

New records of Encyrtidae (Hymenoptera, Chalcidoidea) from Norway VII

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The study of the family Encyrtidae at the Natural History Museum of Oslo continues. In this revision, eight species are reported for the first time from Norway, bringing the total number of Norwegian encyrtids up to 151. *Bothriothorax koponeni* Khlopunov, 1984 is reported for the first time outside Finland, and *Syrphophagus subviridis* (Hoffer, 1970) for the first time outside Slovakia. Until now, *Isodromus limosus* Hoffer, 1969 has only been reported from Bohemia in the Czech Republic and Kostroma Oblast in Russia, while *Copidosoma aretas* (Walker, 1838), *Lamennaisia nobilis* Nees, 1834, *Leptomastix epona* (Walker, 1844), *Psyllaephagus abbreviatus* (Hoffer, 1963) and *Syrphophagus aphidivorus* (Mayr, 1876) are all recorded from Norway for the first time. New records are given for *Anagyrus belibus* (Walker, 1837), *Bothriothorax clavicornis* (Dalman, 1820), *Encyrtus albitarsis* Zetterstedt, 1838 and *Tetracnemoidea piceae* (Erdős, 1946). *Pseudencyrtus idmon* (Walker, 1844) and *Sectiliclava cleone* (Walker, 1848) are recorded for the first time since Francis Walker (1809–1874) collected the types during his visit to Finnmark in 1836. Comments on the biology and distribution for the species are given. The aim of this ongoing study is to highlight the distribution of the family in Norway and finally provide a check-list of the Norwegian species.

Key words: Hymenoptera, Chalcidoidea, Encyrtidae, new records, Finnmark, Norway, Europe, canopy fogging, Malaise traps, Coccoidea, scale insects, Francis Walker.

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Introduction

The chalcid family Encyrtidae represents one of the most important agents in biological control of insects occurring as plant pests. They are, together with the family Aphelinidae, successfully used against many pest species, especially scale insects (Hemiptera, Coccoidea) (Noyes 1985, Nikolskaya & Yasnosh 1966). More than 400 species have been used worldwide as biological control agents of insect pests (Greathead 1986, Neueschwander *et al.* 1990, Noyes 1985, 2018). Parasitoids like encyrtids are the major component of many terrestrial ecosystems and may constitute up to

20% of all insect species (LaSalle & Gauld 1991, Godfray 1994, Memmot *et al.* 1994).

This is the ninth paper on Norwegian Encyrtidae based on the collections at the Natural History Museum of Oslo. The previous papers are Hansen *et al.* (2012), Japoshvili *et al.* (2013), Japoshvili & Hansen (2013, 2014, 2015, 2017) and Hansen & Japoshvili (2013, 2015). The aim of these contributions is to highlight the distribution of the family Encyrtidae in Norway, and finally provide a catalogue of Norwegian Chalcidoidea. This contribution reports eight species previously not reported from Norway, and noteworthy records are given for six species.

Material and methods

This contribution focuses on ethanol preserved material of Encyrtidae in the collections at the Natural History Museum of Oslo. The material was sorted and dried using ethanol and hexamethyldisilazane (HMDS), then card mounted, or, if necessary, slide mounted, following the guidelines of Noyes (2018). For identification, the general key for Palearctic encyrtids was used (i.e. Trjapitzin 1989), in addition to other related publications on lower taxa (e.g. Gibson *et al.* 1997, Graham 1991, Guerrieri & Noyes 2005, 2009). The faunistic divisions within Norway follow Økland (1981), and are given in **bold**.

The coordinates are given in decimal degrees (Grid: *Lat/Lon hddd.dddd*°; datum: *WGS84*). The taxonomy follows Noyes (2018) for the Encyrtidae and Ben Dov (2018) for the Coccoidea. Data on biology and distribution is extracted from Noyes (2018), and for distribution in Europe all countries are listed, but not for other regions. All records refer to fully labeled specimens or slides deposited in the collections at the Natural History Museum of Oslo [NHMO], and for some duplicates in the collection at the Entomology and Biocontrol Research Centre, Agricultural University of Georgia. Abbreviations of entomological collections follow Evenhuis (2018). Only synonyms concerning Norway are mentioned.

List of species

Bothriothorax kaponeni Khlopunov, 1984

Material examined: AKERSHUS [AK], Enebakk: Østmarka NR, Tonekollidalen East [N59.832168° E11.022149° ±50m; 315m a.s.l.] 1♀ 21 August 2005, canopy fogging / spruce (*Picea abies*); tree # 6, leg. Steinn Andersen.

Biology: Unknown (Noyes 2018); may be associated with spruce (*Picea abies*) since the specimen was collected by canopy fogging of spruce.

Distribution: Europe: Finland (Noyes 2018); first record outside Finland.

Copidosoma aretas (Walker, 1838)

Material examined: BUSKERUD East [BØ] Nedre-Eiker: Hagatjern, Ryggsetra [N59.73347° E10.04595° ±25m; 280m a.s.l.] 1♀ 1–30 September 1994, Malaise trap A / hay-meadow, leg. Yngvar Berg & Lars Ove Hansen.

Biology: Various species of the families Coleophoridae, Oecophoridae, Pyralidae and Tortricidae (Lepidoptera) are reported as primary hosts (Noyes 2018).

Distribution: Europe: Austria, Bulgaria, Czech Republic, Denmark, England, Finland, France, Germany, Italy, Netherlands, Russia (St. Petersburg), Slovakia and Sweden; Asia: Peoples' Republic of China (Gansu, Jilin and Shaanxi) (Fusu 2018, Noyes 2018).

Isodromus limosus Hoffer, 1969

Material examined: MØRE OG ROMSDAL [MRI] Norddal: Tafjord, Fjora [N62.2950° E07.3117° ±500m 100m a.s.l.] 1♀ 23 June–18 July 1993, Malaise trap, leg. Oddvar Hanssen.

Biology: Unknown (Noyes 2018).

Distribution: Europe: Czech Republic (Bohemia) and Russia (Kostroma Oblast) (Kalina 1989, Fusu 2018, Noyes 2018).

Lamennaisia nobilis Nees, 1834

[Syn.: *Negenaspidius nobilis* Nees, 1834]

Material examined: BUSKERUD [BØ] Drammen: Underlia [N59.75551° E10.17679° ±5m] 1♀ 1 – 30 June 1992, 1♀ 1 – 31 August 1992, Malaise trap / south facing slope / pine forest, leg. Lars Ove Hansen.

Biology: Unknown (Noyes 2018).

Distribution: Europe: Bulgaria, Czech Republic (Moravia), England, France, Germany, Greece, Hungary, Italy, Lithuania, Moldova, Montenegro, Romania, Russia (Kaluga Oblast, Kuybishev Oblast, Lipetsk Oblast, Penza Oblast, Volgograd Oblast and Voronezh Oblast), Serbia, Slovakia, Spain, Sweden and Ukraine; Africa: Canary Islands and South Africa; Asia: Afghanistan, Armenia, Azerbaijan, Georgia, India (Andhra Pradesh, Karnataka, Kerala, Odisha and Tamil Nadu), Israel, Russia (Altai Kray, Astrakhan' Oblast, Dagestan ASSR, Irkutsk Oblast and Karachai-Cherkess AR), Saudi Arabia and

Turkmenistan (Kalina 1989, Fusu 2018, Noyes 2018).

***Leptomastix epona* (Walker, 1844)**

Material examined: HEDMARK [HES] Elverum: Starmoen NR [N60.84995° E11.69178° ±5m, 210m a.s.l.] 1♀ 27 July–14 Sept. 2004, Malaise trap [S] / Sandy pine forest], leg. Lars Ove Hansen / Eirik Rindal.

Biology: The following primary hosts are reported: *Peliococcus calluneti* (Lindiger, 1912), *Pseudococcus longispinus* (Targioni Tozzetti, 1867), *P. viburni* (Signoret, 1875) and *Peliococcus calluneti* (Lindinger, 1912) (Hemiptera, Pseudococcidae) (Noyes 2018).

Distribution: Europe: Croatia, Czech Republic, Denmark, England, Finland, Germany, Hungary, Macedonia, Montenegro, Netherlands, Poland, Russia (Chelyabinsk Obl., Karelian ASSR, St. Petersburg), Serbia, Spain (incl. Canary islands) and Sweden; Asia: Russia (Irkutsk Obl.); North America: United States of America (California) (Kalina 1989, Fusu 2018, Noyes 2018).

***Psyllaephagus abbreviatus* (Hoffer, 1963)**

[Syn.: *Metaprionomitus abbreviatus* Hoffer, 1963]

Material examined: BUSKERUD Eastern [BØ], Hurum: Verket [W] [N59.61565° E10.41597° ±25m; 17m a.s.l.] 1♀ 19 August–31 October 1995, Malaise trap / sand pit / pine forest, leg. Lars Ove Hansen & Oddvar Hanssen.

Biology: Unknown (Noyes 2018).

Distribution: Europe: Czech Republic, Finland, Lithuania, Moldova, Romania, Russia (Kaluga Oblast, Kostroma Oblast, Lipetsk Oblast, St. Petersburg and Voronezh Oblast) and Slovakia; Asia: Armenia, Mongolia and Russia (Altai Kray, Karachai-Cherkess AR, Khabarovsk Kray and Primorsky Krai) (Fusu 2018, Noyes 2018).

***Syrphophagus aphidivorus* (Mayr, 1876)**

Material examined: BUSKERUD [BØ] Drammen: Underlia [N59.75551° E10.17679° ±5m] 1♀ 1–30 June 1992, Malaise trap / south facing slope / pine forest, leg. Lars Ove Hansen.

Biology: Various species from several families and orders have been reported as primary hosts: i.e. Agromyzidae, Chamaemyiidae (Diptera);

Aleyrodidae, Aphididae and Psyllidae (Hemiptera); Braconidae and Cynipidae (Hymenoptera) (Noyes 2017).

Distribution: Europe: Austria, Bulgaria, Croatia, Czech Republic, England, France, Germany, Greece, Hungary, Italy, Moldova, Montenegro, Netherlands, Poland, Portugal, Romania, Russia (St. Petersburg), Scotland, Serbia, Slovakia, Spain, Sweden and Ukraine; Africa: Kenya and Sudan; Asia: Armenia, Azerbaijan, Egypt, Georgia, India, Iran, Iraq, Jordan, Mongolia, Pakistan, Peoples' Republic of China, Saudi Arabia and Turkmenistan; America: Argentina, Brazil, Chile, Cuba, Mexico, Peru, Puerto Rico and USA (including Hawaii) (Fusu 2018, Noyes 2018).

***Syrphophagus subviridis* (Hoffer, 1970)**

Material examined: VESTFOLD [VE], Re [Våle]: Langøya [N] [N59.499817° E10.366113° ±10m; 3m a.s.l.] 2♀♀ 1 September–26 October 1991, Malaise trap / calcareous meadow / pine forest, leg. Lars Ove Hansen.

Biology: Unknown (Noyes 2018).

Distribution: Europe: Slovakia (Fusu 2018, Noyes 2018); first record outside Slovakia.

Some noteworthy rediscoveries

***Anagyrus belibus* (Walker, 1837)**

[*Doliphoceras belibus* (Walker, 1837)] [Compton 1981, p.85]

Material examined: BUSKERUD [BØ] Nedre Eiker: Mjøndalen, Ryggkollen [W] [N59.75447° E10.05065° ±5m; 16m a.s.l.] 1♀ 12 July–3 August 2008, Malaise trap / sand pit / pine forest, leg. Lars Ove Hansen.

Biology: The following primary hosts are reported: *Metadenopus festucae* Sulc, 1933, *Pseudococcus* sp. and *Trionymus newsteadi* (Green, 1917) (Hemiptera, Pseudococcidae) (Noyes 2018).

Distribution: Europe: Croatia, Czech Republic, Denmark, England, Finland, France, Germany, Hungary, Lithuania, Portugal (Madeira), Moldova, Montenegro, Netherlands, Norway, Romania, Russia (St. Petersburg, Kaluga, Oblast, Karelian ASSR, Moscow Oblast), Serbia, Spain and Sweden; Asia: Azerbaijan, Georgia and

Mongolia (Compton 1981, Trjapitzin 1989, Kalina 1989, Fusu 2018, Noyes 2018).

Comment: Compton (1981) reported this species from Norway: «F 24.vii 1f» [i.e. SOGN OG FJORDANE [SFI] Luster: Jostedal, Fossen 1♀ 24. July 1979, leg. Steve Compton, coll. «the Hull collection»]. Hedquist (1982) reported this species from Norway: «Stigstuv» [i.e. HORDALAND [HOI] Eidfjord: Stigstuv, July–September 1960, leg. Torstein Sølhøy, B. Rosenlund and Tore J. Moldung, det. Karl-Johan Hedquist, coll. ZMUB; for details see Fjellberg (1972)]. Trjapitzin (1989) also reported the species from «Norway», but without any further references.

***Bothriothorax clavicornis* (Dalman, 1820)**

Material examined: AKERSHUS [AK] Oslo: Hovedøya NW [«Lille vestre krutthus» N59.89630° E10.72571° ±5m; 20m a.s.l.] 1♀ 5 September–10 October 2006, Malaise trap, leg. Anders Endrestøl / Stefan Olberg.

Biology: Parasitoid on members of the family Syrphidae; the following species have been reported as primary hosts: *Episyrphus balteatus* (De Geer, 1776), *Neocnemodon fulvimanus* (Zetterstedt, 1843), *Scaeva* sp., *Syrphus* sp., *Syrphus ribesii* (Linnaeus, 1758) and *Syrphus vitripennis* Meigen, 1822 (Diptera, Syrphidae) (Noyes 2018).

Distribution: Belarus, Czech Republic, Denmark, England, Finland, Germany, Hungary, Ireland, Italy, Lithuania, Moldova, Montenegro, Netherlands, Norway, Poland, Romania, Russia (Kaliningrad Obl., Kaluga Obl., Moscow Obl., Nizhniy Novgorod Obl., Ryazan Obl. St. Petersburg and Yaroslavl' Obl.), Slovakia, Sweden, Switzerland and Wales; Asia: Armenia, Peoples' Republic of China, Mongolia, Russia (Adygey AO, Altai Kray, Khabarovsk Kray, Magadan Obl., Tomsk obl., Volgograd Obl.), Turkey and Uzbekistan (Strand 1913, Trjapitzin 1989, Japoshvili & Noyes 2006, Fusu 2018, Noyes, 2018).

Comment: Strand (1913) reported this species from Norway, quoted «Mofjeldet in Ranen 21.8.03» [i.e. NORDLAND [NSI] Rana: Mofjellet 21 August 1903, leg. Embrik Strand, det. Luigi Masi, col. ?ZMHB]; then Japoshvili & Noyes (2006) reported «2♀, 2♂, Aas, 18.IV.1972 (E. Hagvar) (BMNH)» [i.e. AKERSHUS [AK] 2♀♀

2♂♂, Ås: Ås 18 April 1972, leg. Eline Hågvar, det. George Japoshvili, coll. NHMUK].

***Encyrtus albitarsis* Zetterstedt, 1838**

[Syn.: *Encyrtus niveitarsis* Thomson, 1876]

Material examined: HEDMARK [HES] Engerdal: Isterfossen [N61.908371° E11.782553° ±10m; 644m a.s.l.] 1♀ 24 June 2004; 2♀♀ 23 June 2006, leg. Ove Sørlibråten.

Biology: The following primary hosts have been reported: *Pulvinaria aestivalis* Danzig, 1967 and *P. vitis* (Linnaeus, 1758) (Hemiptera, Coccidae) (Noyes 2018).

Distribution: Bulgaria, Czech Republic, Denmark, England, Finland, Germany, Hungary, Netherlands, Norway, Russia (Kaluga Obl., Karelian ASSR and St.Petersburg), Slovakia, Sweden, Switzerland and Ukraine; Asia: Russia (Khabarovsk Kray, Magadan Obl., Primorskij Kray and Yakut ASSR) (Trjapitzin 1989, Fusu 2018, Noyes 2018).

Comments: Trjapitzin (1989) list the species from Norway and Finland without any further references. The type is from Muonioniska in Northern Finland (Zetterstedt 1838 p.432), and Thomson (1876 p.121) records *E. niveitarsis* only from Sweden. It is, thus, questionable if the species is previously recorded from Norway. If not, these are the first Norwegian records.

***Pseudencyrtus idmon* (Walker, 1848)**

[Syn.: *Encyrtus idmon* Walker, 1848]

[Syn.: *Encyrtus idya* Walker, 1848]

[Syn.: *Encyrtus claviger* (Thomson, 1876)]

Material examined: AKERSHUS [AK] Sørum: Sørliøkka, Dammyra [N60.00462° E11.17466° ±10m; 183m a.s.l.] 1♀ 7 April 2007 sweep-netted on *Calluna vulgaris*, leg. Ove Sørlibråten; det. Csaba K. Thuróczy.

Biology: One primary host is reported: *Thecodiplosis brachyntera* (Schwagrighen, 1835) (Diptera, Cecidomyiidae), which is associated with *Pinus mugo* and *Pinus* spp. (Skuhravý & Thuróczy 2007, Noyes 2018).

Distribution: Europe: Czech Republic, Denmark, England, Finland, Germany, Ireland, Montenegro, Norway, Poland, Russia (Kaliningrad Obl., Murmansk Obl. St. Petersburg and Vladimir

Obl.), Spain and Sweden (Fusu 2018, Noyes 2018).

Comments: The type of this species is from Northern Norway and collected by Francis Walker on his visit to Finnmark in 1836 (Walker 1848): quoted «Alten, Finnmark [i.e. FINNMARK [FV] Alta: 22 July–3 September 1836, leg. Francis Walker, coll. NHMUK; for more details about the record, see Walker (1844) and Christy (1837)]. The type of *Encyrtus idya* is also from «Alten, Finnmark» and have similar data as *P. idmon*.

Sectiliclava cleone (Walker, 1844)

[Syn.: *Encyrtus cleone* Walker, 1844]

[Syn.: *Litomastix unguularis* Thomson, 1876]

[Syn.: *Selectiliclava paliuri* Hoffer, 1957]

Material examined: AKERSHUS [AK]

Ullensaker: Sessvollmoen, Aurtjernet W [N60.22954° E11.11133° ±5m; 200m a.s.l.] 1♀ 1 May–30 June 2008, Malaise trap S / sandy area / pine-forest edge, leg. Lars Ove Hansen; BUSKERUD [BØ] Drammen: Underlia [N59.75551° E10.17679° ±5m 115m a.s.l.] 1♀ 1–30 June 1994, Malaise trap / south facing slope / pine forest, leg. Lars Ove Hansen; Hurum: Mølen [N59.489153° E10.498874°; 5m a.s.l.] 1♀ 17 June–10 July 2010, Malaise trap B / sandy shore / forest edge, leg. Lars Ove Hansen; Hurum: Østnestangen N [N59.526716° E10.508789° ±50m; 50m a.s.l.] 1♀ 26 May–8 July 1995 Malaise trap / pine forest, leg. Lars Ove Hansen; BUSKERUD [BV] Rollag: Rollag–Veggli [N60.028324° E9.228857° ±10.000m] 4♀ 1–30 June 1995, car net / along road, leg. Bjørn Sagvolden.

Biology: The following primary hosts have been reported: *Cacopsylla mali* (Schmidberger, 1836), *C. melanoneura* (Foerster, 1848), *C. pyri* (Linnaeus, 1761), *Psylla subferruginea* Edwards, 1915 and other species of the subfamily Psyllinae (Hemiptera, Psyllidae) (Noyes 2018).

Distribution: Europe: Czech Republic, Denmark, England, Finland, Germany, Moldova, Montenegro, Norway, Poland, Romania, Russia (Kaluga Obl., Ryazan Obl., Moscow Obl., St. Petersburg and Voronezh Obl.), Slovakia, Sweden and Ukraine; Africa: Kenya and Sudan; Asia: Azerbaijan, Georgia, Kirgizia, Mongolia, Peoples' Republic of China, Russia (Buryat ASSR) and Uzbekistan (Fusu 2018, Noyes 2018).

Comments: The type of this species is like *P. idmon* from Northern Norway and collected by Francis Walker when he visited Finnmark in 1836 (Walker 1844): quoted «Found in the summer at Alten in Finnmark [i.e. FINNMARK [FV] Alta: 22 July–3 September 1836, leg. Francis Walker, coll. NHMUK; for more details about the record, see Christy (1837) and Graham (1961)].

Tetracnemoidea piceae (Erdős, 1946)

Material examined: AKERSHUS [AK]

Oslo: Hovedøya NW [«Lille vestre krutthus» N59.89630° E10.72571° ±5m; 20m a.s.l.] 1♀ 27 July–29 August 2006, Malaise trap / calcareous ground / forest edge, leg. Anders Endrestøl / Stefan Olberg.

Biology: The following species have been reported as primary hosts: *Kaltenbachiola strobi* (Winnertz, 1853) (Diptera, Cecidomyiidae) and *Physokermes hemicryphus* (Dalman, 1826) (Hemiptera, Coccidae); seems associated with conifers (*Picea abies*) (Noyes 2018).

Distribution: Czech Republic, Finland, Germany, Hungary, Norway, Poland, Russia (Kaluga Obl., Komi ASSR, Moscow Obl. and St. Petersburg), Slovakia and Sweden (Hedquist 1982, Trjapitzin 1989, Fusu 2018, Noyes, 2018). Hedquist (1982) reported the species from Sweden, but did not repeat it in the Swedish catalogue (Hedqvist 2003).

Comment: Hedquist (1982) reported this species from Norway: «Stigstuv» [i.e. HORDALAND [HOI] Eidfjord: Stigstuv, July–September 1960, leg. Torstein Sølhøy, B. Rosenlund and Tore J. Moldung, det. Karl-Johan Hedquist, coll. ZMUB; for details see Fjellberg (1972)]. The material of Encyrtidae and Aphelinidae at ZMUB is under revision.

Discussion

Eight species of Encyrtidae not hitherto reported from Norway were recorded in this investigation. This increases the number of Norwegian encyrtids to 151. Ottesen (1993) estimated the number in Norway to 120, but this study shows that the true number is much higher, and all recent contributions

have given considerable additions. Some of the records in this contribution are quite sensational. *Bothriothorax koponeni* is recorded for the first time outside Finland, and *Syrphophagus subviridis* for the first time outside Slovakia. *Isodromus limosus* has until now only been reported from Bohemia in the Czech Republic and Kostroma Oblast in Russia (Kalina 1989, Fusu 2018, Noyes 2018).

Most of the studied material was collected using Malaise traps, which seems to be an efficient way of collecting encyrtids, but gives reduced information about host associations. However, the method reveals some valuable information about flight periods, and may be used to give predictions about the habitat and probable hosts. *B. koponeni* was collected by the quite unconventional method of canopy fogging on spruce (*Picea abies*), so this species may certainly be associated with spruce.

Twenty-two species were originally reported from Norway prior to this study, but not all of these have been rediscovered. Our aim is to rediscover or recheck all the older traceable material of Encyrtidae published from Norway. Some species have been recovered, so even though they are not «new to Norway», they are included here with a brief historical review. Noteworthy records from six species are presented in this contribution. However the identity of the historical material has not been checked yet.

The two species *Pseudencyrtus idmon* and *Setiliclavula cleone* have not been recorded from Norway since Francis Walker (1809–1874) collected the types during his visit to Finnmark in 1836 (Walker 1844, 1848, Christy 1837).

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