

# Distribution of *Boreus westwoodi* Hagen, 1866 and *Boreus hyemalis* (L., 1767) (Mecoptera) in Norway

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An extensive material collected during nearly fifty years adds new detailed information on the distribution of the winter active insects *Boreus westwoodi* Hagen, 1866 and *B. hyemalis* (L., 1767) in Norway. Since females are difficult to identify, the new data rely on males. Based on the revised Strand-system, the following geographical regions are new to *B. westwoodi*: Ø, BØ, VAY, ON, TEI, TEY, MRI, MRY, and TRY. For *B. hyemalis*, AK, BØ, TEI, RY, SFI, and NTI are new regions. While *B. westwoodi* is widespread in Norway, including the three northernmost counties, *B. hyemalis* seems to be restricted to the south, with the northernmost record in NTI. In Sweden, the situation is similar: *B. westwoodi* is widespread, while *B. hyemalis* has been recorded as far north as Västerbotten, at a latitude corresponding to the northernmost record in Norway. The known distribution of both species in Norway is presented on EIS-grid map.

Key words: *Boreus hyemalis*, *Boreus westwoodi*, Mecoptera, distribution, Norway.

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## Introduction

The cold tolerant and wingless species of the genus *Boreus* Latreille (Fig. 1) are famous for their activity on snow. The genus has a Holarctic distribution (Svensson 1972) with two Norwegian species: *Boreus westwoodi* Hagen, 1866 (Figs. 1 & 4) and *Boreus hyemalis* (L., 1767). Their cold tolerance was studied by Sømme & Østbye (1969), and migration behaviour on snow and phenology of egg-laying by Hågvar (2001). A Fennoscandian review on their ecology was given in Hågvar (2010). However, few entomologists collect winter active insects, and the knowledge on the distribution of the two *Boreus* species in Norway has been limited.

Tjeder (1940, 1945) presented a few records of *B. westwoodi* from both Southern and Northern Norway. A mass occurrence on snow in Buskerud

county was described by Greve (1966). *B. hyemalis* was not recorded from Norway until Greve (1965) documented the species from an alpine habitat near Finse. Later, Fjellberg & Greve (1968) and Greve (1975, 1976) published numerous new localities for both species. The synopsis of described *Boreus* species published by Svensson (1972) did not contain new information of their distribution in Norway. The material presented here will shed a more complete light on the distribution of the two species.

## Material and methods

The present material was collected during a period of nearly fifty years, to a large degree by the two authors, but also by a number of other persons. Practically all specimens were taken on the snow



**FIGURE 1.** *Boreus westwoodi* Hagen, 1866, male. Photo: Arnstein Staverløkk ([www.naturogbilde.no](http://www.naturogbilde.no)).

surface, some specimens were also found in the stomach of birds collected on Hardangervidda.. The material examined is from the authors private collections, and also from numerous museum collections: Zoological Museum at Natural History Museum of Oslo (NHMO), Zoological Museum of Bergen (ZMB), Tromsø Museum (TM), The NTNU Museum of Natural History and Archaeology in Trondheim (VMT), and Helgeland Museum, Natural History Department, Mo i Rana (RMZ). Only male specimens were examined, because it is difficult to identify female specimens to species, due to their similarity in the appearance.. The private material, in alcohol, has been deposited in the Zoological Museum, Oslo.

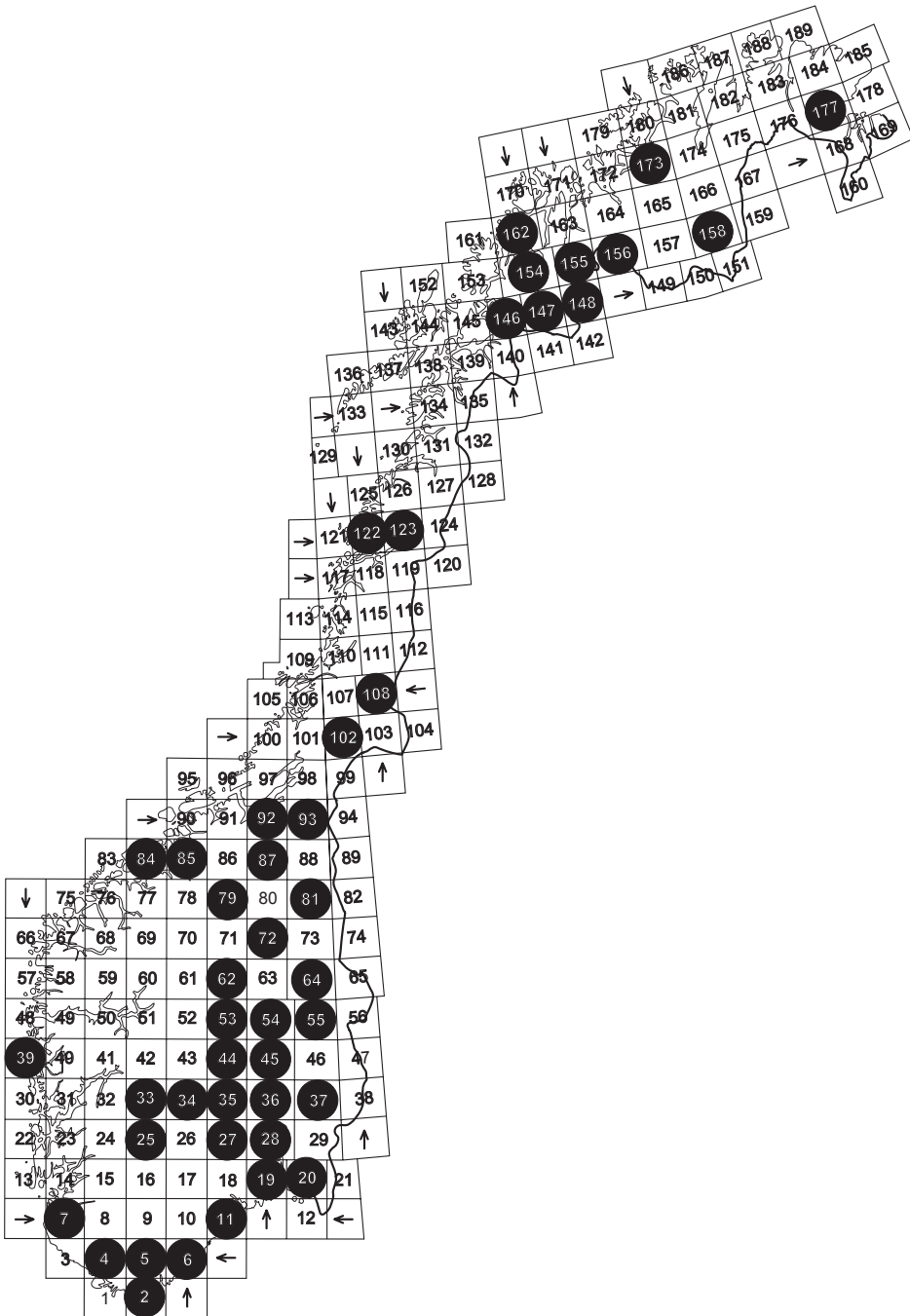
## Results

Figs 2–3 give updated information on the Norwegian distribution of *B. westwoodi* and *B. hyemalis*, illustrated by the EIS-grid system. Based on the revised Strand-system (Økland

1981), the following geographical regions are new to *B. westwoodi*: Ø, BØ, VAY, ON, TEI, TEY, MRI, MRY, and TRY. For *B. hyemalis*, AK, BØ, TEI, RY, SFI, and NTI are new regions. Earlier known Strand regions for the two species are listed in Table 1. Confirmed records in several regions are included in the present publication, see detailed information below.

### New localities of *Boreus westwoodi* in Norway.

**AK**, Bærum: Valler, EIS 28, 3 April 1968, 2♂♂, leg. Hågvar, S.; Hurdal : Skrukkelia, EIS 45, 10 January 1974, 2♂♂, leg. Hågvar, S.; 25 March 1975, 4♂♂, leg. Hågvar, S.; Nannestad: Tømte, Steinsgård, EIS 37, 1 December 1966, 1♂, leg. Østbye, E.; Nesodden: Helvik, EIS 28, 10 April 1981, 1♂, leg. Simonsen, J. H.; Oslo: Kjelsås-Moliksåsen, Nordmarka, EIS 36, 26-27 February 1967, 2♂♂, leg. Mysterud, I.; Sognsvann, EIS 28, 17 January 1965, 1♂, leg. Andersen, J.; Sørkedalen, EIS 28, 8 April 1934, 3♂♂, leg. Sømme (NHMO); Sørkedalen, Kjelsås, EIS 36, 17 March 1965,



**FIGURE 2.** Records of *Boreus westwoodi* Hagen, 1866 in Norway based on the EIS grid. (Two old records in Northern Norway have unknown EIS numbers: One record from >Eastern Finnmark, FØ, and one from inner part of Southern Nordland, NSI (Tjeder 1945).

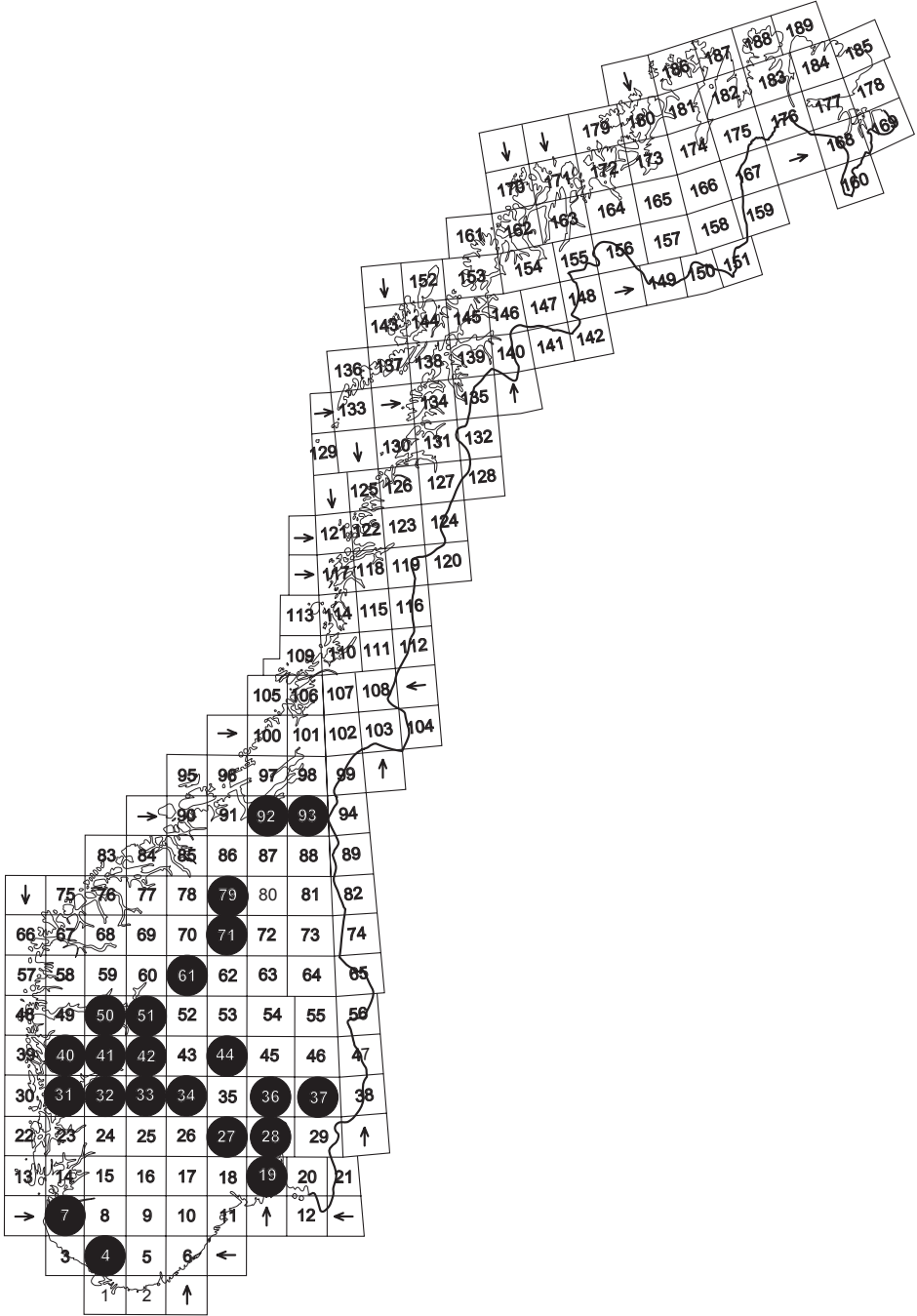
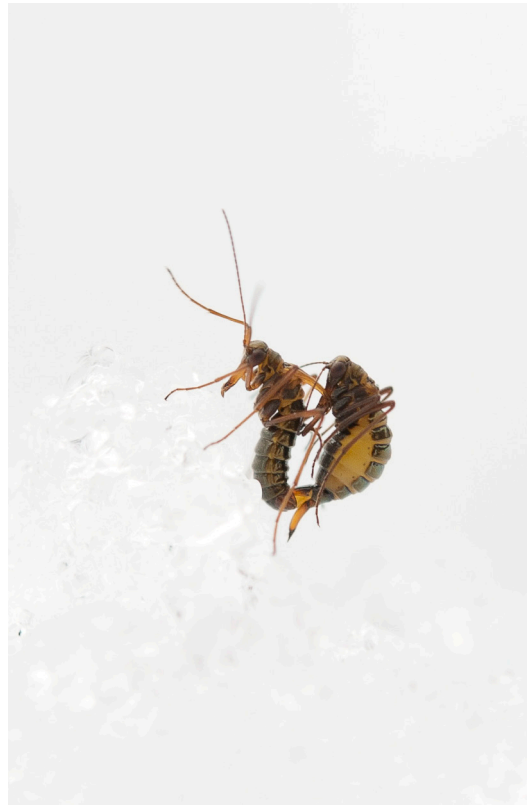


FIGURE 3. Records of *Boreus hyemalis* (L., 1767) in Norway based on the EIS grid.

2♂♂, leg. Østbye, E.; Tryvann, EIS 28, 25 March 1998, 2♂♂, leg. Hågvar, S.; Ullernåsen, EIS 28, October 1930, 1♂, leg. Münster, T. G. (NHMO); Vettakollen, EIS 28, 8 January 1966, 1♂, leg. Østbye, E.; Ås: Høyskoleskogen, EIS 28, 6 January 1998, 1♂, leg. Hågvar, S.; 5 March 1999, 1♂, leg. Hågvar, S.; Ø, Halden: Hafsrød, Idd, EIS 20, October 1925, 2♂♂, leg. Münster, T. G. (NHMO); Moss: Jeløy, Alby, EIS 19, 23 October 1998, 1♂, leg. Sørlibråten, O. (NHMO); **BØ**, Drammen: Drammen, EIS 28, 24 March 1968, 2♂♂, leg. Melåen, J. (NHMO); Kongsberg: Meheia, Kolsjø, EIS 27, 1974, 2♂♂, leg. Østbye, E.; Ravalsjøen, EIS 27, 10–20 April 1965, 11♂♂, leg. Østbye, E.; Skrim, EIS 27, 16 March 1974, 3♂♂, leg. Hågvar, S.; Lier: Sylling, EIS 28, Altanåsen, 13 January 1963, 1♂, leg. Østbye, E.; 10 November 1968, 2♂♂, leg. Østbye, E.; 17 January 1965, 1♂, leg. Østbye, E.; Brekkeåsen, 1966, 1♂, leg. Østbye, E.; Ringerike: Eggemoen ved Hønefoss, EIS 36, 26 February 1967, 1♂, leg. Østbye, E.; Krokskogen, EIS 36, 12 April 1968, 1♂, leg. Hågvar, S.; 15 March 1998, 7♂♂, leg. Hågvar, S.; 1 November 1998, 7♂♂, leg. Hågvar, S.; **BV**, Rollag: Vegglifjell, EIS 35, 15 April 1963, 900 m a.s.l., 1♂; Votnedalen, EIS 35, 12–19 April 1987, 11♂♂, leg. Hågvar, S.; Flå: Mørkedalsåsen, Bergheim, EIS 44, 18 October 1968, 1♂, leg. Østbye, E.; Veneliseter, EIS 44, 27 September 1968, on first snow, 1♂, leg. Østbye, E.; Hol: Dagali, EIS 34, 16 April 1965, 1♂, leg. Greve, L. (NHMO). Many animals observed, some in copula (Greve 1966); **HES**, Elverum: Svarthollet, EIS 55, 22 November 1964, 1♂, leg. Østbye, E.; Ringsaker: Mesnalien, EIS 54, December 1932, 1♂, leg. Sømme (NHMO); **HEN**, Folldal: Gammelsætran, EIS 72, 14 April 1965, 1♂, leg. Østbye, E.; Stor-Elvdal: Atnasjøen, EIS 72, 26 March 1967, 1♂, leg. Semb-Johansson, A.; Imsdalen, EIS 64, 9 November 1969, 1♂, leg. Fremming, O. R.; Tynset: River Auma at Kurøsten, EIS 72, 1♂; Auma, Tyldalskjølen, EIS 72, 12 April 1968, 1♂, leg. Lillehammer, A. (NHMO); **OS**, Gausdal: Ormtjernkampen national park, S of top, EIS 53, 23 October 1975, 1♂, leg. Hågvar, S.; Gran: Lake Gulden, EIS 36, 31 March 1968, 1♂, leg. Hågvar, S.; **ON**, Nord-Fron: Furusjøen, EIS 62, 14–23 April 1973,



**FIGURE 4.** A pair of *Boreus westwoodi* copulating on snow. Midtre Gauldal, 2 April 2011. The female is situated on the back of the male. Photo: Arnstein Staverløkk ([www.naturogbilde.no](http://www.naturogbilde.no)).

4♂♂, leg. Hågvar, S.; 20 April 1968, 3♂♂, leg. Hågvar, S.; **TEY**, Porsgrunn: Dammane, EIS 11, light trap 7–19 October 1988, 3♂♂, leg. Søli, G.E.E. (ZMB); **TEI**, Vinje: Rauland, EIS 25, 22 March 1992, 4♂♂, leg. Hågvar, S.; Tinn: Skjervedalen, Hovin, EIS 34, 12 October 1968, 3♂♂, leg. Lien, L.; **AAV**, Grimstad: Grimstad, EIS 6, October 1920, 1♂, leg. Münster, T. G. (NHMO); **VAY**, Kristiansand: Andøen, EIS 2, October 1921, 1♂, leg. Münster, T. G. (NHMO); Mosby, EIS 5, October 1921, 1♂, leg. Münster, T. G. (NHMO); **RY**, Gjesdal: Giljastølvannet, EIS 7, 12 April 1982, 1♂, leg. Rognes, K. (ZMB); Lund: Stølvann, EIS 4, 11 April 1968, 2♂♂, leg. Sirnes, J.; **MRY**, Gjemnes: Asplihaugen, EIS 84, 11 April 1995, 2♂♂, leg. Skartveit, J. (ZMB); Hanesetmyran, EIS 84, 9 April 1995, 2♂♂, leg. Skartveit, J. (ZMB); Molde: Moldedalen, EIS 84,

**TABLE 1.** Published data about the Norwegian distribution of *Boreus westwoodi* Hagen, 1866 and *B. Hyemalis* (L., 1767). The revised Strand system is according to Økland (1981).

	<i>Boreus westwoodi</i>		<i>Boreus hyemalis</i>	
	Revised Strand	EIS code	Revised Strand	EIS code
Tjeder (1940)	TRI, FV, FN	154, 173, 177		
Tjeder (1945)	AK, HES, RY, NSI, TRI, FV, FN, FØ			
Greve (1965)			HOI	42
Greve (1966)	BV	34		
Fjellberg & Greve (1968)	VE, OS, FI	19, 44, 158	VE, OS, BV, HOI	19, 34, 42, 44
Greve (1975)	HEN, AAY, HOY, STI, NTI	6, 39, 72, 79, 92, 102, 108	ON, HOY, STI	40, 61, 92
Greve (1976)	HOI	33	HOI	32, 33, 41

15 April 1976, 2♂♂, leg. Fjellberg, A. (ZMB); MRI, Surnadal: Kvanne, Stangvik, EIS 85, 11 April 1968, 1♂, leg. Mehl, R.; Surnadal, EIS 85, 19 April 1968, 1♂, leg. Røv, N.; Vindsta, EIS 85, 11 January 1967, 1♂, leg. Røv, N.; Vindøldal, Trollheimen, EIS 85, 17–21 April 1968, 5♂♂, leg. Røv, N.; **STI**, Midtre Gauldal: Rønningen farm, EIS 87, 2 April 2011, 3♂♂, one in copula, leg. Staverløkk, A.; Oppdal: Kongsvoll, EIS 79, 24 April 1998, 1♂, leg. Hågvar, S.; Røros: Femunden, Sørвика, EIS 81, 13 April 1968, 1♂, in copula, leg. Ødegård, H.; Trondheim: Rønningen tourist hut, EIS 92, 20 March 2011, 1♂, leg. Staverløkk, A.; Vikelva, Ranheim, EIS 92, 26 March 1967, 2♂♂, leg. Larsson, B. (VMT); Vikelvdalen, EIS 92, 1♂, leg. Solem, J. O. (VMT); **NTI**, Stjørdal: Stjørdal, EIS 93, 21 October 1967, 3♂♂, leg. Moksnes, A.; **NSI**, Rana: Bjellånes, EIS 123, 14 November 1978, 1♂, leg. Straumfors, P. (RMZ); Bustnes, EIS 123, 11 April 1980, 4♂♂, leg. Straumfors, P. (RMZ); Plurdalen, EIS 123, 31 March 1979, 1♂, leg. Straumfors, P. (RMZ); Selforsfjellet, EIS 123, 23 November 1985, 2♂♂, leg. Straumfors, P. (RMZ); Selforslia, EIS 123, 25 March 1973, 1♂, leg. Straumfors, P. (RMZ); Straumen, EIS 122, 7 November 1976, 1♂, leg. Straumfors, P. (RMZ); Straumfors, EIS 122, 6 April 1980, 1♂, leg. Straumfors, P. (RMZ); Utskarpen, EIS 122, five samples: 30 March 1980, 1♂; 4 April 1980; 1♂; 11 April 1980, 1♂; 19 April 1981, 1♂; 9 April 1982, 1♂. All samples leg. Lundmo, S. (RMZ);

Åenglia, EIS 123, 12 April 1980, 4♂♂, leg. Straumfors, P. (RMZ); **TRY**, Tromsø: Tromsø, EIS 162, 20 October 1968, 1♂; Skattørvatnet, EIS 162, 1985, 2♂♂, leg. Fjellberg, A. (TM); **TRI**, Balsfjord: Tamokdalen, Nordkjoselva, EIS 155, 13 September 1968, 1♂; Bardu: Setermoen, EIS 146, 1984, 1♂, leg. Fjellberg, A. (TM); Målselv: Dividalen, EIS 147, 1985, 2♂♂, leg. Fjellberg, A. (TM); Dividalshytta-Fossbu, EIS 148, 13 October 1968, 12♂♂, one pair in copula, leg. Dunker, H.; Nordreisa: Njallaavzi, 2 km E of boardermark 308B, EIS 156, 4 May 1972, 1♂, leg. Hågvar, G.; **FV**, Alta: Kåfjord, EIS 173, 1♂, leg. Münster, T. G. (NHMO).

#### **New localities of *Boreus hyemalis* in Norway.**

**AK**, Nannestad: Tømte i Steinsgård, EIS 37, 1 December 1966, 6♂♂, leg. Østbye, E.; Oslo: Sørkedalen, Kjelsås, EIS 36, 17 March 1965, 1♂, leg. Østbye, E.; Vettakollen, EIS 28, 6 February 1965, 1♂, leg. Østbye, E.; Ski: Ski, EIS 28, 13 February 1972, 1♂, leg. Selmer; Ås : Høyskoleskogen, EIS 28, 5 March 1999, 3♂♂, leg. Hågvar, S.; **BØ**, Hurum: Grytnes, EIS 28, 10 November 1997, 1♂, leg. Engdal, J. (NHMO); Kongsberg: Ravalsjøen, EIS 27, 10–20 April 1965, 1♂, leg. Østbye, E.; 9 November 1969, 4♂♂, leg. Østbye, E.; Lier: Sylling, EIS 28, 17 January 1965, 1♂, leg. Østbye, E.; 10 November 1968, 2♂♂, Østbye, E.; Ringerike: Krokskogen,

EIS 36, 22 January 1988, 2♂♂, leg. Hågvar, S.; 1 November 1998, 7♂♂, leg. Hågvar, S.; BV, Flå: Mørkedalsåsen, Bergheim, EIS 44, 18 October 1968, 1♂, leg. Østbye, E.; Veneliseter, EIS 44, 27 September 1968, on first snow, 1♂, leg. Østbye, E.; ON, Dovre: Hjerkin, EIS 71, 23 November 1986, 1♂, (ZMB); TEI, Notodden: V. Sætre, Gransherad, EIS 27, 19 March 1967, 1♂; Tinn: Kalhovd, EIS 34, 19 September 1993, 1♂, leg. Sagvolden, B. A. (ZMB); Skjervedalen, Hovin, EIS 34, 12 October 1968, 1♂, leg. Lien, L.; RY, Lund: Stølsvann, EIS 4, 11 April 1968, 1♂, leg. Sirnes, J.; Sola: Vigdel, EIS 7, 17 October 2001, 1♂, leg. Johnsen, J. I. (ZMB); HOY, Osterøy: Kleppe, EIS 40, 9 February 1987, 1♂, leg. Fjeldså, A. (ZMB); Samnanger: Tysse, EIS 31, 26 October–1 November 1980, 1♂, leg. Tysse, Å. (ZMB); HOI, Eidfjord: Stigstuv, Hardangervidda, 1250 m a.s.l., EIS 33, in stomach of four birds, *Anthus pratensis*, one shot 16 September 1969 and three shot 13–18 September 1970, 4♂♂, leg. Østbye, E. and Hågvar, S.; Ulvik: Finse, EIS 42, pitfall traps 2 September–8 October 1969, 7♂♂, leg. Østbye, E. and Hågvar, S.; SFI, Leikanger: Grinde, EIS 50, 31 January 1993, 1♂, leg. Anonby, J. (ZMB); Sogndal: Barsnes, EIS 51, 1 January 1967, 1♂, leg. Hågvar, S.; 2 January 1969, 2♂♂, leg. Hågvar, S.; 11 November 1973, 3♂♂, leg. Hågvar, S.; STI, Oppdal: Near Heimtjørni, EIS 79, (pitfall, 8 September 1994–20 June 1995, 1200 m a.s.l.) 1♂, leg. Skartveit, J. (ZMB); Midtre Knutshø, EIS 79, (pitfall, 8 September 1994–13 June 1995, 1400 m a.s.l.) 7♂♂, leg. Skartveit, J. (ZMB); Sprænbekken, EIS 79, (pitfall, 10 August 1994–7 September 1995, 1060 m a.s.l.) 1♂, leg. Skartveit, J. (ZMB); NTI, Stjørdal: Stjørdal, EIS 93, 21 October 1967, 1♂, leg. Moksnes, A.

## Discussion

**Distribution of *Boreus* species.** The present, extensive data confirm earlier assumptions that *B. westwoodi* occurs widespread in Norway, and that *B. hyemalis* is restricted to Southern Norway (Tjeder 1940, 1945; Greve 1965, 1975; Fjellberg & Greve 1968). The situation is similar in Sweden, *B. westwoodi* occurring from Skåne to Torne

Lappmark, while *B. hyemalis* has been recorded as far north as Västerbotten (Svensson 1972, Bergsten & Pettersson 2000). On a European basis, *B. westwoodi* not only has a more northern distribution, but also a more eastern distribution than *B. hyemalis*. According to Svensson (1972), *B. westwoodi* occurs in Finland, Russia, Eastern Baltic States, Germany, Poland, the former Czechoslovakia, Bulgaria, Switzerland, and Italy. The species has not been confirmed from Western Europe. *B. hyemalis*, on the other hand, has been reported from western countries like England, Holland, Belgium, France, and Denmark, but also from Germany, Poland, the former Czechoslovakia, Romania, Switzerland, Austria, and Italy. It has not been recorded from Finland or Russia, except in Caucasus. May be the two species have been migrating along different routes into Northern Europe after the last glaciation, *B. westwoodi* mainly from east and north, and *B. hyemalis* mainly from south and west.

*B. hyemalis* has been found far above the tree line, up to 1400 m a.s.l. both on Hardangervidda (Fjellberg & Greve 1968), and on Dovrefjell (Oppdal). Therefore, climatic conditions should not be too harsh in northern Norway. Do these wingless insects have a slow dispersal ability, so that only southern Norway has been possible to colonize until now for *B. hyemalis*? *B. westwoodi*, on the other hand, has very few records along the west coast of south Norway (Fig. 2). This more eastern and northern species may not yet have colonized efficiently this part of the country.

The present state of knowledge should be supplied with more data. There are few records of *Boreus* from Nordland. *B. westwoodi* should be looked for in western south Norway. Both species are easy to spot on snow during warm days, especially during early and late winter.

**Why present on snow?** The present, large material contains only four cases where copulating animals were reported on snow (*B. westwoodi*). Weather conditions were stable or rather warm (Målselv 13 October, 4°C; Midtre Gauldal 2 April, about 5°C; Røros 13 April, rainy; Hol 16 April, cloudy;). Also Hågvar (2001) reported only three cases of copulation on snow from November, December and January during warm, stable and

overcast weather, partly foggy or rainy. Sauer (1966) observed in culture that copulation takes a long time, up to two days. The reduced motility of a copulating pair may make copulation on snow hazardous during the colder part of the winter. If the temperature drops fast, the copulating animals may freeze to death before they are able to find a channel down to the subnivean space. We assume that the main copulation occurs in autumn soon after hatching, before a snow cover is established. However, since the females feed on moss and produce eggs throughout the winter (Hågvar 2001), late winter copulation during stable weather conditions may also be of importance. Males live throughout the winter without losing weight, indicating that they eat and have a biological function (Hågvar 2001). Alternatively, copulation occurs under snow. The main purpose of snow surface activity is probably migration (spreading eggs and finding new feeding places), as well as ripening eggs by absorbing heat during sunny days (Hågvar 2001, 2010).

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