

# The genus *Cosmophorus* Ratzeburg, 1848 (Hymenoptera, Braconidae, Euphorinae) in Norway

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The genus *Cosmophorus* Ratzeburg, 1848 (Hymenoptera, Euphorinae) is revised for Norway. The three species *Cosmophorus klugi* Ratzeburg, 1848, *C. regius* Niezabitowski, 1910, and *C. cembrae* Ruschka, 1925 are recorded. A brief overview of the known hosts is given, together with biology and distribution of each species.

Key words: Hymenoptera, *Cosmophorus klugi*, *Cosmophorus regius*, *Cosmophorus cembrae*, Ichneumonoidea, Braconidae, Euphorinae, koinobiont, saproxylic, Scolytinae, Norway.

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## Introduction

The diversity of bark beetle enemies is species rich and includes representatives from several insect orders, e.g. Bothrideridae (Coleoptera), Dolichopodidae (Diptera) and Sesiidae (Lepidoptera), however, the Hymenoptera includes the highest number of species (Hilszczanski 2018). Hymenopteran parasitoids that specifically target hosts that depend directly or indirectly on dead wood are called saproxylic (Speight 1989). They play an important role in the ecosystem by regulating populations of scolytinae and other saproxylic host species. As part of the subfamily Euphorinae Förster, 1862, *Cosmophorus* Ratzeburg, 1848, represents a small genus of specialized parasitoids with a koinobiont

form of parasitism (Shaw & Huddleston 1991). The genus is characteristic with large mandibles and antennal bases raised into two rounded projections. These characters are so striking that the genus should not be confused with any other braconid genus (Shaw 1985). With their enlarged mandibles they grasp the bark beetle behind the scutellum in a head to head position, and holds the grip throughout the oviposition. The female then pushes her flexible “blade formed” ovipositor into the integuments, between the scutellum and the abdomen, and oviposits (Hedqvist 1998). Larvae of endoparasitic koinobionts, that live inside the bodies of active hosts, have adapted their physiology to overcome the immunological system of the host (Hilszczanski 2018). The parasitoids of *Cosmophorus* spp. seem to search suitable wood

for hosts. Aggregation pheromones released by the bark beetles are not proven to act as attraction for these species in the way of localizing their hosts. *C. regius* and other koinobionts are somehow also associated with older successional forest stages (Hilszczanski et al. 2005). Few observations are done on the biology of *Cosmophorus*. Seitner & Notzl (1925) describes the biology of *C. cembrae* and found that the parasitoid oviposits into the host in their constraining burrows. It is likely that *Cosmophorus* spp. also attack hosts on the surface of the wood, see illustration in Hedqvist (1998). Capek (1958) stated that the cocoon was made in the tunnel of the host beetle.

In Norway there are 356 published species of Braconidae (Riedel & Hansen 2014, Staverløkk & Ødegaard 2016). Of these, 73 species belong to the subfamily of Euphorinae (Artsdatabanken 2020). The Swedish number of Braconidae and Euphorinae are higher, respectively 1137 and 122 species (Liljebblad 2020).

## Material and Methods

The material was collected by malaise traps (MT) and window traps (WT). Reference material is deposited in the insect collections at Norwegian Institute for Nature Research (NINA), NTNU University Museum in Trondheim (NTNU) and the Natural History Museum in Oslo (NHMO). The material was collected by several entomologists and their names are abbreviated as follows Arnstein Staverløkk (AS), Eirik Rindal (ER), Frode Ødegaard (FØ), Oddvar Hanssen (OH) and Lars Ove Hansen (LOH). For identification, the key in Hedqvist (1998) and Achterberg & Quicke (2000) was used. Several partially focused images were taken with a Nikon DSLR and then combined in the software program Zerene Stacker© (2016). Stacking images were taken by the first author. The coordinates are given in decimal degrees (Grid: Lat/Lon hddd.dddd°; datum: WGS84). The faunistic divisions within Norway follow Økland (1981), and are given in bold. The new county division introduced from 1 January 2020 has not been implemented in this study.

## Results

Braconidae Nees, 1811  
Euphorinae Foerster, 1862  
*Cosmophorus* Ratzeburg, 1848

### *Cosmophorus klugi* Ratzeburg, 1848

**Material:** AKERSHUS (AK), Oslo: Ljanselva, Leirskallbråten W «Urskogen» [EIS28 N59.85662° E10.81757°], 2♀♀1♂ (Figures 1–3), 13 June–12 September 2009, WT around dead spruce (*Picea abies* L.), leg. LOH & ER, coll. NHMO.

**Distribution:** Austria; Bosnia Hercegovina; China; China-Sichuan; Czech Republic; Czechoslovakia; France; France-main; Germany; Hungary; Italy (country); Italy-main; Japan; Japan-main; Poland; Russia; Russia-Arkhangelsk Oblast; Russia-Karel'skaya Respublika; Russia-Primor'ye Kray; Russia-Tomsk Oblast; Slovakia; Sweden; Yugoslavia (Yu et al. 2016).

**Hosts in Europe:** Coleoptera; Scolytinae: *Dryocoetes autographus* Ratzeburg, 1837, *Hylurgops glabratus* (Zetterstedt, 1792), *Ips typographus* L., 1758, *Pityogenes bidentatus* Herbst, 1783, *Polygraphus poligraphus* L., 1758, *Ips amitinus* Eichhoff, 1871 (Hedqvist 1998, An et al. 2015).

### *Cosmophorus regius* Niezabitowski, 1910

**Material:** **NORD-TRØNDLAG** inland (NTI), Lierne: Raudbergfloan (spruce forest) (Figure 4) [EIS103 N64.454156° E13.912083°], 1♀ (Figures 5 & 6), 4 July–14 August 2017, MT, leg. OH, coll. NTNU; **SØR-TRØNDELAG** inland (STI), Malvik: Vikhammer (mixed forest) [EIS92 N63.43460° E10.62476°], 1♀, 18 May–27 June 2019, MT, leg. AS, coll. NINA.

**Hosts in Europe:** Coleoptera; Scolytinae: *Polygraphus poligraphus* (L., 1758), *Ips amitinus* Eichhoff, 1871 (Hedqvist 1998).

**Distribution:** Austria; China; China-Gansu; Czech Republic; Czechoslovakia; Finland; Germany; Hungary; Japan; Japan-main; Poland; Russia; Russia-Khabarovsk Kray; Russia-Primor'ye Kray; Russia-Sakhalin Oblast; Slovakia; Sweden; Switzerland; Yugoslavia; Yugoslavia-Serbia (Yu et al. 2016).



FIGURE 1. Dorsal view of a male *Cosmophorus klugi* Ratzeburg, 1848 from Leirskallbråten in Oslo municipality.



FIGURE 2. Lateral view of the male *Cosmophorus klugi* Ratzeburg, 1848 from Leirskallbråten in Oslo municipality.



**FIGURE 3.** Front view of the head of the male *Cosmophorus klugi* Ratzeburg, 1848 from Leirskallbråten in Oslo municipality.



**FIGURE 4.** Locality of *Cosmophorus regius* Niezabitowski, 1910 with the Malaise trap in the old forest at Raudbergfloan in Lierne. Photo: Oddvar Hanssen.



**FIGURE 5.** *Cosmophorus regius* Niezabitowski, 1910 from Raudbergfloen in Lierne municipality, Trøndelag.



**FIGURE 6.** *Cosmophorus regius* Niezabitowski, 1910 with large mandibles to hold the bark beetle while oviposition.

### *Cosmophorus cembrae* Ruschka, 1925

**Material:** AUST AGDER coastal (AAY), Grimstad: Sandkleiva, [EIS6 N58.34640° E8.53387°], 1♀ (Figures 7&9), 7 August–19 September 2015, MT, leg. FØ, coll. NTNU; TELEMARK coastal (TEY), Drangedal: Lillehøydalen/Trollknatten (mixed forest) (Figure 8), [EIS11 N59.06978° E9.18247°], 1♀, 6 August–18 October 2018, MT, leg. FØ, coll. NTNU.

**Distribution:** Austria; Czechoslovakia; Finland; Japan; Japan-main; Korea; Lithuania; Poland; Russia; Russia-Krasnoyarsk Kray; Russia-Primor'ye Kray; Russia-Sakhalin Oblast; Slovakia; Sweden; Switzerland; United Kingdom (Yu et al. 2016).

**Hosts in Europe:** Coleoptera; Scolytinae: *Cryphalus abietis* (Ratzeburg, 1837), *C. piceae* (Ratzeburg, 1837), *Pityogenes bistridentatus* (Eichhoff, 1878), *P. chalcographus* (Linnaeus, 1761), *P. quadridens* (Hartig, 1834) (Watanabe 1968, Hedqvist 1998).

### Discussion

Species of saproxylic parasitoids may be very specialized and can utilize different stages of the hosts. Records of *Cosmophorus* in collections are relatively rare in traditional traps like Malaise traps and window traps due to their specialized behaviour. Many saproxylic parasitoids, including *Cosmophorus*, spend much of their time searching tree trunks instead of flying (Quicke 2015). Emergence traps, hatching experiments and *in situ* observations will be an even better way to reveal more of the biology, and yield more specimens to collections. In addition to the three species reported in this paper, there are two more species to expect in Norway. *Cosmophorus roubali* Capek, 1958 is described and reported only from the Czech Republic and reared from *Pityophthorus lichtensteinii* (Ratzeburg, 1837) which is a bark beetle distributed almost all over Europe, including Norway (Knizek 2020). *Cosmophorus henscheli* Ruschka, 1925 is only recorded from Austria and



**FIGURE 7.** Malaise trap at Lillehøydalen in Drangedal municipality, Telemark, where *Cosmophorus cembrae* Ruschka, 1925 was found. Photo: Oddvar Hanssen.



**FIGURE 8.** *Cosmophorus cembrae* Ruschka, 1925 from Sandkleiva in Grimstad municipality, Aust Agder.



**FIGURE 8.** *Cosmophorus cembrae* Ruschka, 1925 from Trollknatten in Drangedal municipality, Telemark.

Sweden, while the hosts; *Pityophthorus henscheli* Seitner and *Pityophthorus micrographus* L. have a wider distribution in Europe (Hedqvist 1998, Knizek 2020), indicating that the *Cosmophorus* species is overlooked because of its cryptic behavior, and might be found where the host is present.

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