Snapshot of the Hymenopteran fauna of Stora Karlsö

JULIA STIGENBERG, JOSEF BERGER, MATTIAS FORSHAGE, NIKLAS JOHANSSON, ARTUR LARSSON, OLE LØNNVE, ALEXEY RESHCHIKOV, HEGE VÅRDAL & IKA ÖSTERBLAD

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Stora Karlsö is a small island close to Gotland in the Baltic Sea of which the Hymenopteran fauna has not been extensively studied before. In August 2014, a team of eight persons carried out an inventory of Hymenoptera, mainly the parasitoid wasps and sawflies, on the island. Sampling was done with Malaise traps for a period of 22 days, complemented with vegetation sweeping, branch shaking and opportunistic handpicking during a five day sojourn. As a result, about 200 species of parasitoid wasps and 14 sawflies are reported for Stora Karlsö for the first time. Eleven species are reported as new to Sweden: The sawfly *Athalia cornubiae* Benson, 1931, the gasteruptiid *Gasteruption opacum* (Tournier, 1877), the diapriid *Spilomicrus rufitarsis* (Kieffer, 1911), the eulophid *Entedonomphale bulgarica* Boyadzhiev & Triapitsyn, 2007, the braconids *Bracon rozneri* Papp, 1998 and *Gnamptodon decoris* (Förster, 1862), and the ichneumonids *Bathythrix maculata* (Hellén, 1957), *Heterischnus filiformis* (Gravenhorst, 1829), *Lissonota picticoxis* Schmiedeknecht, 1900, *Mesochorus tipularius* Gravenhorst, 1829, *Ophion brevicornis* Morley, 1915, and *Plectochorus iwatensis* (Uchida, 1928). Also the gasteruptiid *Gasteruption opacum* (Tournier, 1877) is reported new to Sweden based on a record from inventory by NJ in 2013. This demonstrates how the knowledge of Swedish biodiversity can be substantially augmented by a short and intensive collecting expedition. We strongly recommend that other places in the country be subjected to similar efforts.

Julia Stigenberg, Mattias Forshage, Hege Vårdal, Naturhistoriska riksmuseet, Box 50007, 10405 Stockholm. E-mail: julia.stigenberg@nrm.se, generelle.morphologie@gmail.com, hege.vardal@nrm.se.
Josef Berger, Department of Biology, Lund University, Lund. E-mail: josef.berger@biol.lu.se
Niklas Johansson, Aspåsen/Baskarp, 56692 Habo E-mail: chrysis32@yahoo.se
Artur Larsson, ArtDatabanken, Box 7007, 75007 Uppsala. E-mail: Artur.Larsson@slu.se
Ole Lønnve, BioFokus, Gaustadalléen 21, NO-0349 Oslo, Norway. E-mail: ole@biofokus.no
Alexey Reshchikov, Sun Yat-sen University, 135 Xingangxi St. Guangzhou, 510275, China.
Ika Österblad, ika.osterblad@alumni.helsinki.fi

Stora Karlsö (Fig. 1) is an island in the Baltic Sea, belonging to Gotland both in administrative terms (Gotlands län & kommun) and as a faunal province. It is situated about 6 km off the west coast of Gotland, has a subrectangular outline and an area of about 2.5 km^2. A dominant feature of the landscape is a horse-shoe shaped plateau forming steep cliffs along the coastline to the west, north and northeast. The highest point of the island is 50 m above sea-level. The island consists of ca 400 million year old (Silurian) fossil coral reefs surrounded by layered limestone (Hedgren 2005, Johansson 2013). This exposed and open alvar landscape represents a habitat which can be found almost exclusively in Sweden, on the islands of Gotland and Öland, and in

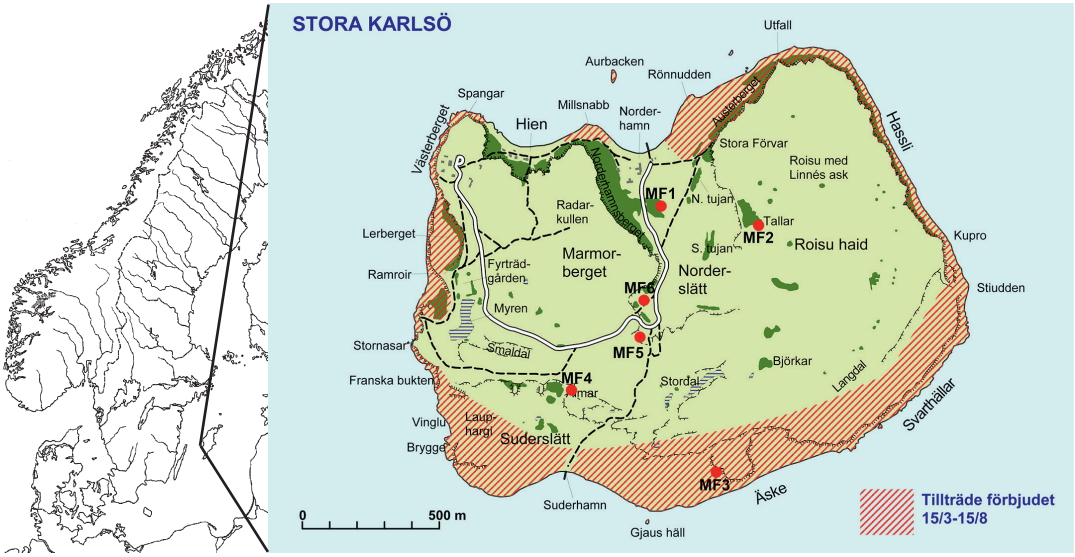

Figure 1. Map of Stora Karlsö by Stellan Hedgren. The Malaise trap locations are marked M1-M6.

Karta över Stora Karlsö av Stellan Hedgren. Placeringen av Malaisefällorna är markerade M1-M6.

Estonia, with minor occurrences in southwestern Finland (Eriksson & Rosén 2008).

For centuries, grazing kept the vegetation on Stora Karlsö low. Together with the geological features, this gave rise to a unique flora and fauna. When Linnaeus visited the island in July 1741, he reported that there was only one tree (an ash, which is still standing on the island) and remarked that the grazing sheep were growing fat on the island (Linnaeus 1745). In 1887 grazing was discontinued, resulting in a dramatic change in the plant cover, with junipers (*Juniperus communis*), pines (*Pinus sylvestris*) and deciduous trees spreading. In the mid-1990's, however, the island management launched an effort to re-create conditions favourable for organisms dependent on grazing (Hedgren 2005). The scree areas of the island are now covered by deciduous forest dominated by ash (*Fraxinus excelsior*), Norway maple (*Acer platanoides*), elm (*Ulmus glabra* and *U. minor*), rowan (*Sorbus aucuparia*) and Swedish whitebeam (*Sorbus intermedia*), with ivy (*Hedera helix*) climbing the trunks and cliffs. Juniper bushes that were rare in the late 1800s can now be found on the entire island and form shrubberies in many of the open areas which were once heavily grazed (Johansson 2013).

A dominating shrub is the St. Lucie cherry (*Prunus mahaleb*) which is introduced and competes with the native blackthorn (*Prunus spinosa*) (Johansson 2013, pers. obs.). Humans have been visiting the island since the stone age (Hedgren 2005), and they have introduced many plant species (including walnut *Juglans regia* and sycamore *Acer pseudoplatanus*, though no one as striking as the St. Lucie cherry (Broqvist & Magntorn 1989, Johansson 2013).

More than for its vegetation, the island is famous for the auk colonies in the cliffs (Guillemot *Uria aalge* and Razorbill *Alca torda*), the most important ones in the entire Baltic. In 1970, a nature reserve was created comprising the island and its surrounding water area within 1 km distance from the shoreline. It is considered one of the oldest nature protection areas in the world, because its fauna and flora have been under effective protection since 1887 when the Karlsö Association for Hunting and Conservation (*Karlsö Jagt- och Naturskyddsförening*) took over management of the island (*http://www.storakarlso.se*).

Hymenoptera

Parasitic wasps constitute a large part of terrestrial animal diversity everywhere, while at the same time being poorly known and usually neglected in inventories and conservation management. In Sweden, they comprise roughly a quarter of the animal species for which the information is so scant that the Swedish populations cannot be judged according to the IUCN red-listing criteria (Gärdenfors 2000). Recent activities within the framework of the Swedish Taxonomy Initiative (Karlsson et al. 2005) have started to clarify the diversity for some groups of parasitic wasps within the country, whereas other groups still remain very poorly known. However, it is widely acknowledged that parasitoid wasps play a highly important role in the ecosystem because by ultimately killing their host, they contribute to population regulation of other arthropods. Also, parasitoids are recommended as indicators in applied conservation: Shaw & Hochberg (2001) suggest that the occurrence of a rare species is more valuable if it, on a particular location, acts as host of a specialised parasitoid. Unfortunately, due to lack of data, protective measures for these wasps are rarely taken. Most information about the biology of parasitoid wasps stems from agronomy research on potential biocontrol agents, which for obvious reasons focuses on the most abundant species. Aculeate wasps are far better studied, and thus well-known to be very relevant to conservation concerns particularly since the general public has become aware of the recent decline of honeybees. Sawflies are somewhat intermediate in terms of knowledge, and mainly wood-living species have been taken into consideration from a conservation viewpoint.

Island Biodiversity

The number of species tends to increase with area (Arrhenius 1921); this relationship has been repeatedly observed and extensively used in ecological modelling (With 2016). Small habitat patches tend to hold small populations which are more likely to go extinct than are larger populations, be it due to stochastic processes or susceptibility to changes in habitat quality. Species composition and turnover are affected not only by habitat area but also by the degree of isolation from similar habitat patches and their size, as these can potentially contribute colonizers (MacArthur & Wilson 1967, Hanski 1999).

Highly specialised species may have difficulties maintaining viable populations on islands, as their population dynamics inevitably reflect host population fluctuations. Within the insect community, such specialists are most prominently represented by mono- and oligophagous herbivores and parasitoids. Parasitoids are particularly vulnerable because of their position at a high trophic level. Comparing species richness across islands in the archipelago of southwestern Finland, Roslin et al. (2014) found that the species-area relationship was more pronounced in higher trophic levels: in the sequence going from plants through herbivores to primary and secondary parasitoids, species number decreased successively more rapidly as a function of shrinking area.

According to Fukami (2015), community assembly – through sequential, repeated immigration from the regional species pool – is influenced on the one hand by processes for which deterministic patterns can be postulated, such as functional traits and phylogenetic structure, and on the other by the rather more random timing and order of events. Influential events may be abiotic, such as flood or fire, or biotic, e.g. colonization by a species which positively or negatively affects the outcome of immigration by another species. A species can exhibit unusual abundance in the absence of otherwise significant predators, parasitoids, parasites or, perhaps most importantly, when released from the inhibitory effect of competitors. If the organism communities of Stora Karlsö have ever reached stable states during the 12.000 years since its emergence after the last ice age, with severe exposure to the brute forces of wind and waves (Larje 2008), time after time these communities must have reassembled owing to changes brought on by dramatic fluctuations in level and salinity of the surrounding water, and not least by human activities during 9.500 years.

Previous inventories including Hymenoptera

In spite of some scattered records, like ants collected by the paleontologist Gustaf Lindström (Stolpe 1882), the entomological exploration of

Figure 2. The participating Hymenoptera experts at the collecting effort in 2014. From left: Niklas Johansson, Artur Larsson, Mattias Forshage, Hege Vårdal, Julia Stigenberg, Ika Österblad, Alexey Reshchikov, Josef Berger.

De deltagande stekelexperterna vid insamlingstillfället 2014. Från vänster: Niklas Johansson, Artur Larsson, Mattias Forshage, Hege Vårdal, Julia Stigenberg, Ika Österblad, Alexey Reshchikov, Josef Berger.

Stora Karlsö was far from methodical until some major collecting efforts by Hans Lohmander in 1927, by Olov Lundblad in 1950 and 1956, and especially by Nils Linnman continuously from the 1930s on (Linnman 1965). Linnman was however mainly focused on Coleoptera, and of these early visits the Hymenoptera material seems to have been very limited and mainly consisting of Lundblad's aculeates.

In the 1980s, this exploration had a bit of a renaissance with groups of entomologists spending time on the island most summers (Struwe 1989). During these years, Lars Norén did a fairly thorough inventory of major parts of the aculeate fauna, as did Olle Högmo with the ants (Högmo 1988), and Carl-Cedric Coulianos with gall-making wasps, both gall wasps proper and gall-making sawflies (Coulianos 2010).

In recent years, several hymenopterists have been visiting the island again, culminating in the present inventory made by our team of eight experts (Fig 2). Materials from most of these collecting events have been included in this paper, and are described under Material and methods below.

We thought it would be interesting to address such an extraordinary island locality with a methodology similar to that of a bioblitz where, during a short period of time, several different methods of collecting and observing organisms are used (e.g. Laforest et al. 2013). The aim of this concentrated collection effort was to find and identify as many hymenopteran species as possible, focusing on the little known parasitic wasps and sawflies.

Our collecting expedition was approved by Länsstyrelsen Gotland (permit nr: Dnr 521-26-14).

Material and methods

Our inventory in 2014 was mainly carried out using Malaise traps (running 8-29 August) (Fig. 3, 4). During five days (25-29 August) trapping was supplemented with sweeping, branch-shaking and visual search (including scouring windows). In addition, galls from *Rosa* sp. and *Quercus robur* were collected, but unfortunately rearing was unsuccessful. During the inventory week, the weather conditions were mostly favourably dry and sunny, although the total sampling result presumably was somewhat negatively affected by strong winds.

The Malaise trap, a tent-like construction for collection of flying insects, has proved to be an efficient method for collecting wasps, flies and midges in particular (Malaise 1937, Karlsson et al. 2005). In the present inventory, five Townes-model Malaise traps were used, placed in differ-

Figure 3. Julia emptying Malaise trap nr 2. In this trap we collected the *Lissonota picticoxis* Schmiedeknecht, 1900.

Julia tömmer Malaisefälla nr 2. I denna fälla fann vi *Lissonota picticoxis* Schmiedeknecht, 1900.

ent habitats (Fig. 1). When the catch for the time interval August 8-24 was inspected, the number of specimens at one location (M5) turned out to be very low, and this trap was relocated for the remaining few days in order to maximize sampling efficiency (M6). Trap material was thus collected from six strategically selected localities. GPS coordinates are presented using WGS 84 system. The listed plants indicate the dominating plants within 2 m from the trap?

Malaise trap #1, 57.28821°N 17.97139°E, elevation 5 m. Calcareous low herb pasture, between a few junipers and roses in a slope facing south. *Odontites* ?*vulgaris*, *Scabiosa columbaria, Thalictrum* sp., *Avenula pratensis/pubescens*. *Prunus mahaleb, Vincetoxicum hirundinaria, Rosa* sp., *Juniperus communis, Fraxinus excelsior, Fragaria viridis, Filipendula vulgaris*.

Malaise trap #2, 57.28730°N 17.97753°E, elevation 35 m (Fig. 3). Calcareous low herb pasture, between sparse pine groves in a slope facing west. There were a few junipers, small rowan saplings (*Sorbus aucuparia*) and *Rosa* sp, but the locality was open, the ground covered by mosses and lichens (*Cladonia* sp, *Hypnum* sp.), sparse grass (mainly *Helictotrichon pratense* and *Phleum phleoides*) and low herbs (*Achillea millefolium, Filipendula vulgaris, Fragaria viridis*, *Galium boreale, G. verum, Helianthemum nummularium, Hypochaeris maculata, Plantago lanceolata, Polygala vulgaris, Scabiosa columbaria, Thalictrum* sp., *Veronica chamaedrys, Vincetoxicum hirundinaria*).

Malaise trap #3, 57.27919°N 17.97448°E, elevation 11 m. Exposed, vegetated coastal stone shore facing south. Alternating patches of vegetation and bare stone field. Trap placement was at the border between open stone field and deciduous shrubbery dominated by *Prunus*. (?) *Anchusa arvensis, Anthriscus sylvestris, Calamagrostis* sp., *Cirsium vulgare, Galium verum, Geranium robertianum, Geum urbanum, Plantago lanceolata, Potentilla argentea, Prunus mahaleb, Satureja acinos, Scabiosa columbaria, Sedum album, Sorbus aucuparia, Vincetoxicum hirundinaria*.

Malaise trap #4, 57.28200°N 17.96597°E, elevation 24 m (Fig. 4). Moist calcareous meadow northwest of a less than 2 m tall rock face; the trap placed adjacent to this. Along the rock face grew deciduous trees and shrubs (*Crataegus* sp., *Fraxinus excelsior, Juniperus communis, Prunus mahaleb*), further from it there were open meadow patches with *Dactylis glomerata, Festuca rubra, Filipendula vulgaris, Fragaria viridis, Galium verum, Geranium robertianum, Hedera helix, Helictotrichon pratense, Hepatica nobilis, Hypericum perforatum, Odontites vulgaris, Origanum vulgare, Phleum phleoides, Plantago lanceolata, Primula veris, Rhytidi-*

Figure 4. Niclas Eklund assisting with putting up Malaise trap nr 4. In this trap we collected two of the new species to Sweden; *Gnamptodon decoris* (Förster, 1862) and Entedonomphale bulgarica Boyadzhiev & Triapitsyn, 2007.

Niclas Eklund hjälper till med uppsättningen av Malaisefälla nr 4. I denna fälla fångades två nya arter för Sverige; *Gnamptodon decoris* (Förster, 1862) och *Entedonomphale bulgarica* Boyadzhiev & Triapitsyn, 2007.

adelphus triquetrus, Satureja vulgaris, Sesleria uliginosa, Thalictrum sp., *Veronica chamaedrys, Vincetoxicum hirundinaria;* the meadow northwards rising towards the drier crest.

Malaise trap #5, 57.28369°N 17.97001°E, elevation 34 m. Just where the edge of the ridge turned into northeast-facing slope. Patches of juniper, St. Lucie cherry (*Prunus mahaleb*) and *Cotoneaster* sp., otherwise dominated by herbs and grass (*Dactylis glomerata, Festuca rubra, Filipendula vulgaris, Fragaria viridis, Galium verum, Helianthemum nummularium, Helictotrichon pratense, Phleum* sp., *Plantago lanceolata, Polygala vulgaris, Scabiosa columbaria, Thalictrum* sp., *Vincetoxicum hirundinaria*).

Malaise trap #6, 57.284763°N 17.970253°E, elevation 36 m. Sun exposed ridge side facing south east. *Origanum vulgare, Ranunculus bulbosus, Festuca ovina, Helictotrichon pratense, Helianthemum nummularium, Vincetoxicum hirundinaria, Juniperus communis, Geranium sanguineum, Filipendula vulgaris, Galium verum, Plantago lanceolata*, *Fragaria viridis*.

Collected material was sorted by participants jointly, and then identification responsibilities were divided among us as follows: AL & HV: Symphyta, MF: Proctotrupoidea, Mymaridae, Mymarommatidae, Aphelinidae, Encyrtidae, Torymidae, Chalcididae, Trichogrammatidae, Figitidae, Dryinidae, Bethylidae, MF & JB: Platygastroidea, Ceraphronoidea, Tetracampidae, JB: Eupelmidae, Eulophidae, Pteromalidae, MF & HV: Cynipidae, JS: Braconidae, AR: Ctenopelmatinae, NJ & AR: Ophioninae, Pimplinae, Banchinae, Tryphoninae, IÖ: Cryptinae, Mesochorinae, NJ: Gasteruptiidae, Ichneumoninae, Diplazontinae, Anomaloninae, Chrysididae, Vespidae, Pompilidae, Apoidea, Crabronidae, AL: Formicidae. Identification effort varied substantially between groups.

Hymenoptera material is mainly deposited at the Swedish Museum of Natural History. Incidentally collected material of other taxa was either passed on to specialists or deposited at the Campus Gotland division of Uppsala University.

Other included collecting efforts

In order to extend our snapshot of the island's Hymenoptera fauna, we decided to include a small amount of other recently collected materials. Ole Lønnve had visited the island in May 2008, collecting Symphyta, mainly by sweeping. In 2011, a group of entomologists visited the island in the tradition of the 80s visits and made a snapshot inventory, but this time including Malaise traps (Elmqvist 2012). From these 2011 traps stems the first Karlsö material including a broad range of parasitic Hymenoptera. The following year, Niklas Johansson made an inventory of the aculeate wasps, during which a lot of larger parasitic wasps were collected but not included in the published report (Johansson 2013) and for the most part had not been identified until now.

Results and Discussion

The primary focus of the inventory was the parasitic wasps. Two thirds of the parasitic wasp families recorded in Sweden were represented in the inventory. We recorded twelve species of parasitic wasps that are new to Sweden, and several other species that have rarely been collected (Appendix 1). At least 15 subfamilies each of the families Braconidae and Ichneumonidae are represented in the material and about 200 species of parasitoid wasps and 14 sawflies are reported for Stora Karlsö for the first time. A rather sizeable amount of chalcid wasps (Chalcidoidea) and figitid wasps (Figitidae) were collected, among these some rare species. While for small-bodied wasps, the Malaise traps provided the major part of the catch, it became obvious that middle-sized and larger parasitic wasps were very patchily distributed in the landscape.

Whereas the major part of the heath was dry and sweeping here was for the most part unrewarding, spots that retained moisture were far more productive. Especially the bog (Myren) on the south eastern part of the island was a particularly productive locality, as most of the ichneumonids in the inventory were collected there, in particular Pimplinae. A large number of those came from the immediate vicinities of a large *Salix* tree. Included in the identifications are also various catches, obtained mainly with Malaise traps by MF in 2011, and a rich assembly of ichneumonids and gasteruptiids feeding on flowering *Laserpitium* near Hien, collected by NJ in 2012. Below we present information on new and interesting findings.

Gasteruptiidae

No gasteruptiids were collected in 2014, but the material from 2012 contained a few specimens, including one which represents a species previously not reported from Sweden: *Gasteruption opacum* Tournier, 1877 (Fig. 5a). According to Fauna Europaea this species is recorded from Norway, but the record is based on an error (Frode Ødegaard, pers. comm.) and the closest true known occurrences are from Germany and Poland. It is a bee parasitoid, but nothing is known on the particular habits of this species.

Table 1. Number of genera, species and new species for the country found in 37 families of Hymenoptera during the Stora Karlsö snapshot inventory and the collecting events made in recent years. Note that many specimens could not be identified to species-level and thus we divided in two separate columns for genera and species identified. The actual number of genera and species are higher.

Antalet arter och nya arter för Sverige funna i 37 stekelfamiljer under Stora Karlsöinventeringen 2014 samt i de inventeringar som gjorts åren precis före. En del stekar kunde inte identifieras till art, därav två separata kolumner för släkten och arter. Det faktiska antalet släkten och arter är högre.

Family	No of genera identified	No of species identified	No of species new for Sweden
Diprionidae	1	1	0
Tenthredinidae	13	17	1
Gasteruptiidae	1	2	1
Diapriidae	8	8	1
Proctotrupidae	4	4	0
Platygastridae	12	2	0
Ceraphronidae	2	0	0
Megaspilidae	3	0	0
Mymarommatidae	1	1	0
Mymaridae	6	0	0
Aphelinidae	3	0	0
Encyrtidae	3	0	0
Torymidae	2	0	0
Eupelmidae	2	4	0
Chalcididae	1	1	0
Eulophidae	20	31	1
Pteromalidae	7	5	0
Tetracampidae	1	1	0
Trichogrammatidae	1	0	0
Cynipidae	4	4	0
Figitidae	9	20	0
Braconidae	32	23	2
Ichneumonidae	62	87	6
Dryinidae	1	1	0
Bethylidae	1	3	0
Chrysididae	1	3	0
Formicidae	9	22	0
Vespidae	6	11	0
Pompilidae	9	13	0
Crabronidae	10	17	0
Sphecidae	1	1	0
Halictidae	3	10	0
Andrenidae	1	6	0
Colletidae	2	6	0
Megachilidae	6	10	0
Apidae	2	4	0
Total	**250**	**318**	**12**

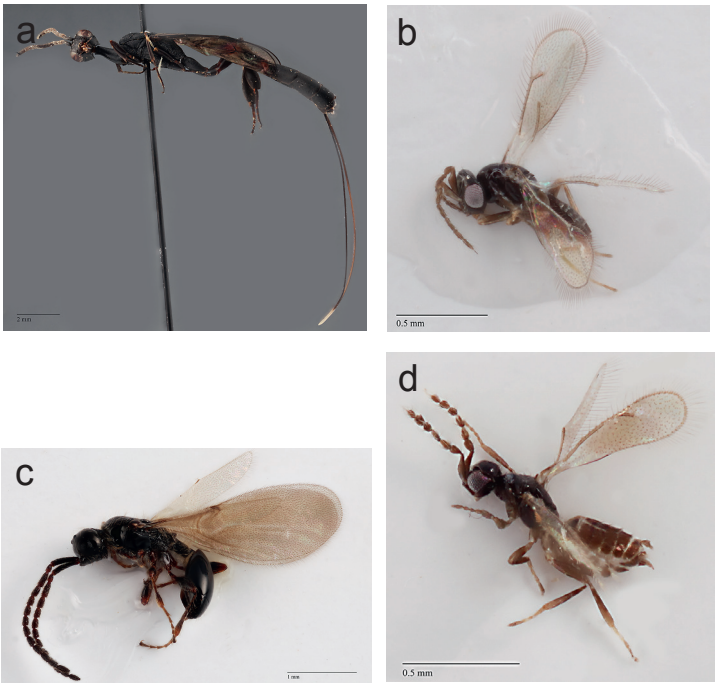

Figure 5. Some rare and interesting wasps that were found on Stora Karlsö: – a) *Gasteruption opacum*, – b) *Omphale* sp., – c) *Spilomicrus rufitarsis*, – d) *Entedonomphale bulgarica*.

Några rara och intressanta steklar funna på Stora Karlsö: – a) *Gasteruption opacum*, – b) *Omphale* sp., – c) *Spilomicrus rufitarsis*, – d) *Entedonomphale bulgarica*.

Proctotrupoidea
Malaise traps and sweeping produced a rich material of Diapriidae and Proctotrupidae, but a large part of it is identified to genus-level only. The most remarkable record was *Spilomicrus rufitarsis* (Kieffer, 1911) of Diapriinae, new to Sweden (Fig. 5c). It is recorded from the British Isles but not from northern Europe. According to Nixon (1980) it is a rare species.

Platygastroidea & Ceraphronoidea
Platygastroidea and Ceraphronoidea have only been identified to genus-level at this point, except for two characteristic scelionines: *Xenomerus ergenna* Walker, 1836 that has characteristic bottlebrush antennae, and the extremely flattened *Telenomus danubialis* Szelenyi, 1939.

Chalcidoidea: Aphelinidae, Encyrtidae, Mymaridae, Pteromalidae, Torymidae, Trichogrammatidae
These families have only been identified to genus-level or less at this point.

Mymarommatidae
The spectacular and tiny *Mymaromma anomalum* (Blood & Kryger, 1922) was not known from the Nordic countries until recently, when it was discovered in Skåne, Södermanland and Uppland as well as in Norway and Finland within a relatively short time span (Forshage & Karlsson 2015; Hansen 1997; Vikberg & Varkonyi 2006; Fredrik Ronquist & Roy Danielsson, pers. comm.). Through the Swedish Malaise Trap Project (SP) it has now been found all over Sweden, sometimes in large numbers, but it is very interesting to note that it occurs even on relatively isolated localities like Stora Karlsö. This indicates long-distance dispersal capacities, similar to other tiny parasitoids (Antolin & Strong 1987).

Its biology is still unknown. Interpolation from the biology of its family suggests that it is most likely an egg parasitoid, and Psocoptera have been suggested as a possible hostgroup.

Tetracampidae
Epiclerus nomocerus (Masi, 1934) was the only representative of this rarely collected family. It is one of the least frequently collected tetracampids in Sweden, as it has so far not been found in the SP (MF, unpublished). The Swedish distribution seems to be restricted to Öland and

Gotland. Wasps of this genus are parasitoids of leaf-mining flies (Agromyzidae) but nothing is known about the biology of this particular species.

Eulophidae

A single male of *Entedonomphale bulgarica* Boyadzhiev & Triapitsyn, 2007 (Fig. 5d) was identified from Malaise trap #4. This recently described species is a new record for Sweden; it was hitherto known only from Bulgaria (Boyadzhiev & Triapitsyn, 2007) but its habitus is very distinctive. Its host is unknown, but other members of this genus are larval parasitoids of a single family of thrips (Thysanoptera: Phlaeothripidae).

Another remarkable eulophid, a single male specimen of *Omphale* (Fig. 5b), was swept on alvar vegetation of Stordal. It is quite similar to *Omphale isander* (Walker, 1839) by having an asymmetrically shaped scape, remarkably long marginal setae of the forewing, and dark brown body colouration. However, the present specimen differs from *O. isander,* as described by Hansson & Shevtsova (2012*),* by having the scape widest above the middle, the pedicel approximately as long as the maximal width of the scape, a pale antenna and a pale clypeus which contrasts with the surrounding dark frons, and the absence of a medial tooth on the clypeus. The pale colour of the clypeus distinguishes it from most other species in this genus, and due to this character, the present specimen runs between *O. clypealis* (Thomson, 1878) and *O. parma* Hansson & Shevtsova, 2012 in the key to European *Omphale* given by Hansson & Shevtsova (2012). However, the specimen differs from *O. clypealis* by having the clypeus not yellowish white but instead yellowish brown (concolourous with the mandibles), and the forewing with only 6 admarginal setae; it differs from *O. parma* by a closed speculum and a slender stigmal vein which is less than half as wide apically than basally. From both species, it differs by the scape that is widest above the middle and abruptly narrowed in its apical third, by the long marginal setae of the forewing, and the dark brown body colouration. It is possible that this is just an aberrant *O. isander* male; this would mean that the species boundaries of *O. isander* need to be widened and its intraspecific variation quantified to encompass the above-mentioned characters.

Eupelmidae

In addition to several specimens of two quite common species with brachypterous females (*Eupelmus vesicularis* and *Merostenus excavatus*), we also caught two macropterous specimens (one female and one male) of *Eupelmus annulatus* Nees, 1834 which was unknown from Sweden until very recently (Gibson & Fusu 2016).

Cynipoidea

Notable cynipoids include an undescribed species of *Trybliographa* (previously known from other places in Sweden, not uncommon), the relatively rare species *Sarothrus brevicornis* Thomson, 1877 and *Callaspidia defonscolombei* (Dahlbom, 1842). These species are all parasitoids on fly larvae, the two former possibly of Anthomyiidae (biology unknown in both cases but this is a guess based on closely related species), and the latter of aphid-predacious Syrphidae and Chamaemyiidae.

Braconidae

The impression regarding braconids on Stora Karlsö is that the species richness is rather modest. We managed to collect representatives of 17 out the 29 subfamilies that occur in Sweden (JS pers. comm.) The largest groups Alysiinae, Aphidiinae, Microgastrinae and Braconinae are abundant in specimens but less diverse regarding species composition. This scarcity notwithstanding, two new species for Sweden were found: *Bracon rozneri* Papp, 1998 (Braconinae) and *Gnamptodon decoris* (Förster, 1862) (Gnamptodontinae). *Gnamptodon decoris* (Fig. 6a) was caught in Malaise trap #4. It occurs in most European countries, the closest to Sweden are Germany, UK, Finland and Russia. It is not noted for Denmark or Norway. Gnamptodontinae contains some of the smallest Braconidae, usually hardly longer than 1 mm. They are exclusively parasitoids of leafmining caterpillars of the Nepticulidae (Lepidoptera) on herbs and low shrubs. They are recognized by the peculiar basal elevation of the second metasomal tergite

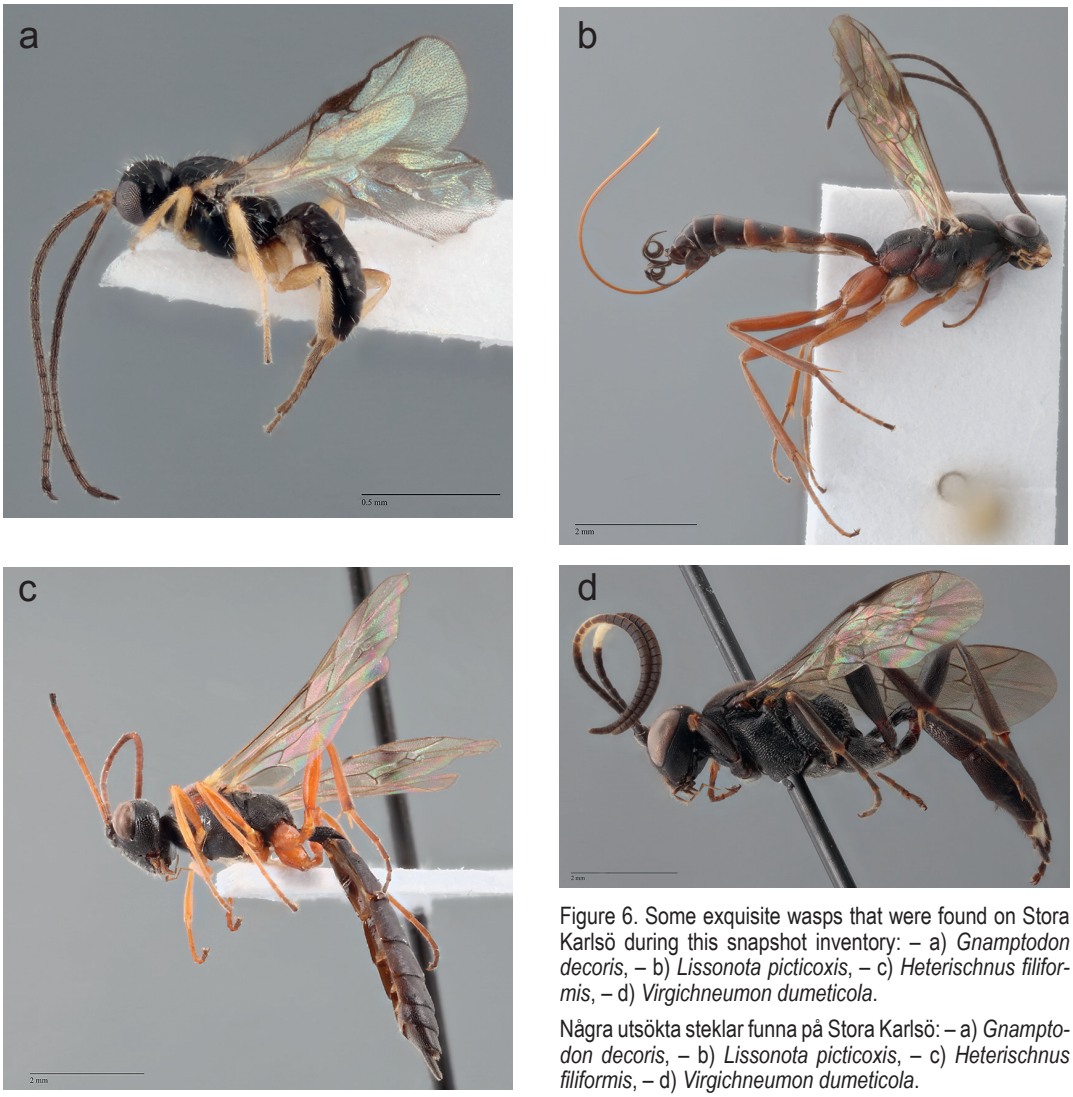

Figure 6. Some exquisite wasps that were found on Stora Karlsö during this snapshot inventory: – a) *Gnamptodon decoris*, – b) *Lissonota picticoxis*, – c) *Heterischnus filiformis*, – d) *Virgichneumon dumeticola*.

Några utsökta steklar funna på Stora Karlsö: – a) *Gnamptodon decoris*, – b) *Lissonota picticoxis*, – c) *Heterischnus filiformis*, – d) *Virgichneumon dumeticola*.

(van Achterberg 1983). Three *Bracon* species (identified by Konstantin Samartsev) were collected, of which 38 specimens of *B. pectoralis* were swept close to a *Salix shrub*. These *Bracon* species are probably not that uncommon though rarely identified. Another notable species is the rare *Meteorus sibyllae* Stigenberg, 2011 (Euphorinae). It is not new to Sweden but new to Gotland, not so frequently collected and not common in Swedish collections.

The only representative of Cheloninae collected, *Chelonus pusillus* Szépligeti, 1908, was recently found as new to Sweden in the SP (identified by Aurel Lozan 2007 but yet unpublished).

The few Opiinae specimens collected all belong to the genus *Opiostomus*, which has not yet been reported from Sweden but is far from uncommon, and will be presented in a coming paper by Dave Karlsson.

Ichneumonidae

A remarkably large part of the species of Ichneu-

monidae were collected exclusively by sweeping, rather than Malaise trapping, and most significantly from a single locality on the island, the bog Myren. Especially the spider parasitoids in the Pimplinae were numerous there. As a contrast, the Banchinae was the only group that appeared to be common also on drier higher grounds on the island.

Habrocampulum biguttatum (Gravenhorst, 1829) (Anomaloninae) is apparently a rare species, and we are not aware of any recent Swedish records of it. It attacks various pine-living moths (Schmiedknecht 1908). *Erigorgus latro* (Schrank, 1781) (Anomaloninae) is a variable species with several varieties described (Schmiedknecht 1908). It is regarded as rare throughout its distribution range and the moth *Diloba caeruleocephala* is mentioned as a potential host. *Diloba caeruleocephala* feeds on *Prunus* spp., which suggests an association with the enormous shrubberies of *Prunus mahaleb* that are commonly found around Suderslätt. *Lissonota picticoxis* Schmiedeknecht, 1900 (Banchinae) (Fig. 6b) is known from Finland and is here reported for the first time from Sweden. No host records are known but the species of this genus are usually caterpillar parasitoids. The first specimen of *Bathythrix maculata* (Hellen, 1957) (Cryptinae) recorded from Sweden was swept at the Myren bog. The distribution of this species ranges from Iran in the southeast to France in the west and Finland in the north. It has been reared from chrysomelid beetle larvae (Sawoniewicz 1980).

For *Platylabus heteromallus* (Ichneumoninae), our specimen represents the first certain record from Scandinavia, whereas *Virgichneumon dumeticola* (Fig. 6d) was recently reported as new to Sweden from the SP (Riedel & Magnusson 2014). *Heterischnus filiformis* (Gravenhorst, 1829) (Fig. 6c) is a member of the Phaeogenini which previously has been recorded from most neighboring countries including Norway and Finland. Several females and males were swept at Myren. The species has also been collected recently from the Swedish mainland (Norrköping, Östergötland Leg. Håkan Andersson, det. Niklas Johansson) and is here presented as new to Sweden. Two species of the subfamily Mesochorinae are reported as new to Sweden, *Plectochorus iwatensis* (Uchida, 1928), this being the northwesternmost record of the species, and *Mesochorus tipularius* Gravenhorst, 1829. *Ophion brevicornis* Morley, 1915 and *Enicospilus inflexus* (Ratzeburg, 1844) (Ophioninae) are new to the list of Swedish species, but this is due to name confusion, which is currently being sorted out by Björn Cederberg (and NJ) in Sweden (forthcoming), and by Broad & Shaw in Britain (2016).

Symphyta

The sawfly fauna of the island had not previously been thoroughly explored. Coulianos (2010) found two gall-making species. We have identified most of the relatively few specimens we collected, all of which belong to the family Tenthredinidae, but the time of the year of the inventory was not optimal for sawfly collection. A more appropriate time for a comprehensive inventory of sawflies would be from late spring to early summer, when the flight periods of most species take place. Sawfly larvae are herbivorous and more or less specialized in their host-plant use, so that many sawfly species only attack a single or a few species of host plant. Despite its isolation and relatively small area, because of the extraordinary limestone-associated flora and warm climate, Stora Karlsö thus might host more sawfly species not commonly seen in Sweden than those that we have recorded below:

One of the collected sawfly species, *Athalia cornubiae* Benson, 1931 (Fig. 7) (Athaliinae (often placed in Allantinae), is a new record for Sweden. The larva feeds on white stonecrop (*Sedum album*) a plant that was observed next to the trap on the southern shore where the species was collected. The species has a Holarctic distribution, but prior to this it has not been found in the Nordic countries (Taeger & Blank 2011). It does not seem to be very common and is probably restricted to one host plant (Gradwell 1957).

Several other species of *Athalia* were collected. When conditions are favourable, the species of this genus potentially have more than one generation per year (Benson 1952), which may explain why they were numerous in August. This is also the case for the curled rose sawfly *Allantus cinctus*, which is often seen as adults in the autumn (Hartig 1837). Of the subfamily Nema-

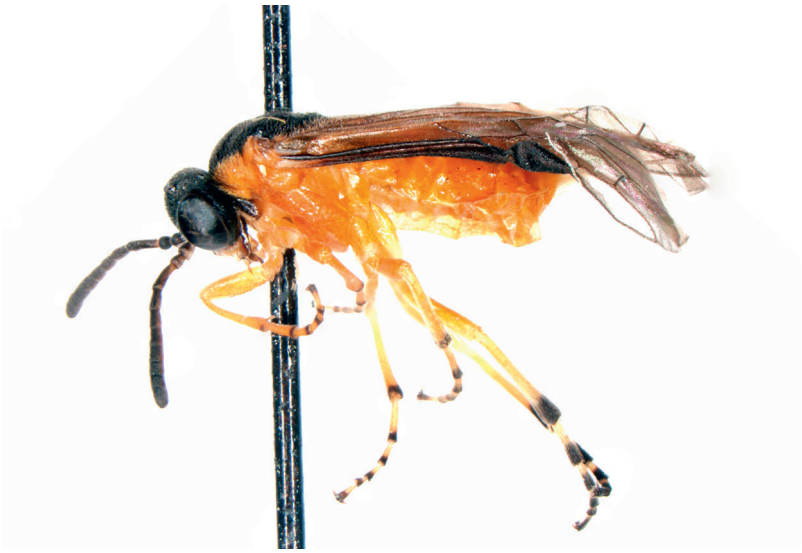

Figure 7. The sawfly *Athalia cornubiae* Benson, 1931. Also a new species to Sweden, collected in Malaise trap nr 5. Photo by Artur Larsson.

Växtstekeln *Athalia cornubiae* Benson, 1931 vars larver lever på vit fetknopp (*Sedum album*) var också en ny art för Sverige. Den fångades i Malaisefälla nr. 5

tinae, we found a couple of species of *Pristiphora,* which may also have 2 or 3 generations and can be found in the autumn (Chawner & Peacock 1923, Viitasaari 2002). Another possibility of the high numbers in August might be that they hibernate in the egg stage, complete their larval development during early summer and fly as imagines during late summer or spring. This is rare among the sawflies, but is for example known for the European pine sawfly *Neodiprion sertifer* (Pschorn-Walcher, 1965).

As could be expected, a totally different set of species were observed by Ole Lønnve when he visited the island for a couple of days at the end of May in 2008 (Appendix). The juniper-feeding *Monoctenus obscuratus* (Diprionidae) was then observed in large numbers all across the island, whereas the other sawfly species were observed at the bog Myren and utilize host plants like *Filipendula ulmaria* (*Empria)* or different species of ferns (*Strongylogaster macula*), commonly seen at the edge of the bog.

Aculeata

The 2012 inventory of the island's aculeate fauna showed, together with older records, that Stora Karlsö harbour several rare aculeate wasps that should be protected and an ecosystem with a unique species composition (Johansson 2013). Johansson (2013) noted that the proportion of the parasitic aculeates was relatively low. Some aculeates new to the fauna of Stora Karlsö were also recorded. The solitary wasp *Stenodynerus bluethgeni* Van der Vecht, 1971 seems to be restricted to alvar habitats. Recent Swedish records are all from first-class dry habitats on Öland. It is absent from the rest of the Nordic countries and its closest occurrences are in the Netherlands and central Germany (Abenius 2012). On Gotland, the most recent record was from Buttle 1972, until a female was found at Suderslätt in 2012 (Johansson 2013) as the first record in 40 years. But since then this species has also been found in a few localities on the Gotland main island. Two specimens of the sphecid wasp *Rhopalum gracile* Wesmael, 1848 were swept at a reed bed at the bog Myren. This small wasp primarily inhabits stems of reed and is found in reed-beds and lush marshes (Blösch 2000). Due to its habitat preferences, it is probably overlooked but the records are new to the province of Gotland (Hellqvist et al 2014). *Lasioglossum zonulum* Smith, 1848, is a medium sized halictid bee which is quite common on the adjacent areas on Gotland. One male was swept on a dry meadow just west of Myren. The species is new to the fauna of Stora Karlsö.

Another interesting observation was that the

rare Gotlandic subspecies of *Andrena marginata* Fabricius, 1777; *A. marginata nigrescens* Aurivillius, 1903, which has previously been recorded from the island (Nilsson 2011), could not be found although the timing of the inventory was just right with respect to its flight period, in some places along with lots of flowering *Succisa pratensis,* which is the species' preferred host plant.

Coelioxys obtusispina Thomson, 1872 is a cleptoparasite of the bee *Megachile lagopoda* (Linnaeus, 1761). This species has a very restricted world distribution and is currently known only from Gotland. Up until the 1950s it was also present in some other parts of Sweden, in Östergötland and Uppland, but since these populations seem to have disappeared the species is currently to be regarded as a Gotland endemic. From Stora Karlsö, Olov Lundblad collected the species in the 1950s and it was rediscovered in 2012 (Johansson 2013).

Conclusions

Since both climatic conditions and vegetation may be very different from other nearby localities, an island fauna can hold big surprises and seem very peculiar. This certainly seems to be the case with Stora Karlsö. Our material necessarily contains only a small subsample of the island's fauna, representing a limited time window. Numerous singletons in the material suggest the observed species richness is still far from the factual. Thus, it would be premature to draw any conclusions in terms of island biogeography. Further studies will be needed to address community assembly topics such as the proportions of specialists vs. generalists, and comparison with mainland communities in similar habitat patches; or indications of locality-specific adaptations of ecological strategies. Any study focussing on proportions of specialists versus generalists will, however, require some knowledge of the biology of each species, which is unfortunately non-existent for many poorly-known groups of Hymenoptera.

It may be further interesting to assess the effect of discontinued sheep grazing on biodiversity by a faunal comparison between Stora Karlsö and its closest neighbour, Lilla Karlsö, where sheep grazing remained continuous up to the present day. Particularly Malaise traps are a very effective and standardised way to sample biodiversity, but to draw meaningful conclusions in terms of island biogeography within one particular time window, a replicated study may be required, setting up the same number of replicated traps in a comparable vegetation on both islands as well as on Gotland and on the mainland within the same time period.

The fact that we found a number of new species to Sweden and a number of rare species probably reflects the poor knowledge of the hymenopteran fauna in general, and we deem it likely that any similar collection and identification effort on any relatively rich spot in the country would produce new and rare species in a similar magnitude, as shown by the evidence from the Swedish Malaise Trap Project (unpublished). Our snapshot of the Stora Karlsö wasp community may not on its own illuminate questions concerning ecological patterns but even so, it is a gleaming glint of the fauna, filled with notable surprises.

Our study thus provides an easy recipe on how the knowledge of Swedish biodiversity can be substantially augmented: By a short and intensive collecting expedition, making use of the synergistic effect of different experts. We strongly recommend that other interesting localities in the country are subjected to similar efforts by temporary teams of determined entomologists with slightly different target groups. Provided that a permit can be acquired from the authorities, there are still many hidden species to discover; and from the point of view of nature conservation, we can only devise effective protection measures if we know what is there to be protected.

Acknowledgements

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Svensk sammanfattning

Stekelfaunan på Stora Karlsö utanför Gotland är överlag dåligt känd trots att den ganska märkvärdiga gaddstekelfaunan undersökts tidigare. För att få mer kunskap om denna fauna och se hur mycket man kan lära sig med en kort gemensam insats genomförde vi, åtta personer, en inventering under fem dagar i augusti 2014 med främst genom handplockning och håvning i vegetation. Vi hade också Malaisefällor uppsatta under 22 dagar. Främst inriktade vi oss mot parasitsteklar och växtsteklar. Vi fick ihop ca 200 arter parasitsteklar och 14 växtsteklar som rapporteras för första gången från Stora Karlsö. Fynd från ett par andra besök på ön har också inkluderats i resultaten här – av Ole Lønnve 2008, Mattias Forshage m fl 2011, Niklas Johansson 2012 och Carl-Cedric Coulianos vid flera tillfällen. Totalt 12 arter (inkluderar ett fynd av NJ 2012) arter rapporteras som nya för Sverige: bladstekeln *Athalia cornubiae* Benson, 1931, bistekeln *Gasteruption opacum* (Tournier, 1877), hyllhornstekeln *Spilomicrus rufitarsis* (Kieffer, 1911), finglansstekeln *Entedonomphale bulgarica* Boyadzhiev & Triapitsyn, 2007, bracksteklarna *Bracon roznari* Papp, 1998 och *Gnamptodon decoris* (Förster, 1862), och följande brokparasitsteklar: *Bathythrix maculata* (Hellén, 1957), *Heterischnus filiformis* (Gravenhorst, 1829), *Lissonota picticoxis* Schmiedeknecht, 1900, *Mesochorus tipularius* Gravenhorst, 1829, *Ophion brevicornis* Morley, 1915, och *Plectochorus iwatensis* (Uchida, 1928). Detta visar hur kunskapsläget för svensk biologisk mångfald kan ökas massivt under en kort men intensiv inventering. Vi rekommenderar starkt att fler platser i Sverige inventeras på liknande vis.

Appendix. Hymenoptera taxa found on Stora Karlsö. Columns indicate where records are obtained; “Malaise trap no” and “sweep net & handp.” are from the present inventory with trap no’s as in Fig. 1, ”x” = presence in unspecified trap(-s), “>” =presence in several traps.; references indicate records from earlier sources. New species for Sweden are marked with “*”.

Steklar som hittas på Stora Karlsö. Kolumnerna anger när fynden gjorts: de två första från denna inventering: siffra = fällnr. som i Fig. 1, ”x” = förekomst i ospec fälla/-or “>” = förekomt i fler fällor; kolumner med referenser anger litteraturkällor för fynd. Nya arter för Sveroge markeras med “*”.

TAXON	Malaise trap no	sweep net & handp.	Johansson (2012)	Forshage (2011)	Lømnve (2008)	Other records
DIPRIONIDAE						
Monoctenus obscuratus (Hartig, 1837)	-	-	-	-	x	-
TENTHREDINIDAE						
Allantinae						
Apethymus serotinus (Müller, 1776)	4	-	-	-	-	-
Empria pallimacula (Audinet-Serville, 1823)	-	-	-	-	x	-
Empria pumila (Konow, 1896)	-	-	-	-	x	-
Athaliinae						
Athalia cordata Audinet-Serville, 1823	-	x	-	-	-	-
Athalia rosae (Linnaeus, 1758)	5	-	-	-	-	-
* *Athalia cornubiae* Benson, 1931	5	-	-	-	-	-
Athalia circularis (Klug, 1815)	-	x	-	-	-	-
Blennocampinae						
Blennocampa phyllocolpa Viitasaari & Vikberg, 1985	-	-	-	-	-	Coulianos 1989
Claremontia waldheimii (Gimmerthal, 1847)	-	-	-	-	x	-
Heterarthriinae						
Endelomyia aethiops (Gmelin, 1790)	-	-	-	-	x	-
Metallus pumilus (Klug, 1816)	2	-	-	-	-	-
Nematinae						
Cladius pectinicornis (Geoffroy in Fourcroy, 1785)	1,4,5	-	-	-	-	-
Pristiphora pallidiventris (Fallén, 1808)	x	-	-	x	-	-
Euura bridgmanii (Cameron, 1883)	-	-	-	-	-	Coulianos 2009
Selandriinae						
Nesoselandria morio (Fabricius, 1781)	-	x	-	-	-	-
Strongylogaster macula (Klug, 1917)	-	-	-	-	x	-
Tenthredininae						
Tenthredo cf. atra Linnaeus, 1758	-	-	x	-	-	-
GASTERUPTIIDAE						
Gasteruption assectator (Linnaeus, 1758)	-	-	x	-	-	-
* *Gasteruption opacum* (Tournier, 1877)	-	-	x	-	-	-

Appendix, continued.

DIAPRIIDAE						
Belytinae						
Belyta depressa Thomson, 1859	all	x	-	-	-	-
Cinetus sp.	-	x	-	-	-	-
Aclista sp.	3	-	-	-	-	-
Pantolyta sp.	-	x	-	-	-	-
Diapriinae						
Psilus fuscipennis (Curtis, 1831)	-	x	-	-	-	-
* *Spilomicrus rufitarsis* (Kieffer, 1911)	-	x	-	-	-	-
Basalys sp. *1*	2	-	-	-	-	-
Basalys sp. *2*	3	-	-	-	-	-
Basalys sp. *3*	x	x	-	-	-	-
Basalys sp. *4*	x	-	-	-	-	-
Basalys sp. *5*	3	-	-	-	-	-
Trichopria sp.	4	-	-	-	-	-
Trichopria oogaster (Thomson, 1859)	3	-	-	-	-	-
Trichopria aequata (Thomson, 1859)	x	-	-	-	-	-
Trichopria wasmanni (Kieffer, 1911)	2	-	-	-	-	-
Trichopria cf. tenuicornis (Thomson, 1859)	5	-	-	-	-	-
Trichopria verticillata (Latreille, 1805)	x	-	-	-	-	-
PROCTOTRUPIDAE						
Proctotrupes bistriatus (Möller, 1882)	1	-	-	-	-	-
Proctotrupes gravidator (Linnaeus, 1758)	2	x	-	-	-	-
Codrus spp.	x	-	-	-	-	-
Pschornia spp.	4	-	-	-	-	-
Phaneroserphus calcar (Haliday, 1839)	-	x	-	-	-	-
Phaenoserphus cf. viator (Haliday, 1839)	5	-	-	-	-	-
PLATYGASTRIDAE						
Platygastrinae						
Inostemma sp.	5	-	-	-	-	-
Leptacis sp.	4	x	-	-	-	-
Platygaster spp.	x	-	-	-	-	-
Amblyaspis sp.	-	x	-	-	-	-
Synopeas sp.	x	-	-	-	-	-
Scelioninae s. lat.						
Gryon sp.	x	-	-	x	-	-
Trimorus spp.	>	x	-	x	-	-
Trissolcus spp.	>	-	-	-	-	-
Scelio sp.	4	-	-	-	-	-
Telenomus spp.	all	x	-	-	-	-
Telenomus danubialis Szelenyi, 1939	4	x	-	-	-	-
Anteris sp.	3	-	-	-	-	-
Xenomerus ergenna Walker, 1836	x	-	-	-	-	-
CERAPHRONIDAE						
Aphanogmus spp.	x	x	-	x	-	-
Ceraphron spp.	x	x	-	-	-	-
MEGASPILIDAE						
Megaspilus spp.	x	x	-	-	-	-

Appendix conuuied

TAXON	Malaise trap no	sweep net & handp.	Johansson (2012)	Forshage (2011)	Lønnve (2008)	Other records
Conostigmus spp.	x	x	-	-	-	-
Dendrocerus spp.	all	x	-	x	-	-
MYMAROMMATIDAE						
Mymaromma anomalum (Blood & Kryger, 1922)	3	-	-	-	-	-
MYMARIDAE						
Alaptus sp.	3	-	-	-	-	-
Anagrus spp.	4	-	-	x	-	-
Anaphes sp.	4	-	-	x	-	-
Erythmelus sp.	4	-	-	-	-	-
Gonatocerus spp.	>	-	-	x	-	-
Ooctonus spp.	>	-	-	-	-	-
APHELINIDAE						
Aphelinus sp.	>	-	-	x	-	-
Centrodora sp.	1	-	-	-	-	-
Coccophagus sp.	-	-	-	x	-	-
ENCYRTIDAE						
Encyrtidae indet.	x	x	-	-	-	-
Copidosoma sp.	6	-	-	-	-	-
Bothriothorax sp.	2	-	-	-	-	-
?Aphycoides sp.	2	-	-	-	-	-
TORYMIDAE						
Torymus spp.	all	x	-	x	-	-
Megastigmus sp.	4	-	-	-	-	-
EUPELMIDAE						
Eupelmus vesicularis (Retzius, 1783)	x	-	-	-	-	-
Eupelmus cf. annulatus Nees von Esenbeck, 1834	1	-	-	-	-	-
Eupelmus urozonus Dalman, 1820	x	-	-	-	-	-
Eupelmus sp. (*males*)	5	-	-	-	-	-
Merostenus excavatus (Dalman, 1820)	-	x	-	-	-	-
CHALCIDIDAE						
Haltichella rufipes (Olivier, 1791)	-	x	-	-	-	-
EULOPHIDAE						
Entedontinae						
Neochrysocharis formosa (Westwood, 1833)	-	x	-	-	-	-
Neochrysocharis chlorogaster (Erdös, 1954)	4	-	-	-	-	-
Chrysocharis nephereus (Walker, 1839)	2	-	-	-	-	-
Chrysocharis pubicornis (Zetterstedt, 1838)	-	x	-	-	-	-
Chrysocharis polyzo (Walker, 1839)	-	x	-	-	-	-
* *Entedonomphale bulgarica* Boyadzhiev & Triaptsyn, 2007	4	-	-	-	-	-
Ionympha carne (Walker, 1839)	-	x	-	-	-	-
Omphale sp, aetius-group						
Omphale nr. isander	-	x	-	-	-	-
Omphale incognita Hansson & Shevtsova, 2012	-	x	-	-	-	-

Appendix, continued.

Entiinae						
Euderus albitarsis (Zetterstedt, 1838)	x	-	-	-	-	-
Eulophinae						
Elachertus isadas (Walker, 1838)	-	x	-	-	-	-
Elachertus lateralis (Spinola, 1808)	-	x	-	-	-	-
Cirrospilus lyncus Walker, 1838	x	-	-	-	-	-
Cirrospilus vittatus Walker, 1838	2	-	-	-	-	-
Diglyphus begini (Ashmead, 1904)	5	-	-	-	-	-
Diglyphus isaea (Walker, 1838)	x	x	-	-	-	-
Elasmus flabellatus (Boyer de Fonscolombe, 1832)	1	-	-	-	-	-
Elasmus sp	-	x	-	-	-	-
Dicladoderus euryalus (Haliday, 1844)	-	x	-	-	-	-
Eulophus larvarum (Linnaeus, 1758)	-	x	-	-	-	-
Hemiptarsenus ornatus (Nees von Esenbeck, 1834)	>	x	-	-	-	-
Hemiptarsenus unguicellus (Zetterstedt, 1838)	4	x	-	-	-	-
Necremnus metalarus (Walker, 1839)	>	-	-	-	-	-
Pnigalio soemius (Walker, 1839)	5	-	-	-	-	-
Sympiesis gordius (Walker, 1839)	4	x	-	-	-	-
Sympiesis gregori Boucek, 1958	4	-	-	-	-	-
Sympiesis sereicornis (Nees von Esenbeck, 1834)	2	-	-	-	-	-
Tetrastichinae						
Aprostocetus cf. orithyia (Walker, 1839)	-	x	-	-	-	-
Aprostocetus sp. *1*	1	-	-	-	-	-
Aprostocetus sp. *2*	1	-	-	-	-	-
Aprostocetus sp. *3*	-	x	-	-	-	-
Aprostocetus sp. *4*	-	x	-	-	-	-
Aprostocetus sp. *5*	-	x	-	-	-	-
Crataepus marbis (Walker, 1839)	-	x	-	-	-	-
Tamarixia sp.	5	x	-	-	-	-
Tamarixia pubescens (Nees, 1834)						
Tamarixia monesus (Walker, 1839)						
Tamarixia upis (Walker, 1839)						
Tetrastichus atratulus	5	x	-	-	-	-
PTEROMALIDAE						
Pteromalidae indet.	x	x	-	x	-	-
Asaphinae						
Asaphes sp.	x	-	-	-	-	-
Asaphes suspensus (Nees von Esenbeck, 1834)	1	x	-	-	-	-
Miscogastrinae						
Halticoptera patellana (Dalman, 1818)	2	-	-	-	-	-
Pteromalinae						
Trichomalus sp.	-	x	-	-	-	-
Trichomalus campestris (Walker, 1834)	1	x	-	-	-	-
Trichomalus cf. lonchaeae Boucek, 1958	-	x	-	-	-	-
Cyrtogaster sp.	-	x	-	-	-	-
Callitula bicolor Spinola, 1811	-	x	-	-	-	-
Pachyneuron sp.	x	-	-	-	-	-

Appendix conuuied

TAXON	Malaise trap no	sweep net & handp.	Johansson (2012)	Forshage (2011)	Lønnve (2008)	Other records
TETRACAMPIDAE						
Epiclerus nomocerus (Masi, 1934)	1,5	x	-	-	-	-
TRICHOGRAMMATIDAE						
Trichogramma sp.	x	-	-	-	-	-
CYNIPIDAE						
Aulacidea pilosellae (Kieffer, 1901)	-	-	-	x	-	-
Diplolepis eglanteriae (Hartig, 1840)	-	-	-	-	-	Coulianos 1989, 2009
Diplolepis rosae (Linnaeus, 1758)	-	x	-	-	-	Coulianos 1988, 1989, 2009
Neuroterus quercusbaccarum (Linnaeus, 1758)	-	x	-	-	-	-
FIGITIDAE						
Anacharitinae						
Anacharis immunis (Walker, 1835)	2	x	-	-	-	-
Anacharis eucharioides (Dalman, 1818)	5	x	-	-	-	-
Xyalaspis armata (Giraud, 1860)	-	x	-	-	-	-
Aspicerinae						
Callaspidia defonscolombei (Dahlbom, 1842)	-	x	-	-	-	-
Charipinae						
Alloxysta cf. macrophadna (Hartig, 1841)	1	-	-	-	-	-
Alloxysta cf. pleuralis (Cameron, 1879)	4	-	-	-	-	-
Alloxysta fulviceps (Curtis, 1838)	x	-	-	-	-	-
Alloxysta cf. citripes (Thomson, 1862)	4	-	-	-	-	-
Alloxysta arcuata (Kieffer, 1902)	>	-	-	x	-	-
Alloxysta cf. tscheki (Giraud, 1860)	2	-	-	-	-	-
Alloxysta sp. *1*	>	-	-	-	-	-
Alloxysta cf. victrix (Westwood, 1833) (*MF 2011*)	-	-	-	x	-	-
Eucoilinae						
Kleidotoma cf. psiloides Westwood, 1833	5	x	-	-	-	-
Kleidotoma cf. myrmecophila Kieffer, 1908	5	x	-	-	-	-
Kleidotoma sp. *1* (*males*)	4	-	-	-	-	-
Kleidotoma cf. affinis Cameron, 1889	-	-	-	x	-	-
Trybliographa cf. diaphana (Hartig, 1841)	5	-	-	x	-	-
Trybliographa agaricola (Thomson, 1862)	1	-	-	-	-	-
Trybliographa cf. trichopsila (Hartig, 1841)	x	-	-	-	-	-
Trybliographa sp. *1*	-	-	-	x	-	-
Didyctium cf. nigriclavum (Kieffer, 1904)	-	x	-	-	-	-
Figitinae						
Figites cf. validicornis Thomson, 1862	-	-	-	x	-	-
Sarothrus brevicornis Thomson, 1877	5	-	-	-	-	-
BRACONIDAE						
Agathidinae						
Bassus sp.	5	-	-	-	-	-

Appendix, continued.

Alysiinae						
Chorebus sp.	x	x	-	x	-	-
Aspilota spp.	x	x	-	x	-	-
Alysia sp.	-	x	-	-	-	-
Orthostigma spp.	x	x	-	-	-	-
Dapsilarthra sp.	-	x	-	-	-	-
Phaenocarpa sp.	-	x	-	-	-	-
Dacnusa spp.	x	x	-	-	-	-
Dinotrema spp.	x	x	-	-	-	-
Aphidiinae						
Aphidius sp.	-	-	-	x	-	-
Diaeretus sp.	x	-	-	-	-	-
Pauesia sp.	x	-	-	-	-	-
Praon sp.	x	-	-	-	-	-
Blacinae						
Blacus armatulus Ruthe, 1861	x	x	-	-	-	-
Braconinae						
* *Bracon rozneri* Papp, 1998						
Bracon exhilarator Nees, 1834	1	-	-	-	-	-
Bracon pectoralis Wesmael, 1838	-	x	-	-	-	-
Cheloninae						
Chelonus pusillus Szépligeti, 1908	>	x	-	-	-	-
Adelius subfasciatus Haliday, 1833	>	x	-	-	-	-
Doryctinae						
Spathius exarator (Linnaeus, 1758)	-	x	-	-	-	-
Heterospilus separator Fischer, 1960	-	x	-	-	-	-
Ontsiria antica (Wollaston, 1858)	4	-	-	-	-	-
Euphorinae						
Meteorus ruficeps (Nees von Esenbeck, 1834)	x	x	-	x	-	-
Meteorus ictericus (Nees von Esenbeck, 1834)	5	x	-	x	-	-
Meteorus cf. abdominator (Nees von Esenbeck, 1834)	x	x	-	x	-	-
Meteorus sibyllae Stigenberg, 2011	3	-	-	-	-	-
Leiophron pallidistigma Curtis, 1833	x	-	-	-	-	-
Townesilitus bicolor (Wesmael, 1835)	>	x	-	-	-	-
Gnamptodontinae						
* *Gnamptodon decoris* (Förster, 1862)	4	-	-	-	-	-
Helconinae						
Diospilus morosus Reinhard, 1862	-	x	-	-	-	-
Hormiinae						
Hormius moniliatus (Nees von Esenbeck, 1834)	x	-	-	-	-	-
Macrocentrinae						
Macrocentrus infirmus (Nees von Esenbeck, 1834)	x	-	-	-	-	-
Macrocentrus thoracicus (Nees von Esenbeck, 1812)	x	-	-	-	-	-
Macrocentrus sp.	-	-	-	x	-	-
Microgastrinae						
Microgastrinae indet.	x	x	-	-	-	-
Apanteles sp.	all	x	-	x	-	-

Appendix conuuied

TAXON	Malaise trap no	sweep net & handp.	Johansson (2012)	Forshage (2011)	Lønnve (2008)	Other records
Opiinae						
Opiostomus spp.	x	-	-	-	-	-
Orgilinae						
Orgilus sp.	2	-	-	-	-	-
Rhyssalinae						
Oncophanes minutus (Wesmael, 1838)	-	-	-	x	-	-
Rogadinae						
Aleiodes bicolor (Spinola, 1808)	-	x	-	-	-	-
Aleiodes circumscriptus (Nees von Esenbeck, 1834)	1	-	-	-	-	-
ICHNEUMONIDAE						
Anomaloninae						
Habrocampulum biguttatum (Gravenhorst, 1829)	-	x	-	-	-	-
Erigorgus cf. latro (Schrank, 1781)	-	x	-	-	-	-
Banchinae						
Banchinae indet.	x	-	-	-	-	-
Apophua sp.	1	-	-	-	-	-
Exetastes adpressorius (Thunberg, 1824)	-	x	-	-	-	-
Exetastes gracilicornis Gravenhorst, 1829	1	x	-	-	-	-
Glypta caudata Thomson, 1889	1	x	-	-	-	-
Glypta dentifera Thomson, 1889	-	x	-	-	-	-
Glypta bifoveolata Gravenhorst, 1829	-	x	-	-	-	-
Glypta fronticornis Gravenhorst, 1829	-	x	-	-	-	-
Lissonota sp.	-	x	-	-	-	-
Lissonota coracina (Gmelin, 1790)	-	x	-	-	-	-
* *Lissonota picticoxis* Schmiedeknecht, 1900	2	x	-	-	-	-
Lissonota cf. accusator (Fabricius, 1793)	-	x	-	-	-	-
Campopleginae						
Campopleginae indet.	x	x	-	-	-	-
Ctenopelmatinae						
Ctenopelmatinae indet.	x	-	-	-	-	-
Rhinotorus sp.	-	x	-	-	-	-
Cryptinae						
Cryptinae indet.	x	-	-	-	-	-
Aritranis sp.	-	x	x	-	-	-
Cryptus dianae s. lat. Gravenhorst, 1829	-	x	-	-	-	-
Ischnus inquisitorius (Müller, 1776)	-	x	-	-	-	-
Stenarella domator (Poda, 1761)	-	x	-	-	-	-
Atractodes croceicornis Haliday, 1839	-	x	-	-	-	-
Bathythrix fragilis (Gravenhorst, 1829)	-	x	-	-	-	-
* *Bathythrix maculata* (Hellén, 1957)	-	x	-	-	-	-
Dichrogaster aestivalis (Gravenhorst, 1829)	-	x	-	-	-	-
Gelis sp.	-	-	x	-	-	-
Gelis areator (Panzer, 1804)	x	x	-	-	-	-

Appendix, continued.

Gelis agilis (Fabricius, 1775)	1	x	-	x	-	-
Megacara vagans (Gravenhorst, 1829)	-	x	-	-	-	-
Orthizema cf. hadrocerum (Thomson, 1884)	-	x	-	-	-	-
Phygadeuontina sp.	-	x	-	-	-	-
Zoophthorus nr. plumbeus (Thomson, 1884)	-	x	-	-	-	-
Diplazontinae						
Diplazon laetatorius (Fabricius, 1771)	x	x	-	-	-	-
Diplazon tetragonus (Thunberg, 1824)	2	x	-	-	-	-
Diplazon scutatorius Teunissen, 1943	5	x	-	-	-	-
Diplazon sp.	2	-	-	-	-	-
Promethes sulcator (Gravenhorst, 1829)	5	-	-	-	-	-
Homotropus signatus (Gravenhorst, 1829)	1	x	-	-	-	-
Homotropus dimidiatus (Schrank, 1802)	-	x	-	-	-	-
Tymmophorus erythrozonus (Förster, 1850)	2	-	-	-	-	-
Syrphoctonus tarsatorius (Panzer, 1809)	-	x	-	-	-	-
Syrphophilus tricinctorius (Thunberg, 1824)	-	x	-	-	-	-
Enizemum ornatum (Gravenhorst, 1829)	-	x	-	-	-	-
Enizemum nigricorne (Thomson, 1890)	-	x	-	-	-	-
Ichneumoninae						
Ichneumoninae indet.	x	-	-	-	-	-
Ichneumon sarcitorius Linnaeus, 1758	-	x	-	-	-	-
Ichneumon suspiciosus Wesmael, 1845	-	x	-	-	-	-
Ichneumon simulans Tischbein, 1873	-	x	-	-	-	-
Cratichneumon flavifrons (Schrank, 1781)	-	x	-	-	-	-
Chasmias motatorius (Fabricius, 1775)	-	x	-	-	-	-
Homotherus locutor (Thunberg, 1824)	-	x	-	-	-	-
Barichneumon peregrinator (Linnaeus, 1758)	-	x	-	-	-	-
Virgichneumon dumeticola (Gravenhorst, 1829)	-	x	-	-	-	-
Platylabus rufus Wesmael, 1845	-	x	-	-	-	-
Platylabus pallidens Wesmael, 1853	-	x	-	-	-	-
Platylabus curtorius (Thunberg, 1822)	-	x	-	-	-	-
Platylabus heteromallus (Berthomieu, 1910)	-	x	-	-	-	-
Platylabus orbitalis (Gravenhorst, 1829)	-	x	-	-	-	-
Platylabus dolorosus (Gravenhorst, 1829)	-	x	-	-	-	-
* *Heterischnus filiformis* (Gravenhorst, 1829)	-	x	-	-	-	-
Centeterus rubiginosus (Gmelin, 1790)	-	x	-	-	-	-
Phaeogenes melanogonos (Gmelin, 1790)	-	x	-	-	-	-
Dirophanes fulvitarsis (Wesmael, 1845)	-	x	-	-	-	-
Dicaelotus pumilus (Gravenhorst, 1829)	-	x	-	-	-	-
Diadromus subtilicornis (Gravenhorst, 1829)	-	x	-	-	-	-
Aethecerus sp.	-	x	-	-	-	-
Mesochorinae						
Mesochorus gemellus Holmgren, 1858	-	x	-	-	-	-
Mesochorus olerum Curtis, 1833	1	x	-	-	-	-
Mesochorus rubeculus Hartig, 1838	-	x	-	-	-	-
Mesochorus semirufus Holmgren, 1860	-	x	-	-	-	-
* *Mesochorus tipularius* Gravenhorst, 1829	1	-	-	-	-	-
* *Plectochorus iwatensis* (Uchida, 1928)	-	x	-	-	-	-

Appendix conuuied

TAXON	Malaise trap no	sweep net & handp.	Johansson (2012)	Forshage (2011)	Lønnve (2008)	Other records
Stictopisthus unicinctor (Thunberg, 1822)	3	-	-	-	-	-
Ophioninae						
* *Ophion brevicornis* Morley, 1915	-	x	-	-	-	-
Pimplinae						
Pimpla spuria Gravenhorst, 1829	x	x	-	-	-	-
Pimpla flavicoxis Thomson, 1877	2	x	-	-	-	-
Pimpla hypochondriaca Retzius, 1783	-	-	x	-	-	-
Pimpla contemplator (Müller, 1776)	x	x	-	-	-	-
Itoplectis aterrima Jussila, 1965	-	x	-	-	-	-
Itoplectis alternans (Gravenhorst, 1829)	-	x	-	-	-	-
Apechthis quadridentata (Thomson, 1877)	-	x	-	-	-	-
Apechthis compunctor (Linnaeus, 1758)	-	-	x	-	-	-
Endromopoda detrita (Holmgren, 1860)	-	x	-	-	-	-
Scambus eucosmidarum (Perkins, 1957)	-	x	-	-	-	-
Scambus calobatus (Gravenhorst, 1829) (*planatus* (Hartig, 1838))	-	x	-	-	-	-
Scambus inanis (Schrank, 1802) (*annulatus Kiss*)	-	x	-	-	-	-
Scambus vesicarius (Ratzeburg, 1844)	-	x	-	-	-	-
Zaglyptus varipes (Gravenhorst, 1829)	-	x	-	-	-	-
Schizopyga circulator (Panzer, 1800)	-	x	-	-	-	-
Clistopyga rufator Holmgren, 1856	2	x	-	-	-	-
Sinarachna pallipes (Holmgren, 1860)	-	x	-	-	-	-
Tromatobia ornata (Gravenhorst, 1829)	-	x	-	-	-	-
Orthocentrinae						
Orthocentrinae indet	x	-	-	-	-	-
Stilbopinae						
Stilbops sp	-	-	-	x	-	-
Tersilochinae						
Phradis morionellus (Holmgren, 1860)	5	-	-	-	-	-
Tryphoninae						
Tryphoninae indet.	x	-	-	-	-	-
Phytodietus variegatus (Fonscolombe, 1854)	-	x	-	-	-	-
Netelia sp	-	x	-	-	-	-
Netelia melanura	x	x	-	-	-	-
Ctenochira haemosterna (Haliday, 1838)	-	x	-	-	-	-
Exenterus ictericus (Gravenhorst, 1829)	6	x	-	-	-	-
Grypocentrus cinctellus Ruthe, 1855	-	x	-	-	-	-
Thymaris tener (Gravenhorst, 1829)	3	-	-	-	-	-
DRYINIDAE						
Aphelopus melaleucus (Dalman, 1818)	-	-	-	x	-	-
Dryinidae indet.	x	-	-	x	-	-
BETHYLIDAE						
Bethylus cephalotes (Förster, 1860)	x	x	-	x	-	-
Bethylus fuscicornis (Jurine, 1807)	-	x	-	-	-	-
Bethylus boops (Thomson, 1861)	-	x	-	-	-	-
CHRYSIDIDAE						
Chrysis subcoriacea Linsenmaier, 1959	-	-	x	-	-	Norén
Chrysis ruddii Shuckard, 1836	-	-	x	-	-	Norén
Chrysis borealis Paukkunen, Ødegaard & Soon, 2015	-	-	-	-	-	Norén
FORMICIDAE						
Myrmica schenki Emery, 1895	-	-	-	x	-	-
Myrmica sabuleti Meinert, 1861	-	-	-	-	-	Frisk 1972
Myrmica rubra (Linnaeus, 1758)	-	x	x	x	-	Högmo
Myrmica ruginodis Nylander, 1846	>	x	-	x	-	Högmo
Myrmica hirsuta Elmes, 1978	-	-	-	-	-	Norén 2009, Högmo
Myrmica lonae Finzi, 1926	x	x	x	x	-	Högmo
Myrmica cf. vandeli Bondroit, 1920	-	x	-	-	-	-
Myrmecina graminicola (Latreille, 1802)	x	x	-	x	-	Högmo, 1988
Solenopsis fugax Latreille, 1798	-	-	-	-	-	Hagman 2013
Leptothorax muscorum (Nylander, 1846)	-	-	-	x	-	-
Leptothorax acervorum (Fabricius, 1793)	-	-	x	x	-	-
Tetramorium caespitum (Linnaeus, 1758)	-	x	x	x	-	Frisk 1971, Högmo
Lasius alienus (Förster, 1850)	-	-	-	-	-	Frisk 1972
Lasius paralienus Seifert, 1992	-	x	-	-	-	Högmo1988
Lasius psammophilus Seifert, 1992	x	-	-	-	-	-
Lasius flavus (Fabricius, 1782)	-	x	x	-	-	Högmo
Formica fusca Linnaeus, 1758	all	x	x	x	-	Norén, Frisk 1972 Bartsch 1988, Högmo
Formica cunicularia Latreille, 1798	-	-	-	-	-	Högmo
Formica polyctena Förster, 1850	-	-	-	-	-	Frisk 1972, Högmo
Formica clara Forel, 1886	4	x	-	-	-	-
Camponotus ligniperda (Latreille, 1802)	-	-	-	-	-	Högmo
Temnothorax tuberum (*Fabricius, 1775*)	-	x	-	-	-	Frisk 1972, Högmo
VESPIDAE						
Vespula germanica (Fabricius, 1793)	x	-	x	-	-	-
Vespula vulgaris (Linnaeus, 1758)	-	-	x	-	-	-
Dolichovespula saxonica (Fabricius, 1793)	-	-	x	-	-	-
Stenodynerus bluethgeni van der Vecht, 1971	-	-	x	-	-	-
Eodynerus quadrifasciatus (Fabricius, 1793)	-	-	x	-	-	Norén
Symmorphus murarius Linnaeus, 1758	-	-	x	-	-	-
Ancistrocerus scoticus (Curtis, 1829)	-	-	x	-	-	Norén
Ancistrocerus parietinus (Linnaeus, 1761)	-	-	x	-	-	Norén
Ancistrocerus parietum (Linnaeus, 1758)	-	-	x	-	-	Norén
Ancistrocerus oviventris (Wesmael, 1836)	-	-	x	-	-	Norén
Ancistrocerus trifasciatus (Müller, 1776	-	-	x	-	-	Norén
POMPILIDAE						
Arachnospila rufa (Haupt, 1927)	-	-	x	-	-	Lundblad
Arachnospila spissa (Schiødte, 1837)	-	-	x	-	-	Lundblad
Arachnospila trivialis (Dahlbom, 1843)	-	-	x	-	-	Lundblad
Arachnospila anceps (Wesmael, 1851)	-	-	-	-	-	Lundblad
Agenioideus cinctellus (Spinola, 1808)	-	-	x	-	-	Lundblad

Appendix conuuied

TAXON	Malaise trap no	sweep net & handp.	Johansson (2012)	Forshage (2011)	Lønnve (2008)	Other records
Episyron rufipes (Linnaeus, 1758)	-	-	x	-	-	Lundblad
Anoplius nigerrimus (Scopoli, 1763)	-	-	-	-	-	Lundblad, Norén
Anoplius concinnus (Dahlbom, 1843)	-	-	-	-	-	Lundblad
Caliadurgus fasciatellus (Spinola, 1808)	-	x	-	-	-	Lundblad
Evagetes crassicornis (Schuckard, 1837)	-	-	-	-	-	Lundblad
Priocnemis hyalinata (Fabricius, 1793)	-	-	-	-	-	Lundblad
Ceropales maculata (Fabricius, 1775)	-	-	-	-	-	Lundblad
Dipogon variegatus (Linnaeus, 1758)	-	x	-	-	-	-
CRABRONIDAE						
Nysson maculosus (Gmelin, 1790)	-	-	x	-	-	-
Gorytes laticinctus (LePeletier, 1832)	-	-	x	-	-	-
Gorytes quadrifasciatus (Fabricius, 1804)	-	x	x	-	-	-
Ectemnius continuus (Fabricius, 1804)	-	-	x	-	-	Norén
Ectemnius cavifrons (Thomson, 1870)	-	-	x	-	-	-
Crossocerus dimidiatus (Fabricius, 1781)	-	-	x	-	-	-
Crossocerus elongatulus (van der Linden, 1829)	-	-	x	-	-	Norén
Crossocerus distinguendus (Morawitz, 1866)	2	-	x	-	-	Norén
Rhopalum coarctatum (Scopoli, 1763)	-	-	x	-	-	Norén
Rhopalum gracile Wesmael, 1852	-	x	-	-	-	-
Trypoxylon medium Beaumont, 1945	-	-	x	-	-	Norén
Trypoxylon attenuatum Smith, 1851	-	-	-	-	-	Norén
Trypoxylon minus Beaumont, 1945	-	-	-	-	-	Norén
Miscophus niger Dahlbom, 1844	-	-	x	-	-	-
Pemphredon inornata Say, 1824	-	-	x	-	-	-
Psenulus concolor (Dahlbom, 1843)	-	-	x	-	-	Norén
Mimesa lutaria (Fabricius, 1787)	-	-	x	-	-	-
SPHECIDAE						
Ammophila sabulosa (Linnaeus, 1758)	-	-	x	-	-	-
HALICTIDAE						
Lasioglossum morio (Fabricius, 1793)	>	x	-	-	-	Norén
Lasioglossum albipes (Fabricius, 1781)	2	x	x	-	-	Norén
Lasioglossum leucopus (Kirby, 1802)	-	x	-	-	-	Norén
Lasioglossum villosulum (Kirby, 1802)	-	-	-	-	-	Norén
Lasioglossum zonulum (Smith, 1848)	-	x	-	-	-	-
Halictus confusus Smith, 1853	-	-	x	-	-	-
Halictus tumulorum (Linnaeus, 1758)	-	x	x	-	-	Norén
Halictus eurygnathus Blüthgen, 1931	-	-	x	-	-	Lundblad
Sphecodes crassus Thomson, 1870	-	-	x	-	-	-
Sphecodes ephippius (Linnaeus, 1767)	-	-	-	-	-	Norén

Appendix, continued.

ANDRENIDAE						
Andrena haemorrhoa (Fabricius, 1781)	-	-	x	-	-	Norén
Andrena labiata Fabricius, 1781	-	-	x	-	-	-
Andrena carantonica Perez, 1902	-	-	x	-	-	Norén
Andrena fucata Smith, 1847	-	-	-	-	-	Norén
Andrena nigroaenea (Kirby, 1802)	-	-	-	-	-	Norén
Andrena marginata Fabricius, 1777	-	-	-	-	-	Norén
COLLETIDAE						
Hylaeus hyalinatus Smith, 1842	-	-	x	-	-	Norén
Hylaeus communis Nylander, 1852	-	-	x	-	-	Norén
Hylaeus brevicornis Nylander, 1852	-	-	x	-	-	Norén
Hylaeus confusus Nylander, 1852	-	-	-	-	-	Norén
Hylaeus annularis (Kirby, 1802)	-	-	x	-	-	-
Colletes floralis Eversmann, 1852	-	-	x	-	-	Norén
MEGACHILIDAE						
Megachile lagopoda (Linnaeus, 1761)	-	-	x	-	-	Lundblad
Megachile versicolor Smith, 1844	-	-	x	-	-	Norén
Megachile willlugbhiella (Kirby, 1802)	-	-	x	-	-	Norén
Hoplosmia spinulosa (Kirby, 1802)	-	x	x	-	-	Lundblad, Norén
Coelioxys obtusispina Thomson, 1872	-	-	x	-	-	Lundblad
Coelioxys elongata LePeletier, 1841	-	-	x	-	-	-
Osmia aurulenta (Panzer, 1799)	-	-	x	-	-	-
Chelostoma rapunculi (LePeletier, 1841)	-	-	x	-	-	-
Hoplitis mitis Nylander, 1852	-	-	x	-	-	Lundblad, Norén
Hoplitis claviventris (Thomson, 1872)	-	-	x	-	-	-
APIDAE						
Anthophora furcata (Panzer, 1798)	-	-	x	-	-	-
Anthophora quadrimaculata (Panzer, 1806)	-	-	x	-	-	-
Bombus lucorum (Linnaeus, 1761)	-	-	-	-	-	Norén
Bombus terrestris (Linnaeus, 1758)	-	-	x	-	-	-