.77	0.56	0.43	0.48
VIII	0.4		0.71	0.73	0.45	0.45
IX	–	–	0.83	0.66	0.26	0.32

Table 3. Posterior angle of urosternites and distribution of sublateral spines on urotergites and on urosternites of *Coryphophthalmus aureaocellus* sp. n.
Таблица 3. Задний угол стернитов и распределение сублатеральных игл на тергитах и кокситах брюшка *Coryphophthalmus aureaocellus* sp. n.

Urites / Сегменты брюшка	Posterior angle of urosternite, degrees Задний угол стернита, градусы		Number of sublateral spines on urites Количество сублатеральных игл на сегментах брюшка			
			urocoxites кокситы брюшка		urotergites тергиты брюшка	
	male / самец	female / самка	male / самец	female / самка	male / самец	female / самка
I	–	–	0	0	0	0
II	76	82	0	0	0	0
III	76	82	0	0	0	0
IV	78	80	0	0	0	0
V	76	78	0	0	1 + 1	1 + 1
VI	72	78	0–1 + 0–1	0	3–4 + 3–4	1 + 1
VII	84	83	4 + 4	2–3 + 2–3	5 + 5	2 + 2
VIII	96	–	5–6 + 5–6	5 + 5	6 + 6	5 + 5
IX	–	–	2/8 + 9/3*	2/5 + 8/1	5 + 5	4 + 4
X	–	–	–	–	4 + 4	4 + 4

Note. * – outer/inner spines.

Примечание. * – наружные/внутренние шипики.

and dorsal surface of 1st–3rd palpomeres of labial palp with numerous, relatively straight and more shorter chaetae. Apical palpomere of labial palp triangular, considerably extended (male) or triangularly oval (female) with about 55 or 32 sensorial cones, respectively. Ratio of its length to width about 0.8 and 2–2.1, respectively (Figs 4, 5). Mandibles with four distal teeth, in both sexes (Figs 6, 7).

Fore femur of male and female slightly widened. Legs relatively long, running. Middle legs shorter than fore and hind legs 1.23–1.25 and 1.11–1.15 times, respectively, in both sexes. Ratios of length to width of femur, tibia and tarsus as shown in Table 1. Ratio of length of 3rd tarsomere of hind tarsus to its total length 0.29–0.3, in both sexes (Fig. 8). The claws of pretarsa are relatively long. Hyaline spine-like chaetae on undersurface of femora, tibiae and tarsi are missing. Ratio of length of styli to width of middle coxae about 1.8, in both sexes, but to width of hind coxae 1.9 (male) or 1.5 (female).

Urocoxites I, V–VII with 1 + 1, II–IV with 2 + 2 eversible vesicles. Length ratios of urosternites, urocoxites and urostyli are shown in Table 2. Posterior angle of urosternites and distribution of sublateral spines on urocoxites and urotergites are given in Table 3. Urocoxite VII of female with protruding lobes between eversible vesicles. Ratio of length to width of one lobe about 0.6 (Fig. 9). Undersurface of distal part of male urocoxites IX also with several relatively long chaetae.

Male genitalia with one pair of parameres on urite IX. Parameres with 1 + 6 divisions, slightly surpassing apex of

penis. Penis and parameres clearly not attaining level of apex of urocoxites IX, ratio of the distance between apices of parameres and of urocoxites IX to width of distal division of penis about 7. Basal division of penis 1.2 times longer than distal division (Fig. 10).

Ovipositor slender, elongate, slightly surpassing apex of styli IX (Fig. 11). Anterior and posterior gonapophyses with approximately 41 or 42 divisions, respectively. One basal divisions of anterior gonapophyses and about 18–19 basal divisions of posterior gonapophyses glabrous. Distal spines of gonapophyses as long as 3–4 apical divisions combined. Distal divisions of anterior and posterior gonapophyses with 5–9 and 4 chaetae, respectively (not including apical spines) (Figs 12, 13).

Differential diagnosis. Between species of the subgenus *Coryphophthalmus* s. str. with 2 + 2 eversible vesicles on urites II–IV *C. aureaocellus* sp. n. belongs to a group species with a body length of 7–12 mm, distal chains of the flagellum are divided into 8–11 annuli, dark with blue tint eyes, brown paired ocelli, the ratio of length to width of compound eye is about 1, the length of the contact line between compound eyes is about 0.5–0.6 of the eye length; the ratio of distance between inner and outer margins of ocelli to the total width of compound eyes is 0.13–0.18 and 0.6–0.7, respectively; the undersurface of 2nd–7th palpomeres of the male maxillary palp is with relatively numerous and long thin chaetae,

Table 4. The main morphological differences between *Coryphophthalmus aureaocellus* sp. n. and its closest congeners.
 Таблица 4. Основные морфологические отличия между *Coryphophthalmus aureaocellus* sp. n. и сходными с ним видами.

Characters Признаки	<i>C. aureaocellus</i> sp. n.	<i>C. lineatus</i>	<i>C. lapidicola</i>	<i>C. divnogorski</i>	<i>C. silvestris</i>	<i>C. borgustani</i>
Body length, mm Длина тела, мм	9–9.5	9–11.5	9	11–12	8–9.5	7.1–9.5
Ratio of length of cercus and body / Отношение длины церки к длине тела	0.48	0.29–0.35	0.39–0.44	0.29–0.33	0.33–0.34	0.34–0.45 (?)
Number of articles in the distal chains of flagellum / Количество члеников в дистальных цепочках жгутика усиков	8–10	9–11	11–13	9–11	9–11	9–11
Paired ocelli colouration (in ethanol) / Окраска парных глазков (в этаноле)	golden-light brown / золотисто-светло- коричневые	dark brown / темно- коричневые	dark brown / темно- коричневые	dark brown / темно- коричневые	dark brown / темно- коричневые	light brown / светло- коричневые
Ratio of length to width of compound eye / Отношение длины глаза к ширине	1.03–1.04	0.97–1.03	1	1.0–1.05	1	0.97–1.03
Ratio of length of contact line to length of eye / Отношение длины линии контакта к длине глаза	0.51–0.53	0.47–0.55	0.54–0.56	0.52–0.65	0.5–0.56	0.50–0.6
Ratio of width to length of paired ocellus / Отношение ширины к длине парного глазка	1.2	1.4	1.3–1.4	1.4–1.6	1.4–1.5	1.4–1.8
Ratio of distance between inner margins of paired ocelli to total width of eyes / Отношение расстояния между внутренними краями парных глазков к общей ширине глаз	0.16–0.18	0.13	0.13–0.15	0.17–0.18	0.16–0.18	0.13–0.15
Ratio of distance between outer margins of ocelli to total width of eyes / Отношение расстояния между наружными краями парных глазков к общей ширине глаз	0.61–0.68	0.60–0.62	0.66–0.7	0.66–0.7	0.64–0.68	0.66–0.72
Ratio of lengths of apical article and preceding one of maxillary palp / Отношение длин апикального и предыдущего члеников нижнечелюстного щупика	0.75–0.76	0.78–0.83	0.75–0.79	0.77–0.8	0.83–0.87	0.65–0.7 ♂ 0.7–0.79 ♀
Number of hyaline dorsal spines on 5 th palpomere of maxillary palp / Количество бесцветных дорсальных шипов на 5 членике нижнечелюстного щупика	4–5	5–6	3–4	6–8	3–4	4–8
Ratio of length to width of apical palpomere of labial palp / Отношение длины к ширине апикального членика нижнегубного щупика	0.8 ♂ 2.1–2.2 ♀	2.2	2.2–2.3 ♂ 2.5–2.6 ♀	2 ♂ 2.5 ♀	2.3–2.4	2.2–2.4

Table 4 (completion).
Таблица 4 (окончание).

Characters Признаки		<i>C. aureaocellus</i> sp. n.	<i>C. lineatus</i>	<i>C. lapidicola</i>	<i>C. divnogorski</i>	<i>C. silvestris</i>	<i>C. borgustani</i>
Ratio of length of 3 rd tarsomere of hind tarsus to its total length / Отношение длины 3-го членика задней лапки к ее общей длине		0.29–3	0.34–0.38	0.28–0.32	0.33–0.36	0.33–34	0.31 ♂ 0.38 ♀
Long thin chaetae on palpomeres of male maxillary palp / Длинные тонкие щетинки на члениках нижнечелюстного щупика самца		II–VI	II–VII	II–VII	II–VII	II–VII	II–VII
Long thin setae on articles of male labial palp / Длинные тонкие щетинки на члениках нижнегубного щупика самца		–	II–III	II–III	II–III	II–III	II–III
Posterior angle of urosternites II–V, degrees / Задний угол II–V стернитов брюшка, градусы		76–82	75–80	70–74	70–80	77–85	67–69
Ratio of length of urostyli to urocoxites (not including apical spines) / Отношение длины брюшных грифельков (не считая апикальных игл) к длине брюшных кокситов	II–V	0.62–0.64 ♂ 0.50–0.51 ♀	0.50–0.54 ♂ 0.40–0.42 ♀	0.50–0.56 ♂ 0.49–0.54 ♀	0.54–0.6 ♂ 0.56–0.62 ♀	0.50–0.58 ♂ 0.54–0.58 ♀	0.51–0.53 ♂ 0.43–0.46 ♀
	VIII	0.71–0.73	0.58 ♂ 0.64 ♀	0.66 ♂ 0.82 ♀	0.56 ♂ 0.53 ♀	0.68 ♂ 0.69 ♀	0.62 ♂ 0.68–0.69 ♀
	IX	0.83 ♂ 0.66 ♀	0.74 ♂ 0.63 ♀	0.84 ♂ 0.69 ♀	0.78 ♂ 0.8 ♀	0.67 ♂ 0.66 ♀	0.77 ♂ 0.56–0.62 ♀
Number of sublateral spines on urocoxites / Количество сублатеральных игл на кокситах брюшка	IX	1–3/5–9	1–3/4–6	3/13–15	6/9–11 ♂ 2–3/7 ♀	3/8 ♂ 0/6 ♀	3–5/6–7 ♂ 1/5–7 ♀
	VIII	5–6 + 5–6	2–4 + 2–4	2–3 + 2–3 ♂ 6–7 + 6–7 ♀	3–6 + 3–6 ♂ 2–4 + 2–4 ♀	3 + 3	5–6 + 5–6 ♂ 2–3 + 2–3 ♀
	VII	2–4 + 2–4	1–2 + 1–2	3 + 3 ♂ 5–6 + 5–6 ♀	4 + 4 ♂ 1–2 + 1–2 ♀	2 + 2	2–3 + 2–3 ♂ 1–3 + 1–3 ♀
Number of sublateral spines on urotergites / Количество сублатеральных игл на тергитах брюшка	X	4 + 4	3 + 3	4 + 4	3–5 + 3–5	3 + 3	3 + 3
	IX	4–5 + 4–5	3 + 3	4–5 + 4–5	3 + 3	2 + 2	2–4 + 2–4
	VIII	5–6 + 5–6	3–4 + 3–4	3–4 + 3–4 ♂ 5–6 + 5–6 ♀	2–3 + 2–3	3 + 3	2–4 + 2–4
	VII	2–5 + 2–5	3–4 + 3–4	2 + 2 ♂ 4–5 + 4–5 ♀	1–2 + 1–2	2 + 2	2–3 + 2–3
Number of divisions male parameres / Количество члеников в парамерах самца		1 + 6	1 + 6	1 + 6	1 + 7	1 + 6	1 + 6
Number of divisions ovipositor / Количество члеников яйцеклада		41–42	43	39–41	39–43	40–42	36–44

without hyaline spine-like chaetae on undersurface of femora, tibiae and tarsi; ovipositor is with approximately 41–42 divisions, parameres of the male are usually with 1 + 6 divisions. This group includes about six known species: *C. aureaocellus* sp. n., *C. lineatus* (Kaplin, 2015), *C. lapidicola* Kaplin, 2020, *C. divnogorski* (Kaplin, 2010),

C. silvestris Kaplin, 2020 and *C. borgustani* (Kaplin, 2015). *Coryphophthalmus aureaocellus* sp. n. differs from other described species of the subgenus *Coryphophthalmus* s. str. by the colouration of paired ocelli, a sharp sexual dimorphism in the structure of the apical palpomere of the labial palp; from species of this group in the length of cerci,

the chaetotaxy of the male maxillary palp, ratios of width to length of the paired ocellus, of the length of the 3rd tarsomere of the hind tarsus to its total length. The main differences between species of this group are summarized in Table 4.

Habitats. Specimens of *Coryphophthalmus aureaocellus* sp. n. were collected in mountain forest (Fagus, Quercus, Hedera colchica), on the trunks of the oriental beech *Fagus orientalis*, active at night. During the day time they hide in the forest litter, 840 m above sea level.

Etymology. The new species takes its name from the colouration of its paired ocelli.

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