Towards a new era for the knowledge of ants (Hymenoptera, Formicidae) in Norway? Nine species new to the country

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Ødegaard, F., Olsen, K.M., Staverløkk, A. & Gjershaug, J.O. 2015. Towards a new era for the knowledge of ants (Hymenoptera, Formicidae) in Norway? Nine species new to the country. *Norwegian Journal of Entomology* 62, 80–99.

A total of nine species of ants are reported new to the Norwegian fauna. The first verified Norwegian records of *Myrmica rugulosa* Nylander, 1846, and *Temnothorax interruptus* (Schenck, 1852) are reported. In addition, *Leptothorax goesswaldi* Kutter, 1967, *Leptothorax kutteri* Buschinger, 1965, *Anergates atratulus* (Schenck, 1852), *Lasius sabularum* (Bondroit, 1918), *Lasius bicornis* (Forster, 1850), *Lasius citrinus* Emery, 1922, and *Formica foreli* Emery, 1909 are reported for the first time from Norway. In addition, notes and new records of the rarely collected species *Temnothorax nylanderi* (Förster, 1850), *Dolichoderus quadripunctatus* (Linnaeus, 1771), *Formica pressilabris* Nylander, 1846, and *Polyergus rufescens* (Latreille 1798) are given. With this report, a total of 65 species of outdoor living ants are recorded from Norway.

Key words: Hymenoptera, Formicidae, *Anergates*, *Coptoformica*, *Chthonolasius*, *Dolichoderus*, *Formica*, *Lasius*, *Leptothorax*, *Myrmica*, *Polyergus*, *Temnothorax*, parasitic ants, Norway.

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Introduction

The knowledge of ants in Norway has steadily increased from the 1880s until now. Important milestones summarizing the knowledge of the Norwegian ant fauna was made by Siebke (1880), who included 19 species (of which 16 or 17 were represented with valid records at that time), Holgersen (1944), who reported 35 species from Norway, and Collingwood (1974, 1979), who reported 44 and 46 species, respectively. Several small papers published during the last 30 years (e.g. Kvamme 1999) still added new species, and the latest update (Ødegaard 2013) included 57 species of outdoor living ant species (i.e. 56 species when excluding the misidentified *Myrmica rugulosa*). The present paper represents a major step towards a more complete mapping of the Norwegian ant fauna.

The current paper is a part of a national strategy for increasing knowledge of biodiversity in Norway (Artsdatabanken 2015a), where

the Norwegian Institute for Nature Research (NINA) leads two large scale mapping projects for insects (INVENT-ART and ACUNOR). More information about both these projects are available online (Artsdatabanken 2015a). The main aims of these projects are to find new species to Norway and to collect new data on poorly known species. As many ant species have a very specialized way of living, it was necessary to target potential species and make directed search for each of them in their natural habitats. The projects have particular focus on dry and warm habitat types, such as sandy areas and southern faced screes as well as dry dead wood, which typically have a rich fauna of ants. This paper summarizes the most interesting records from this effort.

Material and methods

Abbreviations and codes: MT = malaise trap; * new to Norway; AE = Anders Endrestøl; AF = Arne Fjellberg; AS = Arnstein Staverløkk; CO = Caroline Olsen; FØ = Frode Ødegaard; KMO = Kjell Magne Olsen; MSL = Mikkel Strøm-Larsen; NHM = Natural History Museum, Oslo; SOL = Sondre Olsen; STO = Stefan Olberg; ØG = Øivind Gammelmo; JOG = Jan Ove Gjershaug.

As these mapping projects have a broad taxonomic insect focus, several traps of different types were used at the collecting sites. Particularly malaise traps are efficient for collecting alate ants. However, hand collecting is the most important method for ants in general. This included sweep netting, search in dead wood, in mosses, and in the soil, e.g. under stones.

The material collected by FØ and AS is preserved in the dry insect collections at NINA. Material collected by KMO is preserved in 70 % ethanol in the private collection of KMO or deposited at the NHM. All records are available at the interoperable biodiversity database services Species Map Service (run by the Norwegian Biodiversity Information Centre) (Artsdatabanken 2015b), and at the Global Biodiversity Information Facility (GBIF 2015). Several specimens of all species have been DNA-barcoded, and data (project NOFOR) can be accessed in BOLD public data base (BOLDSystems 2015). All specimens are identified by the authors and some critical identifications are verified by prof. B. Seifert at Senckenberg Museum. All species in the current report have been assessed for red listing according to the IUCN categories. Results from this assessment will be available at the Norwegian Biodiversity Information Centre in 2015.

The species

**Myrmica rugulosa* Nylander, 1846

HES, Kongsvinger: Granli, Posteringen N60.1241° E12.1041°, MT 3 August–12 September 2011, 1 alate queen, leg. FØ; Eidskog: Åbogen N60.11572° E12.11407°, 5 September 2014, 8 colonies, leg. FØ; 28 September 2014, 3 additional colonies, leg. KMO. At this locality a total of eleven colonies where found in a dry, disturbed meadow along the roadside (Figure 1–2). The colonies were placed in rather packed, sandy soil mixed with gravel, 0–50 cm below the ground. The colonies were very large compared to other *Myrmica* Latreille, 1804 species and consisted of several thousand individuals. A few alate males and queens were found together with the workers in six of the colonies. Two workers were DNA-barcoded and they clustered together with *M. rugulosa* from Finland and Canada.

In fact, *Myrmica rugulosa* is reported from Norway three times earlier (Siebke 1880, Strand 1903, Olsen 1999). Specimens associated with the two first reports were revealed as misidentifications by Holgersen (1944), and the queen from Ø, Sarpsborg associated with the latest report was checked by us, and proved to be *M. rubra* (Linnaeus, 1758). The records from Hedmark, in 2011 and 2014, therefore represent the first verified records of *M. rugulosa* form Norway. The proposed Norwegian common name for *M. rugulosa* is "dvergeitermaur".

**Leptothorax goesswaldi* Kutter, 1967

AK, Aurskog-Høland: Bråten, N59.94201° E11.7412°, yellow pan trap, 7 August 2013, 1 dealate queen, leg. KMO/SOL (Figure 3). The trap was situated in a small sand pit. The occurrence

FIGURE 1. *Myrmica rugulosa* Nylander, 1846, **A**. queen **B**. male. Photo: A. Staverløkk.

FIGURE 2. The locality at Åbogen in Eidskog, Hedmark, where several colonies of *Myrmica rugulosa* Nylander, 1846 were found. Photo: F. Ødegaard.

FIGURE 3. *Leptothorax goesswaldi* Kutter, 1967, **A**. queen, lateral view **B**. queen, head, dorsal view. Photo: A. Staverløkk.

of this species in Norway is quite surprising, as this is considered one of the rarest ant species in Europe. For unknown reasons, DNA-barcoding did not give sequences for this individual.

Elsewhere, *Leptothorax goesswaldi* is only known from one place in southern Sweden, a few places in the Alps, and from Kazakhstan. The species is a parasite of *Leptothorax acervorum* (Fabricius, 1793). After mating outside the nest, the new queen of *L. goesswaldi* invades a colony of the host and kills the host queen by cutting off her antennae (Buschinger & Klump 1988). New fieldwork in 2014 revealed several colonies of *L. acervorum* in the local area, but no specimens of *L. goesswaldi* were found. The proposed Norwegian common name for *L. goesswaldi* is "parasittsmalmaur".

* *Leptothorax kutteri* Buschinger, 1965

STI, Midtre Gauldal: Soknedal, Rønningen, N62.9592° E10.2663°, 6 July 2014, 1 dealate queen and 3 alate males, in a colony of *Leptothorax acervorum* established in a rotten pine log, leg. AS (Figure 4). The site was located in a boreal forest dominated by Scots pine *Pinus sylvestris* Linnaeus, 1753 and Norway spruce *Picea abies* (Linnaeus, 1753) Karsten, 1881. Relatively large amounts of dead wood in proper state for establishment of *L. acervorum* was present in the surroundings. The occurrence of this species in Norway is not surprising, as it has a wide distribution in both Sweden and Finland.

The species lives in an inquiline relationship with *Leptothorax acervorum*. One or a few queens

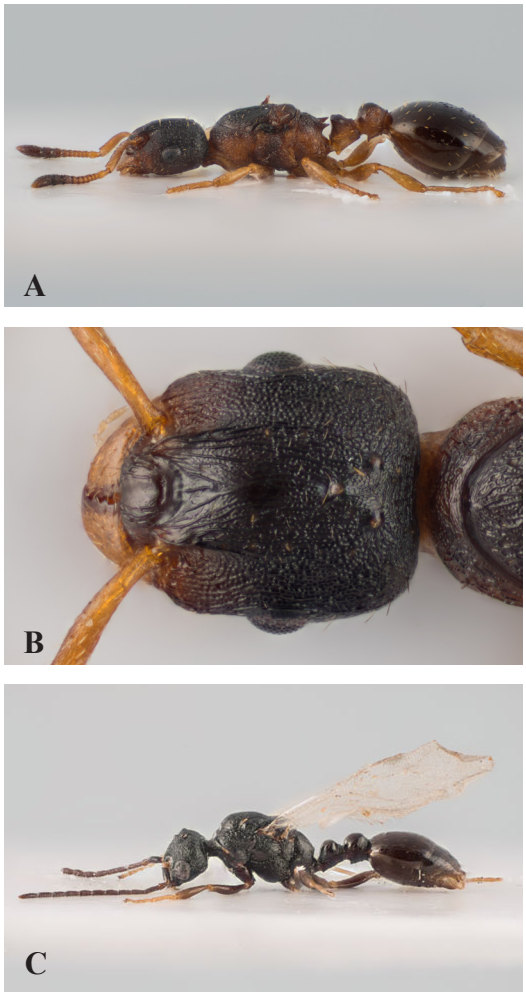

FIGURE 4. *Leptothorax kutteri* Buschinger, 1965, **A**. queen, lateral view **B**. queen, head, dorsal view **C**. male, lateral view. Photo: A. Staverløkk.

FIGURE 5. *Temnothorax interruptus* (Schenck, 1852), **A**. queen **B**. worker. Photo: A. Staverløkk.

are normally found in the host colony and their presence do not seem to affect brood productions by the host appreciably (Douwes et al. 2012).

Both *Leptothorax kutteri* and *Leptothorax goesswaldi* (queen and male) can be separated from *Leptothorax acervorum* by the presence of a pronounced ventral process of the postpetiole (Figure 3a and 4a). The queen of *L. kutteri* can be distinguished from *L. goesswaldi* by the lack of a prominent inward curved frontal edge of the clypeus, different sculpture of the head, shorter hairs of the metasoma, as well as the smaller size (Figure 3 and 4). The males of *L. kutteri* can be distinguished from both *L. acervorum* and *L. goesswaldi* by the short and sparse pubescence of the metasoma (Figure 4c). The proposed Norwegian common name for *L. kutteri* is "snyltesmalmaur".

* ***Temnothorax interruptus* (Schenck, 1852)**

TEY, Kragerø: Skåtøy, Burøyheia. N58.85691° E9.51701°, 2 July 2014, 1 worker, leg. FØ; 16 July 2014, several colonies, including 2 queens (Figure 5), leg. FØ; 16 August 2014, 22 workers, leg. KMO. The colonies were found on a south-western faced, naked rock under scattered patches of mosses. The locality is extremely hot during summer afternoons. Two specimens were DNA-barcoded, and the CO1-sequences were identical to *Temnothorax interruptus* from Finland.

This is the first confirmed records of *Temnothorax interruptus* from Norway. However, the species was reported from Oslo (at Ryenberg and Fjeldstuen) by Siebke (1880). These records were considered doubtful by Collingwood (1974) as no material is conserved, and the nearest occurrence was far away in south-eastern Sweden. Later, the species has been omitted from Norwegian check-lists. The new locality in Telemark represents a natural habitat, which indicates that the species has reproduced in Norway for a long time. The species is fairly easy to recognize, through the S-shaped antennal-grooves, and the long

FIGURE 6. *Temnothorax nylanderi* (Förster, 1850), worker and queen in nest. Photo: A. Staverløkk.

propodeal spines (Seifert 2007). *T. interruptus* was well established taxonomically in the late 19th century, so it is probably no reason to doubt the old records published by Siebke (1880). The proposed Norwegian common name for *T. interruptus* is "lys dvergmaur".

***Temnothorax nylanderi* (Förster, 1850)**

VE, Horten: Løvøya, Kjerkebukta N59.45008° E10.44081°, 9 July 2013, several workers were sweep netted in vegetation of a mixed deciduous forest edge dominated by *Tilia cordata* Miller, 1768 and *Quercus robur* Linneaus, 1753 leg. FØ; 31 July 2013, several small colonies consisting of 20–100 individuals were found in small, dry twigs of oak lying on the ground (Figure 6), with alate males present in one of the colonies, leg. FØ; MT 1 July–7 August 2014, 1 alate male, leg. AS; 28 August 2013, several small colonies consisting of 20–100 individuals were found in small, dry twigs of oak lying on the ground, leg. AS; sieving 30 March 2014, 1 dealate queen and 1 worker, leg. KMO; handpicking 30 March 2014, 28 workers, leg. KMO; 27 May 2014, 8 workers, leg. KMO. **TEY**, Bamble: Nustad Nature reserve, N59.00559° E8.22421°, 14 September 2000, 1 worker, leg. KMO. **TEI**, Seljord: Heggenes, N59.44048° E8.78332°, yellow pan trap, 8 August 2014, 1 worker, leg. KMO.

The first specimens of this species from Norway was found at Natursenteret in Horten (Borrevann) (Kvamme & Olsen 2011), a few kilometres from Løvøya. Two dealate queens were found in dead wood, but not associated with colonies. The present report holds the first records of colonies for this species in Norway. The proposed Norwegian common name for *Temnothorax nylanderi* is "skogdvergmaur".

****Anergates atratulus* (Schenck, 1852)**

VE, Tjøme: Sandø N, N59.08391° E10.46221°, MT 4 July–10 August 2014, 1 alate queen, leg. FØ. **TEY**, Kragerø: Skåtøy, Burøyheia. N58.8596° E9.5189°, 2 July 2014, several hundred alate queens and 12 males found in a colony of *Tetramorium caespitum* (Linnaeus, 1758), leg. FØ/AS/KMO (Figure 7); N58.85940° E9.51992°, 6 August 2014, 5 alate queens in a colony of *T. caespitum*, leg. AS/JOG. Both colonies were situated in dry soil in crevices between bare rock

FIGURE 7. *Anergates atratulus* (Schenck, 1852), **A**. male **B**. female. Photo: A. Staverløkk.

FIGURE 8. The locality for *Anergates atratulus* (Schenck, 1852) at Burøyheia, Skåtøy in Kragerø, Telemark. Photo: F. Ødegaard.

FIGURE 9. *Dolichoderus quadripunctatus* (Linnaeus, 1771), worker. Photo: A. Staverløkk.

surfaces (Figure 8). The microclimate at the sites is extremely hot during sunny summer afternoons.

These are the first records of this parasitic species from Norway. As some Swedish localities for *Anergates atratulus* are situated quite close to the Norwegian border, the species has been expected to be found in Norway. Massive search for the species in areas where the host *Tetramorium caespitum* was recorded finally gave results, but the species is apparently very rare in Norway. *A. atratulus* attacks queenless colonies of *T. caespitum*. The new queens mate with the wingless males in the original nest, and eventually fly out and search for new host nests to attack. Mated queens have a very swollen abdomen and can produce thousands of eggs. The proposed Norwegian common name for *A. atratulus* is "gjøkmaur".

***Dolichoderus quadripunctatus* (Linnaeus, 1771)**

VE, Horten: Løvøya, Kjerkebukta, N59.45008° E10.44081°, 9 July 2013, several workers were sweep-netted in vegetation of a mixed deciduous forest edge dominated by *Tilia cordata* and *Quercus robur* (Figures 9–10) and, in addition, a small queenless sub-colony consisting of about 15 workers was found inside a dry, sun-exposed, dead branch of *T. cordata*, leg. FØ; 31 July 2013, several workers sweep netted, leg. FØ; 27 May 2014, several workers (3 collected) from colony in dead branch near the top of a large oak *Q. robur*, leg. KMO; Veggefjell, N59.44997° E10.44156°, MT 1 July–7 August 2014, 3 workers, leg. AS; MT 7–27 August 2014, 1 worker, leg. AS; Mellomøya, N59.44326° E10.46143°, MT 22 May–16 June 2014, 2 workers, leg. AS; MT 16 June–1 July 2014, 1 worker, leg. AS. Both malaise traps collected material in areas with mixed deciduous forest dominated by *T. cordata, Q. robur* and *Pinus sylvestris.* Results from DNA-barcoded material show that the CO1-sequences of Norwegian specimens cluster together with *Dolichoderus quadripunctatus* from Central Europe.

These records represent the second, third and fourth locality for *Dolichoderus quadripunctatus* in Scandinavia. The only previously known locality for this species in Norway is the island of Mølen in the Oslofjord (Hansen *et al.* 2006), which is located about 4 km away from Løvøya. The

FIGURE 10. The locality at Løvøya in Horten, Vestfold, where *Temnothorax nylanderi* (Förster, 1850) and *Dolichoderus quadripunctatus* (Linnaeus, 1771) occurred in large numbers in July 2013. Photo: F. Ødegaard.

species is obviously rare, but may be overlooked some places, as it seems to prefer dead wood in the canopy for nesting.

* *Lasius sabularum* (Bondroit, 1918)

AK, Oslo: Romsås, Rommen, N59.96388° E10.90105°, 9 April 2002, 4 workers, leg. KMO; Aurskog-Høland: Bråten, N59.94201° E11.7412°, yellow pan trap 7 August 2013, 1 alate queen, leg. KMO/SOL. **VE**, Larvik: Mølen, N58.97514° E9.8247°, MT 20 August–2 October 2009, 4 alate queens, leg. KMO/STO/ØG; Nevlungstranda, N58.96852° E9.84824°, MT 20 August–2 October 2009, 1 alate queen, leg. KMO/STO/ØG; Horten: Borrehaugene, N59.38408° E10.46612°, 9 September 2012, a colony with several hundred workers, leg. FØ. **AAY**, Froland: Lauvrak, N58.58714° E8.32981°, MT 26 July–25 August 2010, 1 alate queen, leg. AE.

Possibly, this species has been previously overlooked in Norway, as it can be very difficult to distinguish from *Lasius umbratus* (Nylander, 1846), and partly *Lasius mixtus* (Nylander, 1846). Unfortunately, DNA-barcoding seems unable to distinguish between *Lasius sabularum, Lasius umbratus* and *Lasius citrinus*.

The species might be found at the same localities as other species of *Chthonolasius* Ruzsky, 1912, but seems to be rarer than *Lasius umbratus* and *Lasius mixtus*. *Lasius sabularum* is distributed in Central Europe, and closer to Norway it is found a few times in southern Sweden and southern and eastern Finland. The temporary host of the species is probably *Lasius niger* (Linnaues, 1758) or *Lasius platythorax* Seifert, 1991. The sexuals are normally found very late in the autumn (September–October) and the mated young queens invade host nests directly after mating or in late autumn (Czechowski *et al.* 2012). The proposed Norwegian common name for *L. sabularum* is “høstjordmaur”.

* *Lasius bicornis* (Forster, 1850)

VE, Larvik: Småås, N59.2113° E10.0102°, MT 14–27 May 2014, 1 alate queen, leg. STO. **TEY**, Porsgrunn: Eidanger, Prestmoen, N59.1220°

FIGURE 11. *Lasius bicornis* (Forster, 1850), **A**. queen **B**. petiole. Photo: A. Staverløkk.

E9.69799°, MT 30 April–13 June 2012, 1 alate queen (Figure 11a), leg. FØ. The traps in Eidanger were situated in a sand pit close to deciduous forests, while the Larvik-trap was put up in an oak-dominated open forest. The species is easy to recognize by the deep and narrow emargination of the petiolar scale (Figure 11b) and the lack of abdominal setae elsewhere than along the hind margin of the tergites.

These are the first Norwegian records of this extremely rare species. Elsewhere in the Nordic countries, this species is previously only known from a colony record in Småland in southern Sweden. In Central Europe the colonies are often found in rotten wood parts of dead or living trees deep in the ground (Seifert 1988). The temporary host of the species is probably *Lasius brunneus* (Latreille, 1798). There are often two flight periods every year, and the main period in Central Europe is from mid-July. The Norwegian specimens, however, were collected in springtime, which indicate hibernation by the alate queens. The species is obviously rare, but due to a concealed way of living, the species may be overlooked in southern Scandinavia. The proposed Norwegian common name for *Lasius bicornis* is "tussejordmaur".

* *Lasius citrinus* Emery, 1922

BØ, Kongsberg: Laugerudmoen, N59.63729° E9.66133° 30 April–11 June 2012, 1 alate queen (Figure 12a), leg. FØ. **VE**, Larvik: Småås, N59.2113° E10.0102°, MT 14–27 May 2014, 1 alate queen, leg. STO; Farmenrøysa øst, N59.2289° E10.0251°, MT 14–27 May 2014, 1 alate queen, leg. STO; MT 27 May–18 June 2014, 1 alate queen, leg. STO; Horten: Mellomøya, N59.44326° E10.46143°, MT 16 June–1 July 2014, 1 alate queen, leg. AS. **AAY**, Froland:

FIGURE 12. *Lasius citrinus* Emery, 1922, **A**. queen **B**. petiole. Photo: A. Staverløkk.

FIGURE 13. *Lasius citrinus* Emery, 1922, worker. Photo: A. Staverløkk.

Lauvrak, N58.58714° E8.32981°, MT 11 June–16 July 2010, 1 alate queen, leg. AE; Øyrekjerr, N58.601° E8.328°, MT 20 July–25 August 2010, 1 alate queen, leg. AE; Grimstad: Store Arnevig N58.26890° E8.44333°, 14 May 2015, one colony of several tens of workers (13 collected) (Figure 13) under a small stone (Figure 14), but the actual nest was not located, leg. KMO. From the localities in AAY, Froland we have several males that might belong to this species, but currently there is no good method to separate males of *Lasius citrinus* from closely related *Chthonolasius*-species. DNA-barcoding does not distinguish between *L. citrinus, Lasius umbratus* and *Lasius sabularum*.

The records of *Lasius citrinus* from Norway were very surprising, as no previous records are known from the Nordic countries. The species is distributed in Central Europe north to 52° latitude. The Norwegian records (Figure 15) are, thus, located more than 800 km away from the nearest occurrences in Europe. Very little is known about the species, but most records are from sunny edges of deciduous forests. Nests are probably

FIGURE 14. The locality for the nest site of *Lasius citrinus* Emery, 1922, at Store Arnevig, Grimstad in Aust-Agder. Photo: K.M. Olsen.

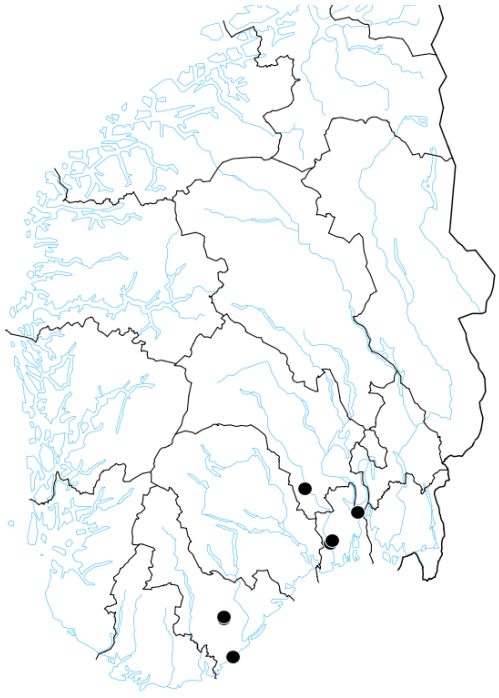

FIGURE 15. Known distribution of *Lasius citrinus* Emery, 1922 in southern Norway.

associated with decaying logs or tree stumps, but also found in the ground among grasses and heather. The temporary host of the species is probably *Lasius brunneus* (Czechowski *et al.* 2012). Often the alates hibernate and the queens can be seen in springtime, which is unusual for *Chthonolasius*-species (Seifert 2007). The species is easy to recognize by the deep emargination of the petiolar scale (Figure 12b) and the presence of abdominal setae all over tergites.

As the species probably nests deep in the ground, it may be somewhat overlooked. Most records from Norway are of sexual individuals from malaise traps, apparently a good method for documentation of *Chthonolasius*-species. Therefore, we expect the species to be found in several new places in the future, both within and outside the known distribution range. The proposed Norwegian common name for *Lasius citrinus* is “huldrejordmaur”.

* *Formica foreli* Emery, 1909

VE, Tjøme: Sønstegård, N59.06544° E10.44354°, 30 April 2011, 5 workers, leg.

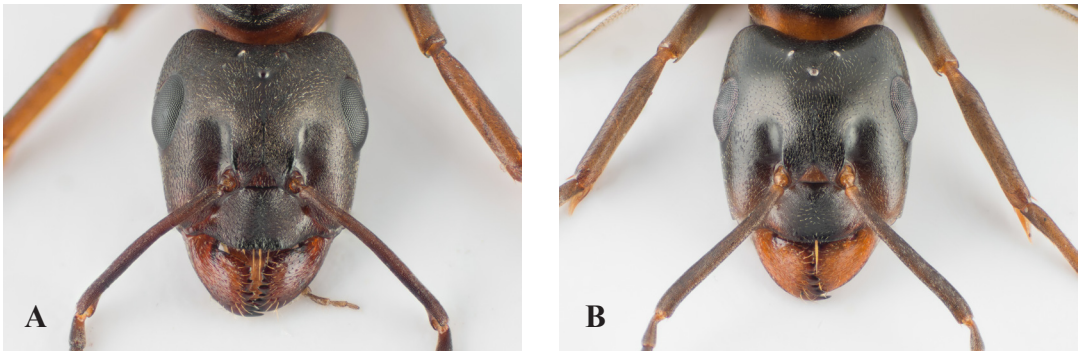

FIGURE 16. Head of **A**. *Formica foreli* Emery, 1909, queen, and **B**. *Formica pressilabris* Nylander, 1846, queen. Photo: A. Staverløkk.

FIGURE 17. Typical nest of *Formica foreli* Nylander, 1846 at Sønstegård in Tjøme, Vestfold. Photo: F. Ødegaard.

KMO/CO/SOL/MSL; 12 July 2012, 3 alate queens (Figure 16a) and several workers, leg. FØ/AF; 1 October 2012, about 100 colonies (Figure 17), leg. FØ/AS; 18 April 2015 several colonies with dealate queens, leg. KMO; Moutmarka, N59.07227° E10.40097°, 12 July 2012, several colonies, leg FØ/AF; 9 July 2013, several colonies, leg. FØ/AF; Hellesmo, N59.07303° E10.40268°, 12 October 2013, several colonies, leg. FØ/AF; 30 Mars 2014, several colonies, leg. KMO. Identifications of workers from Sønstegård and Moutmarka are verified by B. Seifert.

Two specimens from Sønstegård and Moutmarka, respectively, are DNA-barcoded. These

FIGURE 18. *Formica pressilabris* Nylander, 1846 from Huseby, Larvik, Vestfold. Photo: A. Staverløkk.

two individuals had identical CO1-barcodes. No other specimens identified as *Formica foreli* are available in the BOLD database, but one specimen, named *Formica pressilabris* Nylander, 1846 and collected in Spain, cluster together with the Norwegian material. As apparently only *F. foreli* of the two species are known from Spain (Schultz & Seifert 2007), there is a probability that this specimen represent a misidentified *F. foreli*. However, genetic distance from *F. pressilabris* is rather low (0.5 %).

The new records of *Formica foreli* from Tjøme in Norway is quite surprising, as this is a rather thermophilic species restricted to the very south of Scandinavia, in eastern Skåne and Öland. The habitats at Tjøme, with coastal meadows on sandy soil, seem to fit the species very well, and the species has probably been living in this area for a very long time. In fact, the colonies, particularly at the Sønstegård locality, are located very close to each other. As many as 97 colonies were counted in a small area of about 0.7 ha (Ødegaard & Staverløkk 2013). It was also interesting to observe that *F. foreli* was not found at the neighboring island Sandø. On the other hand, the closely related species *Formica pressilabris* was recorded in many colonies at that site. The proposed Norwegian common name for *F. foreli* is "matt heimaur", as opposed to "blank heimaur" for *F. pressilabris*. The name refers to the dull microstructure of the head of the queen, which is often clearly different from the shiny head of *F. pressilabris* (Figure 16).

***Formica pressilabris* Nylander, 1846**

HES, Eidskog: Svartvika, N59.99° E12.12°, 21 May 1977, 4 workers, coll. NHM. **BØ**, Ringerike: Nordby, N60.13486° E10.33095°, 22 June 2014, 1 male and 6 workers, leg. KMO/SOL. **VE,** Larvik: Huseby, E59.04571° E10.11418°, 6 September 2012, two colonies, leg. AS; 11 May 2014, 21 workers from colony, leg. KMO; 30

FIGURE 19. Habitat where the nest of the amazon ant *Polyergus rufescens* (Latreille 1798) was found on 16 July 2014. Photo: F. Ødegaard.

June 2014, swarming of males in the morning at 9:40 CET, and queens in the afternoon at 18:00 CET (Figure 18), leg. AS; Nøtterøy: Haneflu N59.22119° E10.5202°, 22 August 2014, 3 workers, leg. AF; Tjøme: Sandø N59.07361° E10.46669°, April 2014, leg. FØ/AF. **TEY**, Porsgrunn: Hellås, N59.06776° E9.69329°, 26 April 2014, three colonies, leg. FØ; 17 July 2014, alate sexuals, leg. FØ; Skien: Rustaden søndre, N59.2184° E9.6651°, 3 workers, leg. KMO. Queens (Figure 16b) are recorded from Huseby, Hellås and Sønstegård. Specimens from all localities (except those from Nordby, Haneflu, and Rustaden) are DNA-barcoded, and found to cluster together with *Formica pressilabris* from Finland and France, although genetic distance from *Formica foreli* is, as mentioned, rather low.

Formica pressilabris was published as new to Norway based on a colony recorded from Blindern, Oslo, September, 1938 (Holgersen 1940). Already a few years later, the colony was destroyed (Holgersen 1944). The next record was reported from HES, Eidskog (Collingwood 1976). The old record from Vestfold (Collingwood 1979) is uncertain, as it may be mixed with *F. foreli*. Hence, *F. pressilabris* seems to be a rather rare species in south-eastern parts of Norway.

Formica pressilabris is associated with dry meadows in the lowlands, and may be sensitive for intense soil management, which is normal in today's agricultural practice. Probably, the species is declining due to disturbance and habitat destruction within the area of occupancy.

***Polyergus rufescens* (Latreille, 1798)**

The amazon ant *Polyergus rufescens* (Latreille 1798) is a West Palearctic species, distributed from the submediterranean to the north temperate zone east to 88°E in SW Siberia (Seifert 2007). In Scandinavia, it is a very rare species, with only ten

FIGURE 20. The amazon ant *Polyergus rufescens* (Latreille 1798), worker. Photo: A. Staverløkk.

records from the mainland of Sweden north to the Stockholm area. The species is somewhat more common on the island Öland in Sweden (Douwes 2012). In Norway, the amazon ant has previously been found only on the island Skåtøy in Kragerø, Telemark in 1995 (Mehl & Hansen 2015).

The amazon ants (genus *Polyergus*) have a Holarctic range, with 14 species in Europe, Asia and North America. *Polyergus rufescens* has been a favorite subject of myrmecologists in Europe since it was discovered by Huber (1810) that the species practice slavery (dulosis). The amazon ant has an extraordinary degree of specialization. The sickle-shaped, toothless mandibles are useless for digging in the soil or for handling of larvae and pupae, but they are effective weapons for piercing the armor of other ants. The amazon ant is incapable of obtaining their own food, and is wholly dependent of being fed by their slaves, which have been hatched from pupae they have stolen from alien colonies. The most frequent

FIGURE 21. The amazon ant *Polyergus rufescens* (Latreille 1798), male, **A**. dorsal view **B**. head. Photo: A. Staverløkk.

slaves belong to *Formica fusca* Linnaeus, 1758, but also *Formica rufibarbis* Fabricius, 1793 is sometimes used.

Subsequent to the first Norwegian record of *Polyergus rufescens*, several people have searched for the species at the island Skåtøy, without success until 2014. On 2 July 2014, FØ found a worker of the amazon ant at **TEY**, Kragerø: Skåtøy, Burøyheia. N58.85569°

FIGURE 22. The amazon ant *Polyergus rufescens* (Latreille 1798), queen, **A**. dorsal view **B**. head. Photo: A. Staverløkk.

FIGURE 23. The amazon ant *Polyergus rufescens* (Latreille 1798), androgyne individual with characters from the male and the worker on the left and the right side, respectively, **A**. dorsal view **B**. head. Photo: A. Staverløkk.

E9.51644° (Figure 19). When returning on 16 July and 2 August, a nest with winged queens and males (alates) were found, together with slaves of *Formica fusca* (Figure 20–22). This locality was visited by JOG and AS on 6 August, when a winged queen also was seen. KMO collected 1 androgyne male/worker (Figure 23) and 7 workers on 16 August 2014. On 6 August 2014, JOG and AS also found a new colony about half a kilometer away from the first site (at N58.85534° E9.52851°), were nuptial flights were observed. The nest was situated in a rock crevice. A single winged male was found a few hundred meter away from the nest on the same day. This specimen most likely originated from another nest, as the wind direction was towards the nest. It was a hot sunny day with temperature of 20.6 °C at the nearby Jomfruland meteorological station (Meteorologisk institutt

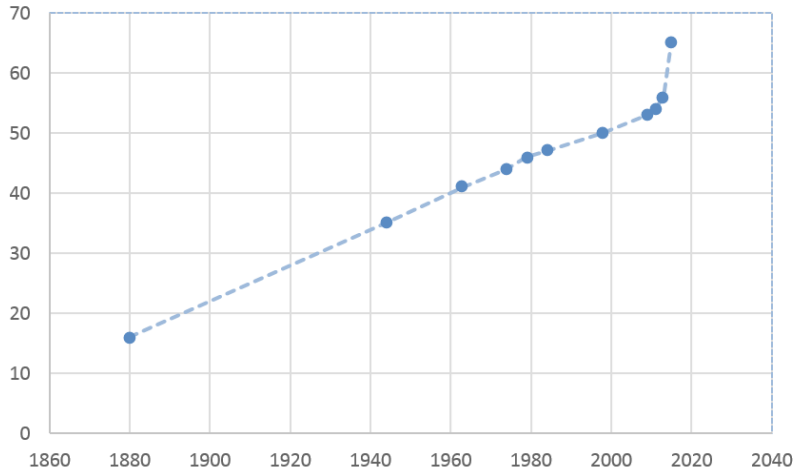

FIGURE 24. The number of ant species known from Norway from 1880 to 2015.

2014). Many winged queens and males came out of the crevice and immediately flew away with the wind. Several individuals were collected.

Polyergus rufescens probably has a very restricted distribution in Norway, as it is a termophilic species which require high summer temperatures. However, it may have a wider distribution along the nearby coast, at sites with similar climate conditions. Their host species *Formica fusca* and *Formica rufibarbis* are very common in the area, and should not be a limiting factor for its distribution. *P. rufescens* is easily neglected because of its concealed way of living, except during the nuptial flights and raids. Most of the time they are hidden underground, as their slaves bring food to the nest.

The nuptial flights normally take place around noon on very hot, sunny days in July–September, with temperatures ranging between 29 and 33 °C (Seifert 2007). The air temperature on 6 August 2014, when nuptial flight was observed at Skåtøy, was only 20.6 °C. However, the nest locality was situated on an open rock, fully exposed to the sun, where the local temperature must have been much higher.

Discussion

It is remarkable that from 2009 on, a total of 14 ant species have been recorded for the first time in Norway. This represents more than 20 % of the Norwegian fauna within a period of five years. Eleven of these species were recorded in the field or detected in trap samples in a two year period from 2013 to 2014 (Figure 24). Does this represent a new era in Norwegian myrmecology?

There are several reasons for this big lift in our state of knowledge. Firstly, there has been a large effort in mapping of species diversity in Norway through the Norwegian Taxonomy Initiative of the Norwegian Biodiversity Information Centre. This initiative has made it possible for dedicated researchers to spend the needed recourses to target particular species. Secondly, the recent taxonomic advance and increased interest for ants in general has grown substantially the last years. Attractive literature for identification, like "Nationalnyckeln" on ants (Douwes *et al.* 2012), "The ants of Poland" (Czechowski *et al.* 2012) and "Die Ameisen Mittel- und Nordeuropas" (Seifert 2007) are certainly crucial for the creation of interest and the possibilities for careful and safe identification of the species.

Including *Lasius citrinus*, a total of 82 indigenous species are known from the Nordic countries (Douwes *et al.* 2012), so there might still be a way to go before the ant fauna of Norway is completely mapped. As pointed out by Ødegaard (2013), many ant species are extremely difficult to find, due to disjunct distribution patterns, parasitic life style or concealed way of living. On the other

hand, most Scandinavian species not recorded in Norway have a pronounced southern distribution, and, therefore, are not very likely to be found this far north. A few species are nevertheless highly expected in the future, like two or three species of the genus *Myrmica*.

Among the nine new species in the present report, at least *Myrmica rugulosa*, *Leptothorax kutteri* and *Anergates atratulus* were highly expected. The most surprising species were *Leptothorax goesswaldi* and *Lasius citrinus*. Species like *Temnothorax interruptus, Lasius bicornis,* and *Formica foreli* were also surprising, as their nearest occurrences are in southeast Sweden, far from the Norwegian border. The same may be said about *Lasius sabularum*, but this is more of an obviously overlooked species.

The result from this study has given valuable additional knowledge useful for the revision of the Norwegian Red List of Species, which will be published during 2015. Hopefully, this mapping effort will be inspirational for further studies of the many different aspects of ant biology and diversity also in Norway.

Acknowledgements. We would like to thank prof. Bernhard Seifert, Senkenberg Museum, for verifying the identifications of *Leptothorax goesswaldi, Lasius sabularum, L. bicornis, L. citrinus* and *Formica foreli*. Also thanks to Oddvar Hanssen and Sondre Dahle (NINA) for help with operating traps and sorting of material, and Arne Fjellberg for his hospitality and guidance to "all" the *Coptoformica*-heaps at Tjøme. Thanks also to Anders Endrestøl, Stefan Olberg and Sondre Olsen for their valuable help in the field. DNA barcode data in this publication was generated in collaboration with the Norwegian Barcode of Life Network (NorBOL), funded by the Research Council of Norway and the Norwegian Biodiversity Information Centre. The project INVENT-ART and ACUNOR was funded by the Norwegian Taxonomy Initiative of the Norwegian Biodiversity Information Centre.

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Received: 5 February 2015
Accepted: 29 April 2015