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Assessment of the risks to Norwegian biodiversity from the import and keeping of terrestrial arachnids and insects

Opinion of the Panel on Alien Organisms and Trade in Endangered species of the Norwegian Scientific Committee for Food Safety

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Assessment of risks to Norwegian biodiversity from the import and keeping of terrestrial arachnids and insects

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Assessment of risks to Norwegian biodiversity from the import and keeping of terrestrial arachnids and insects

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Assessed and approved

The opinion has been assessed and approved by Panel on Alien Organisms and Trade in Endangered Species (CITES). Members of the panel are: Vigdis Vandvik (chair), Hugo de Boer, Jan Ove Gjershaug, Kjetil Hindar, Lawrence R. Kirkendall, Nina Elisabeth Nagy, Anders Nielsen, Eli K. Rueness, Odd Terje Sandlund, Kjersti Sjøtun, Hans Kristen Stenøien, Gaute Velle.

(Panel members in alphabetical order after chair of the panel)

Acknowledgment

The Norwegian Scientific Committee for Food Safety (Vitenskapskomiteen for mattrygghet, VKM) has appointed a working group consisting of both VKM members and external experts to answer the request from the Norwegian Environment Agency. Project leader from the VKM secretariat has been Maria Asmyhr. The members of the working group, Anders Nielsen, Merethe Aasmo Finne (VKM staff), Maria Asmyhr (VKM staff), Jan Ove Gjershaug, Lawrence R. Kirkendall and Gaute Velle (Panel on Alien Organisms and Trade in Endangered Species (CITES) are acknowledged for their valuable work on this opinion. The Panel on Alien Organisms and Trade in Endangered Species (CITES) is acknowledged for comments and views on this opinion. VKM would like to thank Great Britain Non-Native Species Secretariat for allowing the use and adaptation of the risk assessment template. VKM would like to thank the hearing experts Svein Fosså, Thor Håkonsen, Erik Myhre and Jan Ove Rein for their contributions.

Competence of VKM experts

Persons working for VKM, either as appointed members of the Committee or as external experts, do this by virtue of their scientific expertise, not as representatives for their employers or third party interests. The Civil Services Act instructions on legal competence apply for all work prepared by VKM.

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Summary

The Norwegian Scientific Committee for Food Safety (VKM) has been asked by the Norwegian Environment Agency to undertake an assessment of the risks of negative impacts on biodiversity in Norway stemming from the import of terrestrial scorpions, tarantulas, mantids, and stick insects for private use. The committee was asked to assess (1) species survivability under Norwegian conditions, (2) possible impacts of private import on ecosystems and other species, (3) possible risks arising from the introduction of accompanying organisms such as pathogens and parasites, and (4) the likelihood of escape or release of the imported organisms and precautionary measures that could prevent this from happening. The committee was asked to adopt a fifty year perspective in this assessment. Furthermore, any known negative effects on biodiversity of the exporting country should be stated in the report. These factors should, however, not be included as a part of the actual risk assessment.

VKM appointed a working group consisting of members of the Panel on Alien Organisms and Trade in Endangered Species and the VKM Secretariat to answer the request. The Panel on Alien organisms and Trade in Endangered Species has reviewed, revised and finally approved the report prepared by the working group.

VKM adopted a **two-stage** procedure, including an initial screening of all species included in the Terms of Reference and a risk assessment of the species judged to have a potential for establishment in Norway. The initial screening identified taxa with a potential for establishing populations in Norway based on the similarity between climatic conditions in Norway and the organisms current distribution. In cases where a taxon's likelihood of establishment was assessed as being very unlikely, no further assessments were conducted. In cases where the climate conditions of the taxon's current habitat resemble those of Norway now or in a 50-year perspective, a risk assessment was carried out for that taxon in stage two of the procedure. Where very limited or no background information existed, taxa were classified as "lack of information" and could not be assessed further.

The working group screened 6600 species for establishment potential under Norwegian climatic conditions; 6489 species were deemed very unlikely to establish populations and were not assessed further. Sixty-one species were classified as "lack of information".

Fifty-one species were assessed as having potential for establishing populations in Norway, and were risk assessed in stage two of the procedure. For the risk assessment, the working group used an adaptation of the Great Britain Non-Native Species Secretariat`s risk assessment template; the original template was deemed as it cover all aspects of the Terms of Reference. The stage two assessment includes judging the probability of entry, a further and more detailed evaluation of the probability of establishment, judging the probability of spread, an assessment of environmental consequences or impact, and finally an overall risk rating for the taxon in question.

VKM concludes that there is a potential for establishment in Norway in a 50-year perspective, for 20 species of tarantulas, 10 mantids and 20 phasmids (but no scorpions). Only two mantid species, *Mantis religiosa* and *Orthodera novaezealandiae*, are assessed as having a moderate risk of causing negative impacts on Norwegian biodiversity and ecosystems. If they can enter the country, these species is likely to be able to establish viable populations in Norway in a 50 year perspective. *M. religiosa* devours large numbers of prey and is currently spreading in Europe and in North America; however, there are no reports of significant impacts of this species on native biodiversity.

Keywords: VKM, environmental risk assessment, Norwegian Scientific Committee for Food Safety, terrestrical arachnids, terrestrical insects, entry, establishment, introduction, spread, impact, biodiversity, risk reduction option

s/measures, Norwegian Environment Agency

Sammendrag på norsk

Vitenskapskomiteen for mattrygghet (VKM) fikk høsten 2015 i oppdrag av Miljødirektoratet å vurdere risikoen for uheldige følger for biologisk mangfold ved innførsel og hold av landlevende edderkoppdyr og insekter i lukkede terrarier. Bestillingen inkluderte om lag 6600 arter av skorpioner, taranteller, knelere og pinnedyr. VKM ble bedt om å vurdere (1) artenes overlevelsesevne under norske forhold, (2) mulig påvirkning på økosystemer og andre arter, (3) risiko ved introduksjon av eventuelle følgeorganismer som patogener og parasitter og (4) sannsynligheten for spredning av artene utenfor terrariene og mulige risikoreduserende tiltak. VKM ble videre bedt om å vurdere risikoen for uheldige følger for naturmangfoldet ut fra et 50-årsperspektiv.

VKM ble også bedt av Miljødirektoratet om å inkludere informasjon om effekter på økosystemtjenester der dette er kjent, og potensielle negative effekter på biologisk mangfold i eksportlandet. Dette skal imidlertid ikke inngå som en del av selve risikovurderingen.

VKM utnevnte en arbeidsgruppe bestående av medlemmer fra VKMs faggruppe for fremmede organismer og handel med truede arter (CITES) og VKMs sekretariat for å besvare oppdraget. Faggruppen for fremmede organismer og handel med truede arter (CITES) har gjennomgått og revidert utkastet fra arbeidsgruppen og godkjent den endelige rapporten.

På bakgrunn av det høye antallet arter som inngikk i oppdraget, samt den svært begrensede mengden informasjon som finnes om de fleste artene, har VKM delt arbeidet i **to faser**, en screeningsfase og risikovurderingsfase.

I screeningsfasen ble det identifisert arter, eller grupper på høyere taksonomisk nivå, med utbredelsesområde som ikke inneholdt områder med klimatiske forhold som ligner norske (tropiske, subtropiske, ørken, og de fleste tempererte arter). Alle arter som ble eliminert her ble vurdert til å ha lav sannsynlighet for etablering i Norge. Arter som gjensto etter denne screeningen ble risikovurdert i **del 2** av evalueringen.

Av de totalt 6600 artene som har VKM har gjennomgått, lever de fleste i dag i tropiske og subtropiske områder og ble dermed kategorisert til å ha lav sannsynlighet for etablering i Norge. For 61 arter finnes det så godt som ingen informasjon om verken levested eller biologi, og disse ble klassifisert som «lack of information». 50 arter har leveområder der de klimatiske forholdene tilsvarer norske forhold, også når en legger et 50-årsperspektiv til grunn. Disse artene ble vurdert videre i del 2.

For risikovurderingen i del 2 brukte VKM en tilpasset versjon av en risikovurderingsmal fra Great Britain Non-Native Species Secretariat. Spørsmålene som stilles i denne malen er dekkende for å kunne besvare de ulike aspektene som etterspørres i bestillingen fra Miljødirektoratet. Artene er vurdert i detalj for ulike aspekter knyttet til biologi, potensiale for etablering og spredning i Norge, og uheldige følger for biologisk mangfold hvis de etablerer seg i norsk natur.

VKM har konkludert med at 20 arter av taranteller, 10 knelere, og 20 pinnedyr har potensiale for å kunne etablere seg i Norge i et 50-års perspektiv. Av disse, har to arter av knelere blitt vurdert til å ha en «moderat risiko» for å kunne bli en fremtidig invaderende art i Norge. Dette gjelder artene *Mantis religiosa* og *Orthodera novaezealandiae.*

Abbreviations and glossary

Abbreviations

CITES: The Convention on International Trade in Endangered Species of Flora and Fauna

EEA: European Environment Agency

GB-NNSS: Great Britain Non Native Species Secretariat

IUCN: International Union for the Conservation of Nature

Glossary

Alien organism (IUCN definition): a species, subspecies, or lower taxon occurring outside of its natural range (past or present) and dispersal potential (i.e. outside the range it occupies naturally or could not occupy without direct or indirect introduction or care by humans) and includes any part, gametes or propagule of such species that might survive and subsequently reproduce.

Biodiversity: Biological diversity at all scales: the variety of ecosystems in a landscape; the number and relative abundance of species in an ecosystem; and genetic diversity within and between populations as defined by the Convention on Biological Diversity (CBD).

The Norwegian Nature Diversity Act defines biodiversity as ecosystem and species variability and intraspecies genetic variability as well as the ecological relationships between ecosystem components.

Invasive Alien Species (IUCN definition): Invasive alien species are animals, plants or other organisms introduced by man into places out of their natural range of distribution, where they become established and disperse, generating a negative impact on the local ecosystem and species.

Non-native organism: See Alien organism.

Background as provided by the Norwegian Environment Agency

A number of species of invertebrates are imported to Norway for private keeping or for other purposes. As of January 1st, 2016, import of invertebrates will require a permit under the Regulation on non-native species, pursuant to the Norwegian Nature Diversity Act. Organisms listed in Annex II to the regulation are, however, exempted from the permit requirement (see appendix 1 to this letter of assignment).

As a basis for processing applications, the Norwegian Environment Agency needs assessments of the risk of adverse impacts on biodiversity stemming from the import and keeping of currently imported species of insects and arachnids that are not listed in annex II to the regulation.

Terms of reference as provided by the Norwegian Environment Agency

1) The Norwegian Environment Agency requests the Norwegian Scientific Committee for Food Safety (VKM) to undertake an assessment of the risks of negative impacts on biodiversity in Norway stemming from the import and keeping of the following arachnids:
    - Tarantulas: All species within the genus *Brachypelma* (approximately 20 species), as well as the species *Aphonopelma albiceps* and *Aphonopelma pallidum*
    - Scorpions: All species within the genera *Pandinus* and *Heterometrus*

2) Further, the Norwegian Environment Agency requests an assessment of the risks of negative effects on biodiversity in Norway from import of the following taxa in relation to their potential future exemption from import permit requirements:
    - Theraphosidae –Tarantulas – for species not included in the assessment 1
    - Phasmatidae- Stick insects
    - Mantodea- Mantids

Due to the high number of species within the mantids (2400 spp) and stick insects (3100 spp) the evaluation of these groups will have to be conducted on a higher taxonomic level than species level. Consequently the Norwegian Environment Agency has stated that risk assessments of species within these groups may be conducted at the family, subfamily or genus level (in cases where a high number of species prevents individual risk assessments)

The purpose of the regulations concerning non-native organisms is to prevent the import, release and spread of non-native organisms that have, or may have, negative impacts on biodiversity.

The Norwegian Nature Diversity Act defines biodiversity as ecosystem and species variability and intraspecies genetic variability as well as the ecological relationships between ecosystem components.

Aspects/topics to be included in the risk assessment are:

- Species survivability under Norwegian conditions
- Possible impacts on ecosystems and other species,
- Possible risks caused by the introduction of harmful accompanying organisms, including pathogens and parasites
- The likelihood of escape or release of the organisms (e.g. from terraria) and possible precautionary measures that may prevent this from happening

The Norwegian Biodiversity Information Centre's methodology for assessing environmental risks resulting from non-native organisms largely covers the different aspects stated above and may be used as the starting point for the evaluation.

The time frame for the risk assessment of adverse impacts on biodiversity should be 50 years, or 5 generations for organism with a generation time of more than 10 years.

In cases where taxa are likely to affect ecosystem services or may be particularly affected by climate change beyond the specified time frame, this should be stated in the report. Furthermore, any known negative effects on biodiversity of the exporting country should be stated in the report. These factors should, however, not be included as a part of the actual risk assessment.

1 Introduction

1.1 Problems related to invasive non-native species

Over half a century ago, the renowned British ecologist Charles Elton famously referred to the effects of invasive species as "one of the great historic convulsions in the world's fauna and flora" (Elton, 1958). Invasive non-native species are now recognized as one of the major threats to global biodiversity (Hassan et al., 2005). Numerous examples exist of intentional and unintentional introductions of non-native species causing severe impact to native biodiversity and ecosystem functions (Kenis et al., 2009; Scalera et al., 2012; Williamson, 1996). In Europe, the number of non-native species is increasing, and an important part of the increase is attributed to non-native invertebrates (Scalera et al., 2012). Indeed, insects represent a substantial part of non-native species worldwide; however invasive plants and vertebrates have received most attention in the scientific literature (Kenis et al., 2009).

The Norwegian "Black List" presents an overview of non-native species in Norway and the ecological impact they pose on native ecosystems and list important vectors for non-native introductions (Gederaas et al., 2012). These include escape of agricultural (including forestry) and ornamental plants (and animals, including fish stocks), ballast waters and naturalization of biological control agents. The wide variety of ecological conditions found in Norway, both terrestrial and aquatic, suggest that many non-native species might find environmental conditions matching their requirements, increasing the probability of establishment.

Non-native species which spread successfully are classified as "invasive" if they cause environmental or economic damage (though some scientists use the term more generally for any widely established non-native species). VKM has used the IUCN definition of invasive non-native species, where negative impact on native ecosystems is needed.

To establish a viable population, non-native species must colonize and reproduce successfully. There can be a lag of decades to centuries between initial colonization and the ultimate spread of alien species (Simberloff, 2011b). Few non-native species successfully colonize a new region, few colonizing species spread, and fewer yet cause significant environmental or economic damage (Lockwood et al., 2013; Simberloff, 2013).

Multiple colonizations from a variety of sources is especially favorable for successful establishment and spread. Colonizations by small numbers of individuals from a single source suffer from low genetic variation, which may for some taxa reduce the likelihood of longterm success (Lee, 2002).

The likelihood of successful establishment is correlated with what researchers studying the ecology of invasions call *propagule pressure*, which is a function of the numbers of individuals colonizing, the number of locations being colonized, the frequency of colonization, and how well introduced individuals do in their new environment (Lockwood et al., 2013).

One major threat posed by invasive non-native species is competition with native flora and fauna. This may exclude native species from their habitat causing local extinction, such as *Aedes albopictus* causing displacement of native mosquito larvae and or *Acacia dealbata* forming dense, almost impenetrable stands that compete with and prevent the development of other species. Other invasives might act as predators of native fauna (e.g. *Harmonia axyridis* preying on native ladybirds) or herbivores on native vegetation (e.g. *Anoplophora chinensis* killing trees and *Rosa* shrubs) (all examples described by the DAISIE project: www.europe-aliens.org). Impacts of introduced species are magnified when they act synergistically with one another or with a native pest, a process termed invasional meltdown (Simberloff and Von Holle, 1999).

Several invasive insects have also been shown to act as important vectors for diseases to humans and animals (e.g. *Aedes albopictus* being a potential vector for at least 22 arboviruses: Gratz (2004)). Indirect effects of invasive species can act through ecosystem services such as pollination, by monopolizing the pollinator community (Bjerknes et al., 2007) or affecting native, more effective pollinators in subtle ways (Goulson, 2003).

1.2 Invasive Arthropods

Numerous invasive arthropods have been identified around the world. The Center for Invasive Species and Ecosystem Health (http://www.invasive.org/index.cfm) currently lists 502 species of insects as invasive and exotic in North America. The DAISIE project (http://www.europe-aliens.org/) has identified more than 12000 non-native species in Europe, of which 2265 are insects and 199 spiders and mites. However, not all these represent invasive species, the species that cause most concern related to their adverse effects on native biodiversity and ecosystem function. Out of the 100 worst invasive species, the DAISIE project lists 14 species of insects (http://www.europe-aliens.org/speciesTheWorst.do). Non-native species are of minor concern unless they become invasive; however, it is not straightforward to predict whether or not a non-native species will become invasive. Pest species, whether of native or non-native origin can have huge impact on ecosystems and agricultural production and human wellfare. This has been documented repeatedly throughout history, e.g. out of the 10 plagues that devastated the land of Egypt, mentioned in the Old Testament (Exodus 1-12), three describe insect outbreaks (Ehrenkranz and Sampson, 2008).

An example of relevance for this risk assessment is the harlequin ladybird (*Harmonia axyridis*): Listed among the 100 worst invasive species by DAISIE. This beetle is native to eastern Asia, and is used as a biological control agent in many parts of the world. However, the Norwegian Agricultural Inspection Service in 2001 turned down an application for importing this species based on an risk assessments by expert bodies (Gederaas et al., 2012). The species has arrived nonetheless, as a stowaway on imported plants (Staverløkk, 2006), and has now established populations in scattered sites in southeastern Norway. Its main ecological impact is expected to be as a competitor with other ladybirds, due to its broad diet and dispersal and reproductive capabilities, but it is also as an important predator on the eggs and larvae of other insect species (Gederaas et al., 2012). More recent examples include the Africanized honeybee (*Apis mellifera*) which is constantly spreading northwards in the Americas and the Buff-tailed bumblebee (*Bombus terrestris*), native to Europe, now affecting native bumblebee populations and insect pollinated plants in South America (Sáez et al., 2014). In addition to competing directly with similar native insects, invasive species can impose additional threats to native biodiversity through the introduction of parasites and diseases to native species (Goulson, 2013), and by altering ecosystem processes, such as pollination (Bjerknes et al., 2007; Schweiger et al., 2010).

1.3 Factors controlling the risk of invasiveness

Insects and arachnids kept as pets are by and large of tropical origin (Schultz and Schultz, 2009). This precludes establishment in nature in Norway due to our cold and highly seasonal climate. However, the relatively speciose groups under consideration here contain species adapted to a wide variety of environments. Tropical as well as temperate regions contain mountainous areas with environmental conditions that might resemble those found in Norway. Some of the focal groups of insects (phasmids and mantids) and tarantulas include species found in such mountainous areas. There is therefore a potential for some of these to thrive in Norwegian climates, based on the climatic conditions experienced in their native habitats. However, accurately delimiting and modelling the range of climates under which a given species can thrive requires presence/absence data for regions with different climatic conditions. In the lack of such data, available information can be used to support expert judgement. For example, the cold winter conditions of Norway will exclude most tropical species, and long periods with sub-zero temperatures prevent establishment of many non-native arthropod species in Norway.

Short summers with a limited number of growing degree days (GDD) also prevent species with prolonged growth periods from being able complete their life cycles within a typical Norwegian summer. Precipitation patterns are also an important limiting factor for many arthropods. The wet and windy conditions experienced in Norwegian mountains are in many cases very different from the conditions experienced in other mountain ranges (but see Simberloff (2013) for counterexamples). Despite the numerous aspect of local climate that might affect the probability of non-native species establishment and spread, field observations have documented naturalized escapes of non-native phasmids, originating from New Zealand and Italy, in South West England and Ireland (Lee, 2013).

Future climates should also be taken into account when assessing the probability of future establishment of non-native species (see Section 1.6, Potential for successful establishment in a 50 year perspective, and Section 2.2, Climate modelling). Future climate is expected to include warmer temperatures and a higher frequency of extreme events, such as snow melt and thaw followed by frost in spring, or flooding and droughts. Most importantly, there has been an increase in the length of the growing season in recent decades (Karlsen et al., 2009; Myneni et al., 1997) and future years are expected to have even longer growing seasons with longer periods of above-freezing temperatures.

1.4 Challenges relating to taxonomic uncertainty

Species identification of most arthropods requires specialized taxonomic competence, and in many cases is dependent on old species descriptions in obscure publications that are not in most libraries and are difficult to obtain. These animals are small, and the physical features used for identification are often hard to see and even harder to distinguish. In addition, it is may be impossible to identify egg, young instars and nymphs to species level, when (as is normal) anatomical characters used to separate similar species are only present in adults. Because of these difficulties, both amateur and professional biologists often make mistakes when assigning specimens to species. This is relevant to the import of live insects, scorpions and spiders, since specimens in the trade often consist of young instars and nymphs (T. Håkonsen pers.comm. Feb. 2016) and these may be wrongly assigned to species. It is therefore important that the parent generation has been correctly identified to species before eggs and juveniles are imported. Further, adults of arthropods being sold and traded can be from one of a group of closely related species which are nearly indistinguishable. In most cases, only a few taxonomic specialists can identify such species correctly. Consequently, closely related arthropod species may be traded or sold under one commonly used name; these species could have different ecology and different conservation status.

A nomenclatural problem arises in species that have been either combined with other species, recently separated from other species, or moved to a different genus or even a different tribe, subfamily, or family. In these cases, a species is known under one or more old names which are no longer scientifically valid but which are still widely used. VKM has therefore provided older names (synonyms) for all species that have been risk assessed (Appendix IV).

1.5 Biology and ecology of the focal species groups

1.5.1 Phasmids

The Phasmatodea, known as phasmids, stick insects or walking sticks, is an order of insects with over 3,100 valid species names and over 300 genera in 11 families organized in three suborders. Walking stick nomenclature is somewhat confused, since numerous taxon names are synonymous (more than 4,700 taxonomic names exist for the 3,100-plus recognized species); furthermore, new species are constantly being discovered and described. The vast majority of species are tropical, although some are found in temperate regions, including the US (California to southern Oregon), New Zealand, and the Mediterranean region of southern Europe. A few thrive in cold climates: a Patagonian species radiation (*Agathamera*) consists of species primarily found on the slopes of the Andes mountain chain (Vera et al., 2012), and *Timema* comprises species in the mountains of California and southern Oregon.

Seven non-native species have been recorded in Southern England, out of which three from New Zealand are said to be well established (*Acanthoxyla geisovii*, *A. inermis* and *Clitarchus hookeri*). *Acanthoxyla inermis* is also established in southern Ireland (Barnard, 2011).In general, phasmids are considered polyphagous herbivores, able to switch to other hosts if their preferred food plant is unavailable (Baker, 2015). They have a hemimetabolous life cycle with three stages; eggs, nymphs and adults. They are generally large insects with lengths from 1.5 to more than 30 cm as adults, including the world's longest insect (*Phobaeticus chani*) measuring up to 56.7 cm. Many species are parthenogenic, able to produce eggs without mating, and a female can lay several hundred eggs. Pest outbreaks of stick insects have been documented in several crops and plant communities, including coconut plantations in the South Pacific, in parks and recreational sites in the US, in natural Douglas-fir forests of northern California, and the *Eucalyptus* forests of New South Wales in Australia. There is a paucity of detailed studies in the scientific literature on the ecological factors causing the outbreaks (Baker, 2015) though at least some of the trees in California which were defoliated by parthenogenetic *Timema douglasi* had been attacked by *Hylastes* bark beetles and *Armillaria* root disease, perhaps predisposing them to large scale herbivory (B. J. Crespi, pers. comm., Jan. 2016).

1.5.2 Mantids

The Mantodea, or praying mantids, is an order of insects with over 2400 valid species and about 430 genera in 15 families (Otte et al., 2016). Most are tropical, but some are also found in temperate habitats. They are generally thermophiles: species richness increases with increasing mean annual temperature (Battiston et al., 2010). Eighteen species can be found in southern and central Europe and 127 species in the larger Euro-mediterranean area (Battiston et al., 2010). They have life cycle that starts by mating, followed by egg laying and hatching. The eggs are embedded in a solid egg sack (ootheca) which may contain several hundred of eggs; oothecae are usually glued to plant parts, and hence some mantids spread readily by sale and trade of plants. There are up to ten nymph stages before the mature adult stage. At least two species (*Brunneria borealis* and *Sphodromantis viridis*; Bragg, 1987;1996) are parthenogenetic. The lifespan of a mantid is species-, size-, and temperature dependent; the adults of smaller species may live 4–8 weeks, while the adults of larger species usually live 4–6 months (Hurd, 1999). As is generally the case in insects and arachnids, cooler temperatures slow metabolism and lengthen individual life span. Most species usually have a life span of about a year (e.g., *Mantis religiosa*; Manning, 2008), but at least one large tropical species (*Deroplatys truncata*) has been reported to have a life span of two years (sfzoodocents.org, accessed January 15th 2016).

Mantids choose their habitat with care and the environmental requirements vary substantially among species (Battiston et al., 2010). Some species live in damp tropical forest areas, while others live in desserts or dry grasslands. Many mantids live on or near particular plant species where cryptic coloration makes the mantid hard to spot (Abu-Dannoun and Katbeh-Bader, 2007).

Mantids are commonly held as pets, and about 25-30 species have so far been kept as pets in Norway (T. Håkonsen pers. comm. Feb. 2016). In captivity, there is a wide range in recommended temperature (18-40° C) depending on the species. At night, the temperature can be allowed to drop, but it should be at least 15° C with humidity between 30 and 95%. Some species are easy to keep and will breed in captivity under normal room temperature and humidity, while others are harder to keep. Mantids outside captivity do not seem to go beyond 50–51° of North Latitude (Battiston et al., 2010). In colder climates, the eggs overwinter, while the adults die. The egg of the European mantis (*Mantis religiosa*) has been reported to tolerate temperatures down to below -20° C (Mylan, 1929; Salt and James, 1947) suggesting that the bottleneck for a successful life cycle in cold climates may be the short growing season and cold summer temperatures.

Mantids are generalist predators of arthropods and eat whatever they can catch (Hurd, 1999). Some will even attack and devour small vertebrates such as hummingbirds (Ramsay, 1990).The size and species of the pray varies depending on the size of the mantid, where nymphs eat smaller insects. These insects need to be available upon hatching of the mantid. One species (*Tinodera sinensis*) has been shown to have enhanced fitness when eating pollen (Beckman and Hurd, 2003). Based on this result, Beckman and Hurd (2003) suggested that pollen might be an important source of food for generalist arthropod predators during periods of food shortage in nature. The mantids are visually orienting predators, and most are therefore diurnal. Some only need to feed intermittently since they can store food in the foregut for digestion later (Capinera, 2008). Many mantids seem to be adapted to periods of starvation and fasting, which may occur relatively often during their life history (Prete et al., 1999; Rau and Rau, 1913).

There is very little information about diseases of mantids (Ramsay, 1990). A number of species of wasp parasites have been found in mantid oothecae. Nymphs and adult mantids are also parasitized by flies, round worms (Nematoda), horsehair worms (Nematomorpha) and mites (Ramsay, 1990). Little is known about these parasites; for example, it is not known whether they are species specific to mantids or if they are generalist parasites that harm nonrelated insects.

1.5.3 Scorpions

The Order Scorpiones contains four suborders and 14 families with over 1750 described species (Kovařík, 2009). Scorpions are opportunistic predators of small invertebrates, although the larger species are able to kill lizards and mice with their venomous stinger. Some species from Patagonia and Central Europe can survive winter temperatures of about -25˚ C. Most scorpions reproduce sexually, but some reproduce through parthenogenesis. The female is viviparous and gives birth to larvae. The larvae resemble their parents and require between five and seven moults to reach maturity. Little is known about diseases and parasites of scorpions, and it is unlikely that they can transfer these to Norwegian animals as they have no wild relatives in Norway.

The genus *Pandinus* (Thorell, 1876) was revised by (Kovařík, 2009) and later by Rossi (2015). Several new species have been described during the last few years. What were previously subgenera of *Pandinus* (*Pandinus, Pandionoides, Pandinops, Pandinopsis* and *Pandinurus*) have been elevated to genus status, and seven new species have been described in Rossi (2015). An overview of the species in the new genera is also given by Rein (2015).

The species in the *Pandinus* complex are distributed widely across tropical Africa and the southwestern Arabian Peninsula (Prendini et al., 2003). These are all tropical species, and they are not regarded as dangerous for humans.

Species in the genus *Heterometrus* are sold under many different common names, such as giant forest scorpions. In Norway, they are called "*asiatiske jungelskorpioner*" and "*asiatiske keiserskorpioner*". It has become common to sell them as "*Heterometrus* sp." because species identification is very difficult. The genus has at least 35 species and has recently been taxonomically revised by (Kovařík, 2004; Kovařík, 2009). Kovařík presents a key to all the species except *H. atrascorpius and H. telangangensis*. Members of *Heterometrus* are generally large-sized (10-20 cm long), and dark, often uniformly brown or black, sometimes with a green sheen. Species in this genus are distributed across tropical and subtropical southeastern Asia, as well as India, Sri Lanka, Pakistan, Nepal and China (Tibet).

In captivity, tropical scorpions such as these should be kept at temperatures between 21-30˚C, and the air humidity has to be maintained at or above 80%. This should indicate that they cannot survive outdoor in Norway. One species of *Heterometrus* (*H. tibitanus*) lives in Tibet, however no further details is given regarding its distribution or environmental requirements (Lourenço et al., 2005). However, as the other species in this genus are tropical, it is reasonable to suppose that also this species lives in the warmer parts of Tibet.

1.5.4 Tarantulas

The popular term 'tarantula' is used for a variety of spiders, but the group VKM has been asked to assess are the Theraphosidae (tarantulas, baboon spiders, earth tigers). Theraphosidae are the most diverse of the 15 families of primitive spiders in the infraorder Mygalomorphae (World Spider Catalog, 2016). These are the large, long-lived, hairy, often colourful spiders popular with hobbyists and frequently displayed in zoos. Theraphosids are found on all continents except Antarctica. The family currently numbers 969 species in 132 genera distributed among 10 subfamilies (Teyssié, 2015; World Spider Catalog, 2016) and there is probably an equal number of species yet to be discovered and described (Schultz and Schultz, 2009). Though the majority occur in tropical and subtropical habitats, species can be found in the southwestern US, in southern Europe (Spain and Sicily) and southern Asia, and occur as far south as Australia and the southern tips of Africa and South America. The body size of these spiders ranges from 1 – 8 cm, and the leg span of a few species (such as the Goliath birdeater tarantula, *Theraphosa blondi*) can reach 25 cm or more. Generally, tarantulas live deep in burrows in the ground, but some nomadic species make temporary nests ("scrapes") in more or less concealed situations above ground and others build silk nests in trees. Tarantulas feed primarily on insects or other large arthropods, but larger species can take small rodents, small lizards, snakes, or even birds (Bates, 1863; Caras, 1974). Tarantulas grow slowly; females of larger species may take 10 or more years to reach sexual maturity, but males usually take one or a few years less. Females may live anywhere from several to 20 years or more, but males typically die one to two years after reaching maturity, even in captivity (Schultz and Schultz, 2009).

Pet tarantulas are kept in glass or plastic terraria, with water available at all times and the proper conditions for nesting. Despite the beliefs of many hobbyists, caged tarantulas are relatively robust creatures, and do not need to be kept warm at all times; however, as far as is known, no tarantulas survive subfreezing temperatures (Schultz and Schultz, 2009).

No theraphosids are considered pests, and to our knowledge there are only a few known instances anywhere in the world of introduced tarantulas with resident populations, all in Florida (http://people.ucalgary.ca/~schultz/errata3.html). On the contrary, a recent review of invasive spiders in Europe found no instances of successfully invasive Theraphosidae, despite frequent introductions via import of fruit and plants (Nentwig, 2015).

1.6 Potential for successful establishment in a 50 year perspective

The potential for successful establishment of non-native species should be considered in a 50 year perspective (see section Terms of reference). This implies that future climates should be taken into consideration. Arthropods are poikilothermic organisms and directly influenced by temperature in their habitats, through physiological processes and bioenergetics. Rates of growth and development are strongly determined by temperature regimes that influence enzymatic kinetics, activity patterns, feeding, assimilation, respiration, emergence time, etc. (Sweeney, 1984). Warmer temperatures will speed up physiological processes (Buisson et al., 2013; Parmesan and Yohe, 2003), and could cause an increased number of generations per year, altered relative abundances of taxa and species replacements (Velle et al., 2010). In cold regions, some arthropods may be adversely affected by warmer winters. This is because they have substances in the haemolymph that allow them to supercool during winters (Tauber et al. 1986). This ability disappears once temperatures warm up during mid- or late winter, leaving the organism vulnerable to subzero temperatures.

Most mantids, phasmids, scorpions and spiders covered by this report are currently unable to survive in Norway due to a short growing season and a long, harsh winter. Their development requires more accumulated degree-days than are available in Norway today. Some of these species can be expected to survive in a future climate when the length of the growing season increases and the winters become less harsh (Iacarella et al., 2015). In this respect, the future climates of most interest are those of the warmest areas of Norway where the probability of survival is highest. Future climates are covered under section 2.2.

2 Methodology and data

2.1 Methodology for evaluation

VKM adopted a two-stage procedure, including an initial screening of all species in the Terms of Reference and a risk assessment of the species judged to have a potential for establishment in Norway.

The initial screening identified taxa with a **potential for establishing populations in Norway** based on the similarity between climatic conditions in Norway and the organisms current distribution (see question 1.8 in section 2.1.3.). The screening was performed based on available literature (section 2.2). If the **potential for establishment was assessed as being very unlikely**, then no further assessments were conducted for the taxon since it most likely is not able to survive outside captivity in Norway.

If the climate conditions in the habitat of the taxon resemble that of Norway now or in a 50 year perspective, then this taxon was risk assessed in the second stage of the procedure. The assessment includes adjudging the probability of entry, a further and more detailed evaluation of the probability of establishment, the probability of spread, an assessment of environmental consequences/impact, and finally an overall risk rating for the taxon.

For some species limited information exist. These were classified as "**Lack of information**".

2.1.1 Initial screening phase

The initial screening included one of the following three categories (see table 2 for definitions);

1. **Very unlikely:** Low potential of establishment in Norway as climate conditions in the native range is deviating substantially from Norwegian conditions. This category also includes species with low number of observations (in some cases only one), if the observation(s) are in tropical regions. These species were not treated further due to the low probablility of establishment under Norwegian climate conditions.
2. **Unlikely – Very likely:** Can potentially establish in Norway based solely on climate conditions in the native range potentially being similar enough for successful establishment. All species assigned to this group in the initial screening were taken through a risk assessment.
3. **Lack of information**: The available information on the distribution, climate preference and biology of the species too limited to conduct a meaningful risk assessment. This category contains mostly species from tropical regions, but the number of observations is limited and the species habitat requirements are not documented. Examples might be documented observations in Argentina, with no further information on where (tropical forest, the pampas or alpine regions). The

species assigned to the category "lack of information" in the initial screening could not be treated further. Nonetheless, in almost all cases, the nearest relatives to these species were in groups which were screened out based on climate considerations.

The initial screening was started at a coarse taxonomic resolution. The taxonomic resolution was refined for taxa with a potential for establishment in Norway. That is, if the distribution of a higher taxon extended into areas potentially resembling Norwegian conditions, then the Panel assessed each entity on the taxonomic level below. This process was continued to species level, if necessary.

For example in the phasmid infraorder Areolatae, no species in the superfamily Pseudophasmatoidea had a distribution in areas where the climate resembles Norwegian conditions. It was therefore concluded that the potential of establishment in Norway is low and and did not fully assess any species of the superfamily in the second stage of the assessment. The superfamily Bacillioidea is also found in temperate regions with climate conditions close to what is found in Norway. The screening process therefore went to a lower taxonomic entity and examined the families within the superfamily. The family Anisacanthidae is found only on Madagascar and was therefore assigned the category Low potential of establishment in Norway. The family Bacillidae, on the other hand, has a distribution including Southern Europe and was analysed at the subfamily level. Only the subfamily Bacillinae includes species with a northernly distribution. This process continued to species level, in this case ending up with three species in genus *Bacillus* (*B. atticus, B. rossius* and *B. whitei*) with native habitats that have climate conditions that might resemble that of Norway now or in a 50 year perspective. Furthermore, not only single species were treated alone but, where possible, groups of related species from similar climates were jointly screened. For example, in assessing tarantulas, the genus *Euthlia* was assessed as a whole, since all species are found in cold temperate montane environments.

The initial screening is coarse, as it assumes that the species' distribution is only limited by climate. The authors are aware that other processes also influence the species native ranges, such as availability of food, presence of predators or inter-specific competition. However, information on factors that influence the distribution of species is most often lacking, and it was therefore assumed that climate is a limiting factor, as has been demonstrated for many groups of terrestrial arthropods.

2.1.2 Risk assessment scheme

Risk assessments were conducted primarily on species, but in a few cases, groups of closely related species with similar ecology were analysed jointly. To conduct a full risk assessment of the species listed as having a potential for establishment in the initial screening, the Panel used a modified version of the Non-native Species Secretariat for Great Britain form (GB Non-native Risk Assessment scheme, or GB-NNRA, (http://www.nonnativespecies.org/home/index.cfm), with permission to adapt the template granted by the GB-NNRA.

The form was developed by a consortium of risk analysis experts in 2005, and has since been improved and refined, and tested and peer-reviewed by risk analysis experts operating with similar forms in Australia and New Zealand (Roy et al., 2013). The GB-NNRA form complies with the Convention on Biological Diversity and reflects standards used by other forms, such as the Intergovernmental Panel on Climate Change, European Plant Protection Organisation and European Food Safety Authority.

The GB-NNRA methodology is a qualitative risk assessment method, which comprises a range of questions covering all aspects requested in the Terms of Reference of this report. The questions cover the organism's probability of entry and the pathways of entry, establishment and spread, and the potential impact the organisms may have on biodiversity and ecosystem services.

The method can be used to assess any taxonomic group and a wide range of organisms have been risk assessed based on this method including the Red-eared terrapin (*Trachemys scripta elegans)*, Italian crested newt (*Triturus carnifex*), Quagga mussel (*Dreissena rostriformis bugensis*) and many more (see http://www.nonnativespecies.org/index.cfm?sectionid=51) Among these previous assessments are several cases related to import and keeping of organisms for specific objectives.

The original risk assessment method is divided into two major sections (A&B). Only section B was used for the analysis in the current report.

In **Section B** organisms from the initial screening with a potential for establishment, are evaluated in greater detail. The conclusions for the different stages of the risk assessment; entry, establishment, spread and impact are presented separately.

For each question, the assessor is asked to rank the uncertainty of their response, and also add additional comments. For the taxa assessed in the current assignment, where there generally was a lack of data, assessors could clearly indicate the level of certainty behind a particular response and add further comments to clarify.

Based on the assessment of the probability of of entry, establishment, spread and risk of environmental impact the risk assessor endend the assessment with a "Conclusion of the risk assessment" placing the species (or species group) in one of the following categories:

1. **Low risk**: Establishment of the species is unlikely or the potential impact on Norwegian biodiversity is minimal
2. **Moderate risk:** Establishment of the species is moderately likely or likely and the potential impact on Norwegian biodiversity is moderate

3. **High risk:** Establishment of the species is moderately likely or likely and the potential impact on Norwegian biodiversity is major or massive

2.1.3 Modified GB-NNRA protocol

The unaltered version of the GB-NNRA template can be found here: http://www.nonnativespecies.org/index.cfm?sectionid=51. Below is the adapted version used for for all analysis in the current report. Specific changes done to the original template are listed in Appendix II.

Table 2.1.3-1 The adapted version of the GB-NNRA protocol.

SECTION B – Detailed assessment			
PROBABILITY OF ENTRY			
Important instructions: • Entry is the introduction of an organism into Norway. Not to be confused with spread, the movement of an organism within Norway. • For organisms which are already present in Norway, only complete the entry section for current active pathways of entry or if relevant potential future pathways. The entry section need not be completed for organisms which have entered in the past and have no current pathways of entry.			
QUESTION	**RESPONSE [chose one entry, delete all others]**	**UNCERTAINTY [chose one entry, delete all others]**	**COMMENT**
1.1. How many known pathways are relevant to the potential entry of this organism?	none very few few moderate number many very many	low medium high	
1.2. List relevant pathways through which the organism could enter. Where possible give detail about the specific origins and end points of the pathways.	[insert text]		
Pathway name:	[inset pathway name here]		

1.3. Is entry along this pathway intentional (e.g. the organism is imported for trade) or accidental (the organism is a contaminant of imported goods)?	intentional accidental	low medium high	
1.4. How likely is it that large numbers of the organism will travel along this pathway from the point(s) of origin over the course of one year? Subnote: In your comment discuss how likely the organism is to get onto the pathway in the first place	very unlikely unlikely moderately likely likely very likely	low medium high	
1.4. How likely is it that large numbers of the organism will travel along this pathway from the point(s) of origin over the course of one year? Subnote: In your comment discuss how likely the organism is to get onto the pathway in the first place.	very unlikely unlikely moderately likely likely very likely	low medium high	
1.5. How likely is the organism to be able to transfer from the pathway to a suitable habitat or host in Norwegian nature?	very unlikely unlikely moderately likely likely very likely	low medium high	
1.6. Estimate the overall likelihood of entry into Norwegian nature based on this pathway?	very unlikely unlikely moderately likely likely very likely	low medium high	
End of pathway assessment, repeat as necessary.			
1.7. Estimate the overall likelihood of entry into Norwegian nature based on all pathways (comment on the key	very unlikely unlikely	low medium high	

issues that lead to this conclusion).	moderately likely likely very likely		

PROBABILITY OF ESTABLISHMENT			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
1.8. How likely is it that the organism will be able to establish in Norway based on the similarity between climatic conditions in Norway and the organism's current distribution?	very unlikely unlikely moderately likely likely very likely	low medium high	
1.9. How likely is it that the organism will be able to establish in Norway based on the similarity between other abiotic conditions in Norway and the organism's current distribution?	very unlikely unlikely moderately likely likely very likely	low medium high	
1.10. How likely is it that the organism will become established in protected conditions (in which the environment is artificially maintained, such as wildlife parks, glasshouses, aquaculture facilities, terraria, zoological gardens) in Norway? Subnote: gardens are not considered protected conditions	very unlikely unlikely moderately likely likely very likely	low medium high	
1.11. How widespread are habitats or species necessary for the survival, development and multiplication of the organism in Norway?	very isolated isolated moderately widespread widespread ubiquitous	low medium high	
1.12. How likely is it that establishment will occur despite management practices (including eradication campaigns), competition from existing species	very unlikely unlikely moderately likely likely very likely	low medium high	

or predators, parasites or pathogens in Norway?			
1.13. How likely are the biological characteristics (including adaptability and capacity of spread) of the organism to facilitate its establishment?	very unlikely unlikely moderately likely likely very likely	low medium high	
1.14. How likely is it that the organism could establish despite low genetic diversity in the founder population?	very unlikely unlikely moderately likely likely very likely	low medium high	
1.15. Based on the history of invasion by this organism elsewhere in the world, how likely is to establish in Europe? (If possible, specify the instances in the comments box.)	very unlikely unlikely moderately likely likely very likely	low medium high	
1.16. Estimate the overall likelihood of establishment in Norway (mention any key issues in the comment box).	very unlikely unlikely moderately likely likely very likely	low medium high	

PROBABILITY OF SPREAD

Important notes:

- Spread is defined as the expansion of the geographical distribution of an alien species within an area.

QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
2.1. How likely is it that this organism will spread widely in Norway by *natural means*? (Please list and comment on the mechanisms for natural spread.)	very unlikely unlikely moderately likely likely very likely	low medium high	
2.2. How likely is it that this organism will spread widely in Norway by *human assistance*? (Please list and comment on the	very unlikely unlikely moderately likely	low medium high	

mechanisms for human-assisted spread.)	likely very likely		
2.3. How likely is it that spread of the organism within Norway can be completely contained?	very unlikely unlikely moderately likely likely very likely	low medium high	
2.4. Based on the answers to questions on the potential for establishment and spread in Norway, define the area endangered by the organism.	[insert text]	low medium high	
2.5. Estimate the overall potential for future spread for this organism in Norway (using the comment box to indicate any key issues).	very unlikely unlikely moderately likely likely very likely	low medium high	

PROBABILITY OF ENVIRONMENTAL IMPACT			
Important instructions: • **When assessing potential future environmental impacts, climate change should not be taken into account. This is done in later questions at the end of the assessment.** • **Each set of questions starts with the impact elsewhere in the world, then considers impacts in Norway separating known impacts to date (i.e. past and current impacts) from potential future impacts. Key words are in bold for emphasis.**			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
2.6. How much environmental harm is caused by the organism within its existing geographic range, excluding Norway?	minimal minor moderate major massive	low medium high	
2.7. How much impact would there be, if genetic traits of the organism were to be transmitted to other species, modifying their genetic makeup and making their environmental effects more serious?	minimal minor moderate major massive	low medium high	
2.8. How much impact does the organism have, as food, as a host, or as a symbiont or a vector for other damaging organisms (e.g. diseases)?	minimal minor moderate major massive	low medium high	
2.9. How much impact do other factors have, factors which are not covered by previous questions (specify in the comment box)	NA minimal minor moderate major massive	low medium high	
2.10. How important are the expected impacts of the organism despite any natural control by other organisms, such as predators, parasites or pathogens that may already be present in Norway?	minimal minor moderate major massive	low medium high	
2.11. Indicate any parts of Norway where environmental impacts are	[insert text +	low medium	

particularly likely to occur (provide as much detail as possible).	attach map if possible]	high	

ADDITIONAL QUESTIONS - CLIMATE CHANGE			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
3.1. What aspects of climate change (in a 50 years perspective), if any, are most likely to affect the risk assessment for this organism?	[insert text]	low medium high	
3.2. What aspects of the risk assessment are most likely to change as a result of climate change? • Establishment • Spread • Impact on biodiversity • Impact on ecosystem functions	[insert text]	low medium high	

RISK SUMMARIES			
	RESPONSE	**UNCERTAINTY**	**COMMENT**
Summarise Entry	very unlikely unlikely moderately likely likely very likely	low medium high	
Summarise Establishment	very unlikely unlikely moderately likely likely very likely	low medium high	
Summarise Spread	very slowly slowly moderately rapidly very rapidly	low medium high	
Summarise Impact	minimal minor moderate major massive	low medium high	
Conclusion of the risk assessment	low moderate high	low medium high	

2.1.4 Rating and descriptors

In order to provide clear justification when a rating is given in the risk assessment template, the Panel used ratings and adapted versions of the descriptors from Appendix E in (EFSA., 2015).

Table 2.1.4-1 Rating of probability of entry.

Rating	Descriptors
Very unlikely	The likelihood of entry would be very low because the species: • is rare in its native area, • is difficult to keep in captivity, • is not currently in trade.
Unlikely	The likelihood of entry would be low because the species: • is rare in its native area, • is difficult to keep in captivity, • is not currently in trade in trade in Norway.
Moderately likely	The likelihood of entry would be moderate because the species: • is common in its native area, • is difficult to keep in captivity, • is currently in trade.
Likely	The likelihood of entry would be high because the species: • is common in its native area, • is easy to keep in captivity, • is currently in trade.
Very likely	The likelihood of entry would be very high because the species: • is common in its native area, • is easy to keep in captivity, • is currently in trade in Norway.

Table 2.1.4-2 Rating of the probability of establishment.

Rating	Descriptors
Very unlikely	The likelihood of establishment would be very low because: • of unsuitable environmental conditions, • of the absence or very limited availability of required foods (including host plants), • the occurrence of other considerable obstacles preventing establishment.
Unlikely	The likelihood of establishment would be low because: • the unsuitable environmental conditions in most parts of Norway, • of the limited availability of required foods (including host plants), • the occurrence of other obstacles preventing establishment.
Moderately likely	The likelihood of establishment would be moderate because: • environmental conditions are suitable in few parts of Norway, • required foods (including host plants) are abundant in few areas of Norway, • no obstacles to establishment occur.
Likely	The likelihood of establishment would be high because: • environmental conditions are suitable in some parts of Norway, • required foods (including host plants) are widely distributed in some areas of Norway, • no obstacles to establishment occur, • Alternatively, the species has already established in some areas of Norway.
Very likely	The likelihood of establishment would be very high because:

	• environmental conditions are suitable in most parts of Norway, • required foods (including host plants) are widely distributed in Norway, • no obstacles to establishment occur, • Alternatively, the species has already established in Norway.

Table 2.1.4-3 Rating of the probability of spread.

Rating	Descriptors
Very unlikely (minimal)	The likelihood of spread would be very low because: • the species has limited spreading capabilities (e.g. no wings), • highly effective barriers to spread exist (e.g. patchy distributed habitats), • required foods and nesting resources are not or very rarely present in the area of possible spread.
Unlikely	The likelihood of spread would be low because: • the species has limited spreading capabilities (e.g. no wings), • effective barriers to spread exist (e.g. patchy distributed habitats), • required foods and nesting resources are occasionally present.
Moderately likely (moderate)	The likelihood of spread would be moderate because: • the species has limited spreading capabilities (e.g. no wings), • partly effective barriers to spread exist, • required foods and nesting resources are abundant in some parts of the area of possible spread.
Likely (major)	The likelihood of spread would be high because: • the pest has effective ways to spread (e.g. wings), • no effective barriers to spread exist; • required foods and nesting resources are abundant in some parts the area of possible spread.
Very likely	The likelihood of spread would be very high because: • the pest has effective ways to spread (e.g. wings), • no effective barriers to spread exist, • required foods and nesting resources are widely present in the whole risk assessment area.

Table 2.1.4-4 Rating of the assessment of impact.

Rating	Descriptors
Minimal	No impact on local biodiversity
Minor	Potential impact on local biodiversity are within normal fluctuation
Moderate	Impact may cause moderate reduction in native populations
Major	Impact may cause severe reductions in local populations with consequences for local biodiversity and ecosystem functions and services
Massive	Impact may cause severe reductions in local biodiversity (local extinctions), with severe consequences for ecosystem functions and services

Table 2.1.4-5 Ratings used for describing the level of uncertainty.

Rating	Descriptors
Low	Available information on the species distribution, ecological requirements and climate tolerance. No subjective judgement is introduced. No unpublished data are used.
Medium	Some information is missing on the species distribution, ecological requirements and climate tolerance. Subjective judgement is introduced with supporting evidence. Unpublished data are sometimes used.
High	Most information is missing on the species distribution, ecological requirements and climate tolerance. Subjective judgement may be introduced without supporting evidence. Unpublished data are frequently used.

2.2 Sources of Information

The list of species considered in this report is extensive (~6600 species) but most are tropical and are therefore not assessed in detail. VKM has focused on species where data on their distribution indicated that they live under climatic conditions that might resemble those found in Norway now or in the near future. There is limited information for many species, due to low numbers of observations and lack of detail on the habitat where the specimens have been observed (e.g. Tibet, with no further detail). In cases where the indicated distribution might include areas that resemble Norwegian climatic conditions VKM risk assessed the species in detail.

Where the distribution maps indicated a species might live in an appropriate climate, climate maps and relevant research literature were consulted, and where necessary (and possible) authors of recent taxonomic works were contacted by email. For example, the more southernly phasmids in the genus *Agathemera* were investigated in more detail using the distribution map in the revision by Vera et al. (2012) and a map of mean annual temperatures for Argentina (https://en.wikipedia.org/wiki/Climate_of_Argentina#/media/File:Temperature_map_of_Argentina_and_Falkland_Islands.png). Working in this way, VKM found that five Andean *Agathemera* species live in a zone of mean annual temperatures between 4° and 12° C and hence these were therefore subjected to detailed risk assessment in our report. VKM also contacted the lead author of the revision, to discuss questions regarding the potential invasiveness of these targeted species.

2.2.1 Phasmids

For the initial screening, distribution maps provided the Phasmida Species File website (Brock et al., 2016) were used to find species living in areas where climate conditions potentially resemble Norwegian conditions today and in a 50 year perspective. This web-based database provides detailed and updated species information including distribution maps. The database and website are developed and run by the Species File Software (SFS) group and is authored, updated and maintained by renowned entomologists from the UK, US and Germany in cooperation with the Orthopterists' Society. For species undergoing risk assessment, information was obtained through searches for the species scientific name in Google and ISI Web of Science. Also general Google searches on "Stick insects", "Walking sticks" and "Phasmid*" were conducted to reach the "grey" literature (web pages) produced by hobbyists and the pet trade industry. Where necessary, more detailed distribution data were gleaned from the primary research literature.

2.2.2 Mantids

For the Mantodea VKM used distribution maps provided by the web resource http://mantodea.speciesfile.org/ (Otte et al., 2016). As with the Phasmida Species File, this database is developed and run by the Species File Software (SFS). Both in the original screening and in the final risk assessment, the information from (Otte et al., 2016) was supplemented by a multitude of scientific papers and books, especially (Battiston and Massa, 2008; Battiston et al., 2010; Ehrmann, 2002; Otte and Poole, 1997) and the internet resource Biology Catalog (Hallan, 2008). The publications are given in Appendix IV and were found through on-line databases and libraries, such as the ISI Web of Science. Information was also obtained through Google searches, such as searching for the species name or family name, "Mantodea", Mantids", "Mantid" or "praying mantis". Species described up to 2015 were included in the screening.

2.2.3 Scorpions

For the scorpions VKM used information provided by the internet resource The Scorpion Files (Rein, 2015), and the publications Kovařík (2009) and Rossi (2015). VKM also had personal communications with Jan Ove Rein, Norwegian University of Science and Technology, January 19th 2016.

2.2.4 Tarantulas

Recent books by leading Theraphosidae experts were used for general biology and for some data on distribution, but these cover relatively few taxa (Schultz and Schultz, 2009; Teyssié, 2015). Searching ISI Web of Knowledge revealed that there are few indexed publications with data on natural distributions, because much of the relevant literature is either too old to be indexed or in publications not covered by Web of Knowledge; using Google Scholar was similarly fruitless. Further, most publications which are indexed deal with only a limited subset of theraphosid genera. In order to cover all theraphosids, it was necessary to use two authoritative online databases. The comprehensive World Spider Catalog (WCS: http://www.wsc.nmbe.ch/introduction) is the primary source of taxonomic information for scientists who study spiders; this fully searchable database for spider taxonomy has been continuously updated since its start in 2000. The Tarantula Bibliography is a module of Michael Jacobi's Exotic Fauna (TTB:

http://exoticfauna.com/tarantulabibliography/genus_subfamily.html), and is equally up-to-date. Both websites list all species of all genera of Theraphosidae; WCS gives all taxonomic references for each species, and TTB gives a subset. Importantly, WCS links downloadable pdfs of almost all the taxonomic papers cited, an invaluable resource given the paucity of such publications found in Web of Knowledge (a few are available via TTB as well). But, unlike the phasmid and mantid websites, there is no geographic (or other ecological) information in the WCS species coverage; TTB does give regions ("Central America") or the countries in which each species is found, though maps are not provided.

Using TTB first, VKM screened all 131 genera and 985 species of Theraphosidae. For species collected from countries with appropriately cold environments (mountainous areas outside of the tropics), all available taxonomic literature was examined, by downloading pdfs of the original description and any subsequent articles. ISI Web of Knowledge was also searched for any additional information on these taxa, but was rarely of help. As with phasmids, experts were contacted directly with respect to a handful of species which are found in unusually cold regions (the mountains of southwest US and of Patagonia).

2.3 Climate modelling

Climate envelope modelling can be used to assess the suitability of new habitats for non-native species. However, this approach must be augmented with an understanding of the species ecological niche, including both climatic and other ecological requirements (Jiménez-Valverde et al., 2011).

Due to the extensive number of species to be assessed and the limited information on the ecology and environmental requirements of most, VKM used an approach to this risk assessment that includes an assessment of the climate in Norway and the climate where the species is native. There is limited or no information available on environmental and ecological requirements of the species assessed here. Therefore, VKM restricted the assessment of the potential for establishment in the initial screening to the climatic niche, and considered that species originating from regions with climates similar to what is found in Norway now or in a 50-year perspective have a potential for establishing in Norway.

The globally averaged combined land and ocean surface temperature show a warming of 0.85°C (0.65 to 1.06) over the period 1880 to 2012, when multiple independently produced datasets exist (IPCC, 2013). The rate of the warming has accelerated towards the present. Future climate change is expected to vary heterogeneously between- and within regions, and according to season. Currently, the warmest annual mean temperature in Norway is found in coastal southern Norway at 8.0°C (period 1971-2000). The warmest summer temperatures are in the southern part of Østlandet and the coastal areas of Sørlandet, with an average of about 17°C. Given the mid-range CO_2 emission scenario RCP4.5, these warm areas can expect an annual temperature increase of 2.0°C by the year 2066, with the highest increase (2.4°C) occurring during winters (Table 2.3-1). The increase in temperature is more pronounced given the emission scenario RCP8.5 (Table 1). The number of growing season days will also increase under both climate scenarios (Table 1).

Table 2.3-1 Modelled climate change (increase in temperature, precipitation and growing season days) from the period 1971-2000 and towards year 2066 under the CO_2 emission scenarios RCP4.5 (emission peak 2040-2050, then decline) and RCP 8.5 (business as usual). These two scenarios are recommended by the ICPP. The projections are based on an ensemble of ten different climate models. Source, including uncertainties in the projections: klimaservicesenter.no

	Annual °C	**Summer °C**	**Winter °C**	**Annual ppt %**	**Winter ppt %**	**Summer ppt %**	**Growing season days**
Norway RCP 4.5	2.2	2.0	2.5	6.7	5.6	10.5	0-60
Southern/Eastern Norway RCP 4.5	2.0	1.9	2.4	2.4/6.0	6.7/17.2	1.6/2.3	0-60*
Norway RCP 8.5	3.3	2.9	3.5	10.7	7.1	12.5	0-60
South-eastern Norway RCP 8.5	3.0	2.6	3.2	6.6/10.2	6.7/17.2	1.5/2.3	30-60

Summer= June, July, August; winter= December, January, February. *Small areas in southernmost Norway may experience up to 60 days increase.

Given a realistic temperature increase of 2°C, the average annual temperature will reach a maximum of 10°C in Norway in 2066. Winters may still be a bottleneck for the survival of non-native species. The mean temperatures of coastal southern Norway will increase to about 4.5°C during winters. However, one can expect that periods with sub-zero temperatures and snow cover will be even shorter in 2066 than suggested by the modelled increase in winter temperatures. This is because the daily minimum temperatures are increasing about twice as fast as the maximum daily temperatures (IPCC, 2013).

Given the prevalence of mild winters, the model errors involved (about +/-0.7) and a precautionary principle, VKM adopted that non-native species that currently live in areas with an annual temperature mean at or below 11 °C normally may survive in Norway in a 50 year perspective. An annual temperature of 11°C is in accordance with scenario RCP8.5. Using this scenario has also been recommended by the Norwegian Biodiversity Information Centre (Sandvik et al., 2015) for assessing the risk from black listed species.

The amount of precipitation will also increase during the next 50 years, especially during winters (Table 2.3-1). However, it is not straightforward to assess the potential for successful survival in nature based on precipitation. Some species thrive in moist habitats and others in dry habitats, but in general the species response to precipitation is poorly known, and therefore not considered in the assessment.

3 Assessment results

Based on the intial screening procedure, 51 species were classified as having a potential for establishment under Norwegian conditions. These species were assessed further using the GB-NNRA section B questionnaire described in section 2.1.2 and 3 of this report. The resulting summaries from these assessments are presented in the tables below. The full questionnaire (i.e. section B) for each taxon can be found in Appendix IV to this report.

Using the GB-NNRA section B, VKM assessed the potential for entry, establishment (beyond climate constraints) and the potential for spread within Norway. Finally, VKM assessed the potential impact the species might have, if established, on Norwegian biodiversity.

3.1 Phasmids

Ca 3100 species of phasmids were screened for establishment potential. Of these, 25 species were classified as "lack of information" and approximately 3055 species were classified as having low probablility of establishment under Norwegian conditions. More specific information on how the different taxa that were classified in the different screening categories can be found in Appendix I.

The remaining 20 species of phasmids were classified as having potential for establishment under Norwegian conditions, and were thus assessed using GB-NNRA section B (full assessments in IV and summaries are listed below). The conclusion from the risk summaries below listed below was "low risk" for all 20 species.

Table 3.1-1 Summaries of the assessments for phasmids.

	Response	**Uncertainty**	**Comment**
Species: *Bacillus rossius* Rossi 1788 and *B. whitei* (Nascetti & Bullini, 1981)			
Summarise Entry	moderately likely	low	In trade, but no records of escapes in Norway. In Southern England the species has established
Summarise Establishment	unlikely	low	Native range is the Mediterranean, but can survive temperatures down to 15 degrees Celsius. Climate requirements for egg survival are unknown, but are most likely limiting factors as the species has only established in Southern England.
Summarise Spread	very slowly	medium	The species are wingless. Generally stick insect does not spread very well.

	Response	Uncertainty	Comment
Summarise Impact	minimal	low	Based on the establishment of the species beyond its native range the ecological impact is assumed to be minimal
Conclusion of the risk assessment	low	low	Though the potential for establishment and spread is present, the potential environmental impact is negligible and therefore VKM conclude on low risk.
Species: *Bacillus atticus* Brunner von Wattenwyl, 1882			
Summarise Entry	very unlikely	low	Not currently trade, but the market is dynamic and this can change in the future.
Summarise Establishment	very unlikely	low	Native range is the Eastern Mediterranean, but can survive temperatures down to 15 degrees Celsius. Climate requirements for egg survival is unknown, but are most likely limiting factors as the species has not established beyond the Mediterranean region
Summarise Spread	very slowly	medium	*Bacillus atticus* are wingless insects. Generally stick insect does not spread very well.
Summarise Impact	minimal	low	Based on the establishment of the species beyond its native range the ecological impact is assumed to be minimal
Conclusion of the risk assessment	low	low	VKM see no potential for establishment and spread in Norway and the potential environmental impact is negligible and therefore VKM conclude on low risk.
Species: *Clonopsis gallica* Charpentier, 1825			
Summarise Entry	moderately likely	low	In trade, but no records of escapes in Norway. In Southern England the species has established
Summarise Establishment	unlikely	low	Native range is the Mediterranean, but can survive temperatures down to 15 degrees Celsius. Climate requirements for egg survival are unknown, but are most likely limiting factors as the species has only established in Southern England.
Summarise Spread	very slowly	medium	*Clonopsis gallica* are wingless insects. Generally, stick insect does not spread very well.

	Response	Uncertainty	Comment
Summarise Impact	minimal	low	Based on the establishment of the species beyond its native range the ecological impact is assumed to be minimal
Conclusion of the risk assessment	low	low	Though the potential for establishment and spread is present, the potential environmental impact is negligible and therefore VKM conclude on low risk.
Genus: *Agathemera* (Stål 1875), all 8 species			
Summarise Entry	very unlikely	low	Unattractive insects, might be of interest because of rarity in collections. Difficult currently to breed, so likely to remain rare in private holdings generally, so probably very unusual to have them in Norway.
Summarise Establishment	moderately likely	low	Simultaneous escape locally of enough individuals to start a population is very unlikely; though not much is known of diet breadth, none of the known host plant genera occur in Norwegian nature.
Summarise Spread	unlikely	medium	Very hard to predict, since VKM don't know if it could feed on any widespread plants in Norway.
Summarise Impact	minimal	medium	Not known to be outbreak species in their native environments, not known to be able to feed on common plants in Norway
Conclusion of the risk assessment	low	low	The likelihood of establishment of viable populations is minimal, and spread unlikely.
	Response	**Uncertainty**	**Comment**

	Response	Uncertainty	Comment
Species: ***Tectarchus salebrosus* (Hutton, 1899)** ***Micrarchus parvulus* Carl, 1913** ***Niveaphasma annulatum* (Hutton, 1898)** ***Acanthoxyla prasina* (Westwood, 1859)** ***Argosarchus horridus* (White, 1846)**			
Summarise Entry	moderately likely	medium	No current known trade to Norway, but the market is dynamic and this can change in the future.
Summarise Establishment	moderately likely	low	The climate in Norway today is probably too harsh, but with climate change in the next 50 years, the climate in some parts of Norway may be similar to what VKM find in parts of New Zealand.
Summarise Spread	unlikely	medium	These species is wingless and therefore does not spread very well.
Summarise Impact	minimal	low	Based on the situation in England from other species of New Zealand stick insects, the ecological impact is assumed to be minimal (Lee 2016)
Conclusion of the risk assessment	low	low	Though the potential for establishment and spread is present, the potential environmental impact is negligible, and therefore VKM conclude on low risk.
	Response	**Uncertainty**	**Comment**
Species: ***Acanthoxyla geisovii* (Kaup, 1866)** ***Acanthoxyla inermis* Salmon, 1955** ***Clitarchus hookeri* (White, 1846)**			

	Response	Uncertainty	Comment
Summarise Entry	moderately likely	medium	No current known trade to Norway, but the market is dynamic and this can change in the future.
Summarise Establishment	Moderately likely	low	The climate in Norway today is probably too harsh, but with climate change in the next 50 years, the climate in some parts of Norway may be similar to what VKM find in parts of New Zealand.
Summarise Spread	unlikely	medium	These species is wingless and therefore does not spread very well.
Summarise Impact	minimal	low	Based on the situation in England, the ecological impact is assumed to be minimal (Lee 2016)
Conclusion of the risk assessment	low	low	Though the potential for establishment and spread is present, the potential environmental impact is negligible, and therefore VKM conclude on low risk.

3.2 Mantids

Ca 2400 species of mantids were screened for establishment potential based on climatic overlap between the native distribution area and Norwegian climates now and in the near future. 36 species were classified as “lack of information” and approximately 2360 species were classified as having low probability of establishment under Norwegian climates. More specific information about which taxa that were classified in the different screening categories can be found in Appendix I.

The remaining 10 species of mantids were classified as having potential for establishment under Norwegian conditions, and were thus assessed using GB-NNRA section B (full assessments in IV and summaries listed below). The conclusion from the risk summaries below was “low risk” for eight species and “moderate risk” for 2 species (*Mantis religiosa* and *Orthodera novaezealandiae*).

Table 3.2-1 Summaries of the assessments for mantids.

	Response	Uncertainty	Comment
Species: *Ameles heldreichi* Brunner, 1882			
Summarise Entry	moderately likely	medium	*A. heldreichi* is held as a pet.
Summarise Establishment	unlikely	high	The egg can survive sub-zero temperatures during winters. However, summer temperatures in Norway are too cold now and likely too cold in 50 years. The species does not presently occur naturally north of southern France.
Summarise Spread	unlikely	medium	Female lack wings that may suggest limited capacity of spread. However, ecological requirements and spreading capacity of the species are poorly known. In general, mantids are considered to have a low capacity of spread.
Summarise Impact	minimal	high	No known impact. However, information is lacking.
Conclusion of the risk assessment	low	medium	There is a potential for establishment in very limited, if any, areas. The impact is unknown.
Species: *Brunneria borealis* Scudder, 1896			
Summarise Entry	unlikely	medium	*B. borealis* species is common in its native area in USA (north to Ohio), and is in trade.
Summarise Establishment	unlikely	medium	The species is truly parthenogenetic, suggesting that it can establish with a small founder population. Summer temperatures in Norway are too cold now and likely also in 50 years. It is a generalist predator and can be expected to acquire food in Norway.
Summarise Spread	unlikely	medium	Unlikely since areas where it potentially can survive are few and scattered, if they exist. In general, mantids are considered to have a low capacity of spread.
Summarise Impact	minimal	high	No known impact.
Conclusion of the risk assessment	low	medium	Very few, if any, areas in Norway will be warm enough in a 50-year perspective. The species is parthenogenetic and can establish with a small founder population. The impact is unknown.
Species: *Litaneutria minor* Scudder, 1896			

	Response	Uncertainty	Comment
Summarise Entry	unlikely	medium	*L. minor* is common in its native area. The species is only to a limited extent kept as a pet and only small numbers are in trade. *L. minor* cannot be imported in large groups due to strong cannibalism. It is difficult to breed due to their aggressive nature and because of their small size it can be hard to find suitable food for specimen in captivity.
Summarise Establishment	unlikely	medium	The egg can survive sub-zero temperatures during winters. Adults prefer warmer and drier conditions than found in Norway today, but suitable conditions may arise in a 50-year perspective. It is a generalist predator and can be expected to acquire food in Norway.
Summarise Spread	unlikely	medium	Fairly agile species, but capacity of spread is not known. Spread is still unlikely since areas where it potentially can survive are few and scattered.
Summarise Impact	minimal	high	No known impact. High uncertainty because many impacts on natural ecosystems are difficult to predict.
Conclusion of the risk assessment	low	medium	There is potential for establishment in limited areas based on climatic requirements, however this is not expected since entry is unlikely. The impact is unknown.
Species: *Litaneutria borealis* Brunner, 1893			
Summarise Entry	unlikely	high	*L. borealis* does not seem to be common in its native area. No information has been found that suggests that the species is in trade.
Summarise Establishment	unlikely	medium	Ecological requirement of *L. borealis* is not known. The egg can survive sub-zero temperatures during winters. Summer temperatures in Norway are too cold now and likely also in 50 years.
Summarise Spread	unlikely	high	Capacity of spread is unknown. In general, mantids are considered to have a low capacity of spread.
Summarise Impact	minimal	high	No known impact. However, information is lacking.
Conclusion of the risk assessment	low	medium	The likelihood of entry is low, and there is some potential for establishment in very limited areas. Information on spread and impact is lacking.

	Response	Uncertainty	Comment
Species: *Mantis religiosa* (Linnaeus, 1758)			
Summarise Entry	moderately likely	medium	*M. religiosa* is common in its native area, and is currently spreading northward in Europe and in North America. May enter by trade, as hitchhiker on goods and vehicles or on a longer time span by natural range expansions.
Summarise Establishment	likely	medium	The egg can survive sub-zero temperatures during winters. The adult may prefer warmer temperatures than found in Norway today, but the temperatures are likely to be within its tolerance in a 50 year perspective. It is a generalist predator and can be expected to acquire food in Norway.
Summarise Spread	moderately likely	medium	*M. religiosa* is currently spreading in Europe, Australia and in North America, suggesting a large capacity to spread.
Summarise Impact	moderate	high	They have a great appetite and eat anything they can catch. However, high uncertainty because many impacts on natural ecosystems are difficult to predict.
Conclusion of the risk assessment	moderate	high	There is potential for establishment in warm areas. If established, *M. religiosa* may develop viable populations and spread, and possibly impact biodiversity and ecosystems.
Species: *Miomantis caffra* Saussure, 1871			
Summarise Entry	unlikely	medium	*M. caffra* species is common in its native area and is in trade. Escape from captivity must occur in areas of Norway with the warmest summers in order to survive outside.
Summarise Establishment	moderately likely	medium	The species may just be able to survive in some very limited areas of Norway in a 50 year perspective. It is a generalist predator and can be expected to acquire food in Norway
Summarise Spread	likely	low	The species is currently spreading in New Zealand and Portugal, despite management practices in New Zealand. This suggests a large capacity of spread. However, areas where it potentially can survive in Norway are few and scattered.

	Response	Uncertainty	Comment
Summarise Impact	minimal	high	Although not considered a pest species, it is displacing the New Zealand native species (*O. novaezealandiae*) in urban environments of northern New Zealand. However, it is difficult to predict impacts on biodiversity and natural ecosystems in Norway.
Conclusion of the risk assessment	low	medium	There is perhaps a potential for establishment in the warmest areas. The impact is unknown.
Species: *Oligonicella scudderi* Saussure, 1870			
Summarise Entry	unlikely	high	*O. scudderi* is common in its native area. Uncertain how many specimens are imported to Norway, but likely to be few. Because of their small size it can be hard to find suitable food for specimen in captivity.
Summarise Establishment	unlikely	medium	The egg can survive sub-zero temperatures during winters. Summer temperatures in Norway are too cold now and likely too cold in 50 years. It is a generalist predator and can be expected to acquire food in Norway.
Summarise Spread	unlikely	medium	Adult females have undeveloped wing pads that may suggest a low capacity of spread. However, spreading capacity is mostly unknown.
Summarise Impact	minimal	high	No known impact. However, information is lacking.
Conclusion of the risk assessment	low	medium	The likelihood of successful establishment is very low given that the summers in Norway are too cold now and likely too cold in a 50 year perspective. The impact is unknown.
Species: *Orthodera novaezealandiae* Colenso, 1882			
Summarise Entry	moderately likely	medium	*O. novaezealandiae* is endemic to New Zealand, where it is common. It is in trade. Special care must be taken to prevent this small, quick-moving species from escaping. Nymphs are especially fast and can leap far.
Summarise Establishment	likely	low	The environmental conditions in southern Norway are similar to that of areas where the species is present. It is a generalist predator and can be expected to find prey.
Summarise Spread	likely	medium	Capacity of spread is unknown.
Summarise Impact	minimal	high	No known impact. However, it is difficult to predict impacts on natural ecosystems.

	Response	Uncertainty	Comment
Conclusion of the risk assessment	moderate	high	There is a potential for establishment. The impact on Norwegian biodiversity is unknown.
Species: *Tenodera sinensis* Saussure, 1871			
Summarise Entry	likely	medium	*T. sinensis* is very common. Originally it only occurred in Asia, but because of international commerce it has been introduced in North America. There this species is thriving and can be found in almost the whole continent. It is a common pet for mantis enthusiasts, and oothecae can easily be purchased. They are notable for quickly adapting to the presence of humans.
Summarise Establishment	unlikely	high	The egg of *T. sinensis* can survive sub-zero temperatures during winters. Experience from the BC coast of Canada suggests that development requires more accumulated degree-days than are available in Norway today. It is uncertain whether the temperatures may be within its tolerance in a 50 year perspective. It is a general predator and can eat pollen as an alternative source of food, suggesting it can find food in Norway. After one mating the female mantis will produce fertilized eggs for the rest of her life.
Summarise Spread	unlikely	high	The species is currently spreading in USA, but capacity of spread is not known since the spread is assisted by humans.
Summarise Impact	moderate	high	*T. sinensis* has a great appetite and eat anything they can catch, including small vertebrates. It is thought to outcompete many of the native mantids in the USA, which are in decline. However, the uncertainty is high because many impacts on natural ecosystems are difficult to predict.
Conclusion of the risk assessment	low	medium	Temperatures in Norway are likely too cold.
Species: *Yersiniops solitarius* (Scudder, 1896)			
Summarise Entry	unlikely	high	*Y. solitarius* does not seem to be common in its native area. No information has been found that suggests that the species is in trade.

	Response	Uncertainty	Comment
Summarise Establishment	unlikely	medium	Ecological requirement of *Y. solitarius* is poorly known. The egg can survive sub-zero temperatures during winters. Summer temperatures in Norway are too cold now and likely too cold in 50 years. It is a generalist predator and can be expected to find food.
Summarise Spread	unlikely	high	Capacity of spread is unknown. Mantids are often considered to have a limited capacity of spread.
Summarise Impact	minimal	high	No known impact. However, information is lacking.
Conclusion of the risk assessment	low	high	There is a potential for establishment in limited areas, however the likelihood of entry is very low. The impact is unknown.

3.3 Scorpions

Initial screening was done for all species in the genus *Pandinus* (now split in the genera *Pandinoides, Pandinops, Pandinopsis, Pandinurus* and *Pandinus*) and *Heterometrus*. These six genera contain 80 species in total (See Appendix I). All species are tropical except the species *Heterometrus tibetanus* from Tibet with no further details are known (Lourenço et al., 2005). None of the species were given a full assessment due to the discrepancy between the climate conditions in their native habitat and Norway, even in a 50 year perspective.

3.4 Tarantulas

A total of 969 theraphosid species were screened. Most tarantulas are from tropical or subtropical regions, or from deserts. Only four genera in one subfamily, the Theraphosinae, were considered to have species from climates potentially similar enough to Norway's to warrant a more detailed examination. The result was 9 full section B assessments covering a total of 20 species. In all cases, VKM concluded that there was Low risk to Norwegian biodiversity from the included species. The summaries of the assessments are given in Table 3.4-1.

Table 3.4-1 Summaries of the assessments for tarantulas.

	Response	Uncertainty	Comment
Species: *Aphonopelma chalcodes* Chamberlin, 1940			
Summarise Entry	unlikely	low	Species is popular among hobbyists. Escape or release very unlikely, entry into Norwegian nature in which they could survive is unlikely.
Summarise Establishment	very unlikely	low	If kept in captivity: very unlikely one or a few tarantulas would escape or be released at the same time in the same place, unlikely that a male would be one of the few escaping or being released, very unlikely that such escape/release would be in a time and place where they could survive.
Summarise Spread	very slowly	low	Probably no spread
Summarise Impact	minimal	low	None known
Conclusion of the risk assessment	low	low	
	Response	**Uncertainty**	**Comment**
Species: *Aphonopelma iodius* (Chamberlin & Ivie, 1939)			
Summarise Entry	unlikely	low	Species is popular among hobbyists. Escape or release very unlikely, entry into Norwegian nature in which they could survive is unlikely.

	Response	Uncertainty	Comment
Summarise Establishment	very unlikely	low	If kept in captivity: very unlikely one or a few tarantulas would escape or be released at the same time in the same place, unlikely that a male would be one of the few escaping or being released, very unlikely that such escape/release would be in a time and place where they could survive.
Summarise Spread	very slowly	low	Probably no spread
Summarise Impact	minimal	low	None known
Conclusion of the risk assessment	low	low	
Species: *Aphonopelma mareki* Hamilton, Hendrixson & Bond, 2016			
Summarise Entry	very unlikely	low	If and when traded: escape or release very unlikely, entry into Norwegian nature in which they could survive very unlikely
Summarise Establishment	very unlikely	low	If kept in captivity: very unlikely one or a few tarantulas would escape or be released at the same time in the same place, unlikely that a male would be one of the few escaping or being released, very unlikely that such escape/release would be in a time and place where they could survive
Summarise Spread	very slowly	low	Probably no spread
Summarise Impact	minimal	low	None known

	Response	Uncertainty	Comment
Conclusion of the risk assessment	low	low	
Species: ***Aphonopelma marxi*** **species group** ***sensu*** **Hamilton et al. 2016:** ***Aphonopelma marxi*** **(Simon, 1891)** ***A. catalina*** **Hamilton, Hendrixson & Bond, 2016** ***A. chiricahua*** **Hamilton, Hendrixson & Bond, 2016** ***A. madera*** **Hamilton, Hendrixson & Bond, 2016** ***A. peloncillo*** **Hamilton, Hendrixson & Bond, 2016** ***A. vorhiesi*** **Hamilton, Hendrixson & Bond, 2016**			
Summarise Entry	very unlikely	low	If and when traded: escape or release very unlikely, entry into Norwegian nature in which they could survive very unlikely
Summarise Establishment	very unlikely	low	If kept in captivity: very unlikely one or a few tarantulas would escape or be released at the same time in the same place, unlikely that a male would be one of the few escaping or being released, very unlikely that such escape/release would be in a time and place where they could survive
Summarise Spread	very slowly	low	Probably no spread
Summarise Impact	minimal	low	None known
Conclusion of the risk assessment	low	low	
Species: ***Bistriopelma lamasi*** **Kaderka, 2015 and** ***Bistriopelma matuskai*** **Kaderka, 2015**			

	Response	Uncertainty	Comment
Summarise Entry	very unlikely	low	If someday traded: escape or release very unlikely, entry into Norwegian nature in which they could survive very unlikely
Summarise Establishment	very unlikely	low	If someday kept in captivity: very unlikely one or a few tarantulas would escape or be released at the same time in the same place, unlikely that a male would be one of the few escaping or being released, very unlikely that such escape/release would be in a time and place where they could survive
Summarise Spread	very slowly	low	Probably no spread
Summarise Impact	minimal	low	None known
Conclusion of the risk assessment	low	low	
Species: *Euathlus* Ausserer, 1875: 6 described species, but undescribed species also occur in Chile			
Summarise Entry	very unlikely	low	Escape or release very unlikely, entry into Norwegian nature in which they could survive very unlikely
Summarise Establishment	very unlikely	low	Very unlikely one or a few tarantulas would escape or be released at the same time in the same place, unlikely that a male would be one of the few escaping or being released, very unlikely that such escape/release would be in a time and place where they could survive

	Response	Uncertainty	Comment
Summarise Spread	very slowly	low	Probably no spread
Summarise Impact	minimal	low	None known
Conclusion of the risk assessment	low	low	
Species: *Hapalotremus albipes* Simon, 1903			
Summarise Entry	very unlikely	low	If and when traded: escape or release very unlikely, entry into Norwegian nature in which they could survive very unlikely
Summarise Establishment	very unlikely	low	If someday kept in captivity: very unlikely one or a few tarantulas would escape or be released at the same time in the same place, unlikely that a male would be one of the few escaping or being released, very unlikely that such escape/release would be in a time and place where they could survive
Summarise Spread	very slowly	low	Probably no spread
Summarise Impact	minimal	low	None known
Conclusion of the risk assessment	low	low	
Species: *Phrixotrichus scrofa* (Molina, 1788)			
Summarise Entry	very unlikely	low	Escape or release very unlikely, entry into Norwegian nature in which they could survive very unlikely

	Response	Uncertainty	Comment
Summarise Establishment	very unlikely	low	Very unlikely one or a few tarantulas would escape or be released at the same time in the same place, unlikely that a male would be one of the few escaping or being released, very unlikely that such escape/release would be in a time and place where they could survive
Summarise Spread	very slowly	low	Most likely no spread
Summarise Impact	minimal	low	None known
Conclusion of the risk assessment	low	low	
Species: *Phrixotrichus vulpinus* (Karsch, 1880)			
Summarise Entry	very unlikely	low	Escape or release very unlikely, entry into Norwegian nature in which they could survive very unlikely
Summarise Establishment	very unlikely	low	Very unlikely one or a few tarantulas would escape or be released at the same time in the same place, unlikely that a male would be one of the few escaping or being released, very unlikely that such escape/release would be in a time and place where they could survive
Summarise Spread	very slowly	low	Probably no spread
Summarise Impact	minimal	low	None known
Conclusion of the risk assessment	low	low	

4 Precautionary measures

The species dealt with in this risk assessment are all kept as pets and there will always be risk of specimens escaping from captivity. Large adults are often easy to handle, but small nymphs may occur in large numbers which can cause handling problems. The probability of escapes will increase if the animals are taken out of terraria and let to crawl freely around. Recommendations for keeping the animals contained at all times will potentially reduce the risk of escapes.

Information regarding potential risk associated with deliberate release could reduce the risk. In the legal pet trade, pet traders actively inform their customers on responsible hold of the pets they buy, including information about the consequences of releasing non-native organisms to natural ecosystems. Legal pet traders in Norway run regular campaigns on various aspects of responsible hold of the animals they trade in, including background information on which species are legal and why.

5 Uncertainties

A measure of the uncertainty is included for each question of the adapted GB-NNRA Risk Assessment scheme. For each question, the assessor is asked to rate their response with a 3-point scale, low, medium or high uncertainty. Tables defining the rationale behind the response scales and the uncertainty-scale can be found in section 2.1.4.

5.1 Taxonomic and nomenclatural uncertainties

There is always uncertainty in the taxonomy and nomenclature of diverse small organisms such as those VKM treat in this report, and for this reason, older scientific names of the species being examined (synonyms) are listed. Our ability to correctly identify a given species changes with time, as more and more similar species are discovered and named, and the boundaries of higher categories to which a species is assigned change similarly as our knowledge increases. Advances in molecular phylogenetic techniques and the wide availability of DNA sequencing are revolutionizing taxonomy and systematics of highly diverse arthropod lineages, including those treated in this report. Taxonomy has entered a phase of heightened nomenclatural instability, as old systematic groupings are re-shaped based on a modern understanding of morphological character evolution plus the vast increase in numbers of useful species differences afforded by DNA sequences. The taxonomic landscape is rapidly evolving, as species are re-shuffled among genera, genera fission and fuse, new species and genera are described, and so on. Closer examination often reveals widespread species to be species complexes clearly separable by molecular genetic data but only sometimes identifiable by external morphological features. One consequence of this instability is that there are often discrepancies between species conceptions or species boundaries recognized by experts and those used by the pet trade and hobbyists, where single biological species may be known under multiple common names or where single names may refer to multiple biological species. This taxonomic and nomenclatural instability necessarily spills over into uncertainty in our risk assessments, as well as into matters of conservation, when the taxonomy of taxa being treated is weak or outdated. Thus, 21 species of tarantulas in the genus *Brachypelma* are CITES II listed, but *B. embrithes* (Chamberlin & Ivie, 1936) which is listed is no longer in that genus, having been moved to to *Sericopelma* (Gabriel and Longhorn, 2015) and *B. ruhnaui* (Schmidt, 1997) has been synonymized with *B. albiceps* (Schmidt, 2003). The tropical species *S. embrithes* (formerly *B. ambrithes*) is known only from the type locality in Panama; it has been placed in five different genera in the last 80 years. The popular Mexican golden redrump is listed under the name *Aphonopelma albiceps* in CITES II, but has been moved recently to the genus *Brachypelma* (Locht et al., 2005), which is one of four genera this tarantula has been placed in since its description in 1897.

5.2 Uncertainties relating to climatic tolerance and niche

The initial screening of taxa analysed in this report is based on inferred climatic tolerances of the organisms. For the majority of the taxa, little or no information on biology and ecology is available. In many cases, all that is known is the original collection data for the type specimen(s), which in the worst cases can be as general as "North America" ("*America borealis*") or "Tibet". Thus, for organisms observed once in a country comprising various climatic zones (e.g. alpine vs tropical lowland), there is uncertainty related to whether or not they can establish populations under Norwegian conditions.

Further, although aspects of the climatic conditions of the current distributional area of some taxa suggests that they could survive in Norway, there is uncertainty relating to the organisms' tolerance for frost, precipitation, wide temperature fluctuations, length of active season, and so on, which again adds uncertainty related to whether escaped specimens would be able to survive and reproduce under Norwegian conditions.

With respect to the task of judging the effects of climate change over the next 50 years, several factors create uncertainties in climate projections based on different CO_2-increase scenarios. First, there is a lack of knowledge about the sensitivity of the climate system on earth. Second, the general circulation models used to model future climates have limitations (ICPP 2013). Projections that follow scenarios with a low CO_2 emission, such as RCP 4.5, are in general more certain than projections that follow scenarios with a high CO_2 emission, such as RCP8.5. Also, the upper boundary of the climate projections is beset with larger uncertainties than the lower boundary. In attempting to cancel out uncertainties in the general circulation models, many researchers have chosen to base climate projections on an ensemble of models. VKM has adopted projections made by the Norwegian Centre for Climate Services (*Norsk klimaservicesenter*) that are based on an ensemble of ten different climate models (Hanssen-Bauer et al., 2015).

The projected annual mean temperature for Norway in 2066 under scenario RCP8.5 is 3.3 °C with an upper boundary (90th percentile) of 4.6 °C and a lower boundary (10th percentile) of 2.8 °C (Hanssen-Bauer et al., 2015). Under RCP2.5, the projected temperature is 2.2 with an upper boundary (90th percentile) of 3.2 °C and a lower boundary (10th percentil) of 1.6 °C. The uncertainties of the modelled winter- and summer temperatures are similar to the uncertainties for annual temperature.

5.3 Uncertainties related to the species general biology

Several environmental factors control the probability for a new species to establish and spread in new environments. In general a species distribution is set by the combination of climate conditions and the availability of additional required resources. In addition to the climate conditions assessed in the initial screening, species need access to food and in many cases also suitable breeding sites. Generalist predators, such as many mantids, or generalist herbivores, such as many phasmids, might adapt to new environments by switching diet to what is locally available. Species with wide or flexible diets and relaxed habitat requirements will be more likely to succeed in establishing populations in new habitats. However, for most species assessed here, there is simply no knowledge about the species' requirements and limiting factors, and our assessment of these factors is therefore prone to high uncertainty. To predict precisely the probability of establishment, all factors must be studied in detail and this has never been done for any of the species in focus here.

To establish viable populations, introduced species also need to reproduce successfully. Egg and nymph survival rates for our focal species are prone to high uncertainty, in particular under the new environmental conditions the species will experience if introduced to Norway. Furthermore, arthropods are prey for native mammals and birds and the predation pressure the species' will experience in Norway is unknown.

Wingless arthropods are generally slow movers, which limits their capacity to spread. Walking speed and distance, and flight distances for certain mantids and phasmids are unknown for most species. The species' spread might also be obstructed by barriers if they have problems crossing areas with unfavourable habitat. The lack of information regarding these aspects of the species' ecology introduces uncertainties with respect to their ability to spread.

6 Answers to terms of reference

The terms of reference to the risk assessment requested by the Norwegian Environment Agency are answered by VKM as follows:

1) The Norwegian Environment Agency requests the Norwegian Scientific Committee for Food Safety (VKM) to undertake an assessment of the risks of negative impacts on biodiversity in Norway stemming from the import and keeping of the following arachnids:

- Tarantulas: All species within the genus *Brachypelma* (approximately 20 species), as well as the species *Aphonopelma albiceps* and *Aphonopelma pallidum*

VKM has assessed the risk to Norwegian biodiversity of import and keeping of tarantulas in the genus *Brachypelma*, as well as the species *Aphonopelma pallidum* and *A. albiceps*, as low.

VKM assessed the risks of negative impacts on Norwegian biodiversity stemming from the import and keeping of the above mentioned arachnids as low (with high confidence) based on the low probability of establishment under Norwegian climate conditions today and in a 50 years perspective.

Brachypelma are found from Mexico to Costa Rica, with almost all species being found in desert or semi-desert environments (a few species are tropical). These species are seldom, if ever, exposed even briefly to temperatures below zero degrees Celsius, and have specific requirements for burrowing (deep enough soft soils), and therefore all *Brachypelma* (including "*Aphonopelma*" *albiceps*) are eliminated from further consideration in the first screening phase, as it is considered impossible that these could establish viable populations in natural habitats in Norway. *Aphonopelma pallidum* (Chihuahua Rose-grey Tarantula, Mexican Grey Tarantula) is known only from arid parts of northern Mexico, and hence was screened out as well, following the same reasoning as for *Brachypelma*.

- Scorpions: All species within the genera *Pandinus* and *Heterometrus*

VKM assessed the risks of negative impacts on Norwegian biodiversity stemming from the import and keeping of the above mentioned scorpions as low (with the exception of *H. tibetanus* [lack of information]) based on the low probability of establishment under Norwegian climate conditions today and in a 50 years perspective.

All species within the genera *Pandinus* (now split into the genera *Pandinus*, *Pandionoides*, *Pandinops*, *Pandinopsis* and *Pandinurus*) and *Heterometrus* occur only in the tropics, except *Heterometrus tibetanus*, a species native to Tibet, China. In the case of *H. tibetanus,* VKM found no information on its distribution, biology or climate requirements. It was therefore given the status "lack of information" in the initial screening. None of the remaining species were further assessed as the discrepancy between the climate conditions in their native habitat and Norway, even in a 50 years perspective, make the probability of establishment low.

2) Further, the Norwegian Environment Agency requests an assessment of the risks of negative effects on biodiversity in Norway from import of the following taxa in relation to their potential future exemption from import permit requirements:

- Theraphosidae –Tarantulas – for species not included in the assessment 1

The risks of negative impacts on Norwegian biodiversity stemming from the import and keeping of any tarantulas was assessed as low.

For most of the species, this conclusion is based on the low probability of establishment under Norwegian climate conditions today and in a 50 years perspective. Twenty species were assessed individually, but with the same conclusion, based on species longevity and reproductive biology. It seems very unlikely that more than one tarantula of the same species would escape or be released at the same time in the same place and that a male would be one of the few escaping or being released. In addition, it is very unlikely that such escape/release would be in a time and place where they could survive.

- Phasmida - Stick insects

The risks of negative impacts on Norwegian biodiversity stemming from the import and keeping of phasmids was assessed as low.

For most of the species, this conclusion is based on the low probability of establishment under Norwegian climate conditions today and in a 50 years perspective. Twenty species were assessed individually, but with the same conclusion, based on both the low probability of establishment and the low potential impact on Norwegian biodiversity.

- Mantids

The the risk to Norwegian biodiversity of import and keeping mantids was assessed as low for all species except *Mantis religiosa* and *Orthodera novaezealandiae* (moderate risk).

Mantis religiosa is currently spreading northwards in Europe and North America and has developed viable populations as far north as northern Germany (Linn and Griebler, 2015) with transient populations in Latvia at 56° N (Pupiņš et al., 2012). It is believed that the expansion of *M. religiosa* to the north in Germany is connected with warmer temperatures (UNEP-CMS-DEFRA 2009; Liana, 2007). Populations at the edge of the species distribution are often small, unstable and sometimes vanish after a short period. However, in a 50-year perspective, the species is expected to be able to develop viable populations in Norway and will likely arrive by natural dispersal or via plant import.

The warmest annual mean temperature in Norway is found in coastal southern Norway at 8.0°C for the period 1971-2000. The annual mean temperature in north-east Germany where *M. religiosa* has viable populations was 8.3 °C for the period 1960-1991. This is well within the mean annual threshold of 11 °C that we have adopted. The warmest summer (4 months) temperature in Norway is currently about 17 °C, while current summer temperatures north-east Germany are around 15.5 °C. Winters are most likely not a problem for survival, and since this is a generalist predator which can take small insects, food availability will likely not be a problem. Given enough time, we can perhaps expect that *M. religiosa* will spread to Norway by natural range expansion. Natural range expansion from the south to southern Norway requires a detour around the Oslofjord or Gulf of Bothnia, which may slow natural range expansion. Import and trade may then be a shortcut that accelerates natural expansions. *M. religiosa* is a cosmopolitan insect in continuous expansion, and is characterized "as a flexible species with abilities to invade rapidly on new territories out of the natural area" (Pupiņš et al., 2012). The species was introduced to North America and to Australia and has spread widely since. In the literature, it has been considered as "invasive" on these grounds, However, "invasive" was not defined further.

The species *O. novaezealandiae* is endemic to New Zealand, where it is common (Ramsay, 1990). The climatic conditions in southern Norway are similar to that of southern South Island on New Zealand where the species is present today. The species is often kept as a pet. Because it is a quick-moving species, there is a danger it can escape from captivity. It is a generalist predator and can be expected to acquire large numbers of prey. However, if spread to Norway outside captivity, the impact can be considered unknown.

Few assert any substantial risk to native biodiversity after establishment of *M. religiosa* or *O. novaezealandiae*, but this cannot be concluded with certainty. Mantids have been found to influence biodiversity in replicated field enclosures *M. religiosa* reduced the overall biomass by 88% relative to controls by directly eliminating grasshoppers and crickets, and to a lesser extent by reducing numbers of cursorial spiders (Fagan and Hurd, 1991). In another study, the mantid *Tenodera sinensis*, caused top-down effects in the ecosystem that decreased herbivory enough to affect plant growth (Moran et al., 1996). This study was performed in in open-field plots at natural densities. Predation by the mantid decreased the biomass of herbivorous arthropods through predation, and this in turn increased biomass of plants (op. cit.).

Specific questions listed in the Terms of Refernce are discussed below:

1. Species survivability under Norwegian conditions

Most of the species assessed in this risk assessment are tropical, though many popular tarantula and scorpion species live in dry, warm desert or semidesert regions. Most species were excluded in our initial screening based on survivability under Norwegian conditions. In the initial screening VKM used climate projections and assessed the species potential for establishment in a 50 year perspective. However, for some species, no information exists on the species native habitat, and consequently there is no information on the climatic conditions required for it to survive and reproduce. An example of this is the stick insect *Bacillus inermis* (Thunberg, 1815) where the type specimen is lost and no information exists on where the species was found. In cases like this VKM has stated in the initial screening "Lack of information". However, species with lack of information to this degree are most likely very rare or live in inaccessible habitats reducing the potential for entry into Norway substantially. It is also possible that the species has been described later under another name and thereby been assigned "no risk" through the initial screening or undergone a full risk assessment. Another relevant example is *Phyllium (Phyllium) tibetense* (Liu, 1993). This species has only recently been described and is native to Tibet. However, no more detail on the habitat where it was observed is to be found. Tibet includes numerous climate zones and habitat types from cold mountains to damp rainforests under heavy influence of monsoon rain. Since the species is relatively new to the scientific community, VKM could infer that its population size is limited or that it thrives in remote and inaccessible areas, leading us to conclude to that the potential for commercial trade and consequently entry to Norway is limited. Still, the species was listed as as "Lack of information" as one cannot conclude about its potential for establishing in Norway. With respect to the different groups undertaken in this risk assessment, it was concluded that there is a risk of establishment, based solely on climate requirements, for 20 species of tarantulas, 0 species of scorpions, 10 species of mantids and 20 phasmids.

Dietary requirements can often be a limiting factor with respect to a species ability to establish populations in new habitats. However, based on recent establishment of stick insects in Southern England, it seems that at least for this group the species are able to switch host plants and adapt to new environments. Despite that they are mostly found in gardens, which might hold plant species from other parts of the world, they are also found feeding on native English plant species (the species established in Southern England are of both Mediterranean and New Zealand origin). Theraphosid spiders are generalist predators but require large, relatively soft-bodied prey; orthopterans, cockroaches, large larvae, and other good-sized insects are relatively common where most temperate and tropical tarantulas are native, but strikingly infrequent or non-existent in Norway. Lack of such large-bodied prey must further reduce the likelihood of establishment of theraphosids outdoors in Norway. Mantids are generalist predators but can feed on smaller prey. They prefer arthropods, especially insects, and will eat almost any species, including their own (Ramsay, 1990). This suggests that they will be able to acquire food in Norway. Once established in

Norwegian nature, it may be hard to control their population sizes (Cannings, 2007; Fea, 2011). The conditions are ripe for expansion if they are present and the fundamental niche of the species can be fulfilled.

Finally, VKM can draw inferences about likelihood of an organism becoming invasive from previous history. Thus, the nearest instances of invasive phasmids are in southern England and the nearest example of invasive mantids is northern France. There are very few studies that have examined the effects of invasive mantids on natural ecosystems. It is reasonable to assume that alarming consequences would be reported, suggesting that a lack of studies imply that the consequences are minimal. Mantids have even been used as biological control agent since they sometimes feed on pest insects. However, they also feed on other beneficial insects, questioning their effect as biological control agent and also suggesting that care should be taken not to introduce mantids into Norway. In New Zealand, *Miomantis caffra* is now displacing the native mantid *Orthodera novaezealandiae*, which formerly was the more common, suggesting that mantids can become invasive with negative effects on native biodiversity. However, no native mantids are found in Norway implying that direct competition, as found in New Zealand, is not expected. Mantids predating on native insect fauna might, however, pose a potential risk to Norwegian biodiversity.

The scorpions evaluated in this report are all tropical, except *Heterometrus tibetanus* from Tibet, with which VKM has no further information (Lourenço et al., 2005). The risks of establishment of these tropical scorpions in Norway are considered as low.

Interestingly, despite intense interest in tarantulas as pets, and regular introductions via imported fruit, theraphosids have never established reproductive populations anywhere in Europe. Only a few, very local populations of non-native tarantulas are known to have established elsewhere in the world, all in subtropical Florida: *Brachypelma vagans*, *Aphonopelma seemanni*, and *Avicularia avicularia* (see errata to Schultz and Schultz 2009: http://people.ucalgary.ca/~schultz/errata3.html). The risk of establishment and spread of these large spiders in Norway, with a much harsher climate, must be minimal.

Conclusion
In the initial screening, VKM has concluded that there is a potential for establishment, based solely on climate requirements, for 20 species of tarantulas 0 species of scorpions, 10 species of mantids and 20 phasmids.

1. Possible impacts on ecosystems and other species

For most species undertaken in this risk assessment, the conclusion is that there is low or very low risk for negative impacts on Norwegian ecosystems and biodiversity, including ecosystem services. This is based on the biology of the species that have been subject to a full risk assessment and documentation of the species invasion history in other countries (where such information exists). Two species of mantids, *Mantis religiosa* and *Orthodera novaezealandiae* have been assessed as having a Moderate risk. The species are likely to establish viable populations in Norway in a 50 year perspective. If they can enter, the species devour large number of prey. *M. religiosa* is currently spreading in Europe, Australia and in North America. The impact is still considered as unknown.

Conclusion

Only two of the species, *Mantis religiosa* and *Orthodera novaezealandiae*, have been assessed as having moderate risk of impact on Norwegian ecosystems and other species. None of the remaining species that we have assessed are likely to have any important impact on Norwegian ecosystems and biodiversity, and hence are categorized as low risk here.

2. Possible risks caused by the introduction of harmful hitchhiker organisms, including pathogens and parasites

None of the focal taxa have close relatives in the Norwegian fauna: there are no scorpions, tarantulas, mantids or phasmids in Norway. Nor have we found records of pathogen or parasite spill-over to native biodiversity in other areas where focal species have been introduced (where such information exists). We therefore conclude that, for the taxa in focus here, there is low risk of introduction of hitchhiker organisms.

3. The likelihood of escape or release of the organisms and possible precautionary measures that may prevent this

For animals kept as pets, there is always a potential for escapes or deliberate release. However, a certain propagule pressure is needed for an alien species to establish sustainable populations in a new region. This may be lower for species with parthenogenetic reproduction (females able to lay eggs without mating), where in theory only one female is enough for establishment in new areas. Increased information through the pet trade industry might act as a precautionary measure. Based on our discussion with enthusiasts and industry representatives, there is reason to believe that people keeping insects and arachnids as pets will follow instructions regarding handling to prevent escapes if the potential risk to Norwegian biodiversity is clearly stated and documented. Moreover, there is a strong incentive for hobbyists to prevent escapes, since exotic species (especially those from other continents or relatively inaccessible environments) are expensive and difficult to replace, and any offspring they produce can be traded or sold.

Conclusion

In the case of scorpions and tarantulas, we conclude that the risk of escape into nature is low. Mantids and phasmids produce large numbers of tiny offspring. We therefore see a possibility for escape both as adults, young instars and as eggs through deliberate release or as hidden on plants and in soil. The commercial pet trade may act as a precautionary measure by providing information on safekeeping and dangers associated with release.

Possible risks caused by the introduction of harmful hitchhiker organisms, including pathogens and parasites.

None of the species included in this risk assessment have close relatives; there are no phasmids, mantids, scorpions or tarantulas or in the Norwegian fauna. Nor have we found records of pathogen or parasite spill-over to native biodiversity in other areas where species of these groups have been introduced. We therefore conclude that, for the species in focus here, there is Lowof introduction of hitchhiker organisms. Generally, there is a lack of information on hitchhiker organisms for most of the species in focus. Our conclusion is strengthened, though, by the fact that there seems to be no discussion of problems with hitchhiking organisms in internet discussions (or scientific literature) despite (1) the great interest among hobbyists for phasmids, mantids, scorpions and tarantulas, and (2) that the animals being kept in terraria are often collected from the wild.

The likelihood of escape or release of the organisms and possible precautionary measures that may prevent this.

For animals kept as pets, there is always a potential for escapes or deliberate release. However, for most species a certain propagule pressure is needed for an invader to establish. This may be lower for species with parthenogenetic reproduction (females able to lay eggs without mating), where in theory only one female is enough for establishment in new areas. Information on potential risks associated with release of the animals is required by legislation. More specific information regarding potential impacts and mitigation measures through the pet trade industry might act as a precautionary measure. Based on our discussion with enthusiasts and industry representatives, there is reason to believe that persons holding insects and arachnids as pets will follow instructions regarding handling in order to prevent escapes, if the potential risk to Norwegian biodiversity is clearly stated and documented. Many exotic species (such as those from other continents) are expensive and difficult to replace, and any offspring they produce can be traded or sold, providing a strong incentive for hobbyists to prevent escapes.

Conclusion in regard to the terms of reference

Despite the large number of species that were assessed, only a few species were adjudged to have a potential for establishing viable populations in Norway, even given a climate warming during the next 50 years (to 2066). Walking sticks, mantids, scorpions, and tarantulas are, by and large, not able to establish populations in Norway, excepting these species not exclude in the initial screening:

Phasmids

Bacillus atticus Brunner von Wattenwyl, 1882
Bacillus rossius Rossi 1788
Bacillus Whitei Nascetti & Bullini, 1981
Clonopsis gallica Charpentier, 1825

Agathemera sp (Stål 1875), all 8 species
Tectarchus salebrosus (Hutton, 1899)
Micrarchus parvulus Carl, 1913
Niveaphasma annulatum (Hutton, 1898)
Acanthoxyla prasina (Westwood, 1859)
Argosarchus horridus (White, 1846)
Acanthoxyla geisovii (Kaup, 1866)
Acanthoxyla inermis Salmon, 1955
Clitarchus hookeri (White, 1846)

Mantids

Ameles heldreichi Brunner, 1882
Brunneria borealis Scudder, 1896
Litaneutria minor Scudder, 1896
Litaneutria borealis Brunner, 1893
Mantis religiosa (Linnaeus, 1758)
Miomantis caffra Saussure, 1871
Oligonicella scudderi Saussure, 1870
Orthodera heldreichi novaezealandiae Colenso, 1882
Tenodera sinensis Saussure, 1871
Yersiniops solitaries (Scudder, 1896)

Scorpions

None of the species of scorpions included in this risk assessment have been found to have potential for establishment in Norway.

Tarantulas

Aphonopelma chalcodes Chamberlin, 1940
Aphonopelma iodius (Chamberlin & Ivie, 1939)
Aphonopelma mareki Hamilton, Hendrixson & Bond, 2016
Aphonopelma marxi species group *sensu* Hamilton et al. 2016 (6 species)
Bistriopelma lamasi Kaderka, 2015 and *Bistriopelma matuskai* Kaderka, 2015
Euathlus Ausserer, 1875 (6 species)
Hapalotremus albipes Simon, 1903
Phrixotrichus scrofa (Molina, 1788)
Phrixotrichus vulpinus (Karsch, 1880)

However, after conducting full assessments of the above-mentioned species, we conclude that only the mantids *Mantis religiosa* and *Orthodera heldreichi novaezealandiae* can potentially impact Norwegian ecosystems and its native fauna. These species have been categorized as having moderate risk. All other species included in this risk assessment have been categorized as either having low probability of establishment, or, if assessed further, low risk of negative impact on Norwegian biodiversity.

7 Data gaps

- We lack detailed knowledge of species distribution for the majority of the taxa assessed in this report. Species collected only once are especially problematic.
- We need knowledge of the biology and ecology of focal taxa, including climatic preferences/tolerance.
- With respect to taxonomy, there is a need for further taxonomic research and for stabilization of species names within the focal taxa groups. There are known (even, traded) undescribed species in at least some of the assessed genera or species groups (e.g. the Chilean *Euathlus* tarantulas and New Zealand *Micrarchus* phasmids). Scientific names being used for some commercially and privately traded species that are risk assessed here are no longer valid.

8 Additional information

The terms of reference states request that any known negative effects on biodiversity of the exporting country be stated in the report. Furthermore, any known effects on ecosystem services should be mentioned. In cases where taxa are likely to affect ecosystem services or may be particularly affected by climate change beyond the specified time frame, this should be stated in the report.These factors should, however, were not be included as a part of the actual risk assessment.

8.1 Impact of climate beyond a 50-years perspective

Given the expected climate warming beyond a 50-years perspective, we can expect that more of the species considered in this report will be able to establish viable populations in Norway.

8.2 Ecosystem services

Human well-being depends on wide array of benefits derived from natural ecosystem processes, such as production of materials for food, shelter, or medicine, provision of clean water and clean air, nutrient cycling, and flood regulation (Hassan et al., 2005; McLaughlan et al., 2014), and hence their are growing worries about the potential wide-reaching impacts of invasive non-native species (Gutiérrez et al., 2014; Simberloff and Von Holle, 1999; van Wilgen et al., 2008). However, the direct and indirect consequences of invasive aliens are difficult to measure and even more difficult to predict (Lockwood et al., 2013; Simberloff, 2011a; Simberloff, 2013). Indeed, a recent review of impacts on ecosystem services of Europe's 10 worst invasive species concluded that their were few well documented negative effects, and that a number of species were positive for ecosystems and human well-being such as bivalves which improve water quality (McLaughlan et al. 2013). The authors found that negative impacts were often assumed rather than demonstrated. Thus, it is difficult to predict the overall ecosystem impacts of invasive arthropods from our focal groups.

There is very little information about parasites and diseases in phasmids. But as for most animals there are reports of infectious diseases (Perez-Ruiz et al., 2015; Rapp, 1995) and nematodes (Yeates and Buckley, 2009) and dipteran (Pawlowski and Kraemer, 2008) parasites. Whether these infections and parasites are generalists able to infect other insects or species/phasmid-specific is not known. Diseases and parasites seem however, not to be part of the general discussion among enthusiasts, suggesting that it is not a major problem in animals kept as pets

8.3 Negative impacts on biodiversity of the exporting country

8.3.1 Phasmids

No phasmids are listed in CITES appendices. Eight species of phasmids are, however, listed in the IUCN red list of species: *Carausius alluaudi, C. gardineri, C. sechellensis* and *Phyllium bioculatum* have the status "least concern", *Graffaea seychellensis* is "endangered", *Carausius scotti* and *Dryococelus australis* are considered "critically endangered" and *Pseudobactricia ridleyi* "extinct".

All but *P. ridleyi*, previously found in Singapore, are native to the Seychelles, suggesting that the available information about that species is incomplete. However, of interest here is the Seychellean variant of *P. bioculatum*. IUCN describes the species' distribution as being only a few islands on the Seychelles, while speciesfile includes Borneo, China, India, Java, Mauritius, Peninsular Malaysia, Seychelles, Singapore, Sri Lanka and Sumatra on their distribution map. Despite its apparently wide distribution, the IUCN regard the populations on the Seychelles as distinct enough to put it on their list. There is also a discrepancy between the common names used for this species within the IUCN (Seychelles leaf insect) and in the speciesfile database (Grey's leaf insect) that pose concern regarding the validity of the IUCN listing. *P. bioculatum* is in trade in Europe, but commercial pet trade depend on individuals reared in culture, as far as we know.

8.3.2 Mantids

Overharvesting of species that are locally or regionally threated or rare is problematic. Illegal harvesting of species can have severe effects on the biodiversity in their native environments. The rarity of most mantids remains unknown; only three species of mantids have been treated by IUCN. Of these, *Ameles fasciipennis* are on the Red List of Threatened Species as critically endangered (CR) (Battiston, 2014). In addition, the rarity of mantids has been assessed for the Euro-Mediterranean area based on reported abundances.

In the list below, **1** denotes extinction risk (species should not be harvested), **2** denote seriously threatened (species should not be harvested) and **3** is potential risk (harvest with care) (adopted from Battiston et al., 2010). *Ameles aegyptiaca* 2, *Ameles decolor* 3, *Ameles dumonti* 3, *Ameles fasciipennis* 2, *Ameles gracilis* 1, *Ameles kervillei* 3, *Ameles limbata* 1, *Ameles maroccana* 3, *Ameles massai* 2, *Ameles modesta* 3, *Ameles moralesi* 3, *Ameles nana* 3, *Ameles picteti* 3, *Ameles poggii* 3, *Ameles syriensis* 3, *Aptermonatis aptera* 2, *Apteromantis bolivari* 2, *Bolivaria kurda* 3, *Elaea gestroi* 3, *Empusa pennata* 3, *Empusa uvarovi* 2, *Geomantis algerica* 2, *Geomantis larvoides* 3, *Hierodula transcaucasica* 3, *Holaptilon pusillulum* 2, *Iris deserti* 3, *Iris polystictica* 3, *Miomantis ehrenbergi* 3, *Miomantis paykullii* 3, *Oxyothespis dumonti* 3, *Oxyothespis maroccana* 3, *Oxyothespis senegalensis* 3, *Oxyothespis tricolour* 3, *Paraseverinia finoti* 3, *Pareuthyphlebs occidentalis* 2, *Pareuthyphlebs* *palmoni* 2, *Perlamantis alliberti* 3, *Pseudoyersinia andreae* 2, *Pseudoyersinia betancuriae* 1, *Pseudoyersinia brevipennis* 1, *Pseudoyersinia canariensis* 1, *Pseudoyersinia inaspettata* 2, *Pseudoyersinia kabilica* 2, *Pseudoyersinia lagrecai* 2, *Pseudoyersinia occidentalis* 3, *Pseudoyersinia paui* 2, *Pseudoyersinia pilipes* 1, *Pseudoyersinia salvinae* 2, *Pseudoyersinia subapetra* 1, *Pseudoyersinia teydeana* 1, *Rivetina asiatica* 3, *Rivetina caucasica* 3, *Rivetina syriaca* 3, *Severinia granulata* 3, *Severinia lemoroi* 3, *Severinia ullrichi* 2, *Tenodera rungsi* 3.

8.3.3 Scorpions

Three species (*Pandinus imperator*, *Pandinus gambiensis* and *Pandinopsis dictator*) are the only scorpions listed by the CITES Appendix II since 1995, due to overexploitation for the pet trade (UNEP-WCMC, 2010). These three species are only distributed in West Africa.

Several other unprotected species are also harvested for export, especially *P. cavimanus* and *P. viatoris* in Tanzania. Even in countries with effective quotas, the origin of traded species, either from farms or from the wild, can't be determined. Besides overharvesting, the species are endangered by habitat destruction due to deforestation. Traded specimens are sometimes labelled "*Pandinus africanus*", which is an invalide synonym for *P. imperator*, a name which is apparently used on scorpions from West Africa to avoid CITES regulations for this species. However, other unlisted species are also traded under this name (Rein, 2010). These species have not yet been assessed for the IUCN Red List (http://www.iucnredlist.org).

8.3.4 Tarantulas

Few tarantulas have been evaluated by the IUCN. Twelve species are considered 'threatened' (classified as vulnerable, endangered, or critically endangered) and hence would be vulnerable to any further collecting. These include six species of *Poecilotheria* (parachute spiders, tiger spiders) from India and Sri Lanka, all three species of the Seychelles genus *Nesiergus*, *Grammostola vachoni* Schiapelli & Gerschman, 1961 from Argentina, and the Indian *Haploclastus kayi* Gravely, 1915.

Although few theraphosids are listed in Cites Appendix II, overharvesting of any species of large, slowly developing tarantulas is problematic. Illegal harvesting of some species has had severe effects on the biodiversity in their native environments. Spiders in the genus *Brachypelma* are large, often colorful desert-dwelling tarantulas which became extremely popular in the 1980s in the invertebrate pet trade. Dense populations are mainly in northern and central Mexico. Overcollecting and habitat degradation reduced populations dramatically, and all species are now listed as Cites II (Yáñez and Floater, 2000)http://checklist.cites.org/#/en). *Brachypelma albiceps* (Pocock, 1903) (Mexican golden red-rump) is Cites II listed but as *Aphonopelma albiceps*, though it was transferred to the former genus by Locht et al (2005). *Aphonopelma pallidum* (Pickard-Cambridge, 1897) (Chihuahua Rose-grey Tarantula, Mexican Grey Tarantula) was previously in *Brachypelma*, and is Cites II listed.

Almost nothing is known about the more temperate theraphosids. High altitude populations are likely to be small, if simply because their habitats must be smaller than they would be at lower elevations. Certainly, overharvesting would be a threat to them and their environments, but is very unlikely given that these species both are difficult to find and live in relatively inaccessible environments.

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Appendix I

Screening tables: All species screened in the current report are listed in the tables below

Phasmids: Initial screening infraorder Anareolatae

The initial screening of suborder Verophasmatodea is summarised below. Infraorder Anareolatae contains 2 families with 12 subfamilies and 304 genera in total. The initial screening is done solely based on climate conditions throughout the species' distributions. For the Phasmida we have used distribution maps provided by two internet resources; http://phasmida.speciesfile.org/ (Brock at al. 2016). Taxa thriving solely in areas where the climate conditions deviates substantially from those found in Norway, even in a 50 year perspective, are categorised as "very unlikely" with low potential for establishment in Norway.

Family	Subfamily	Tribe	Genus	Species	Screening category
Diapheromeridae	Diapheromerinae	Diapheromerini			Very unlikely
		Ocnophilini			Very unlikely
		Oreophoetini			Very unlikely
	Necrosciinae	Necrosciini	Calvisia	medogensis	Lack of information
			Lopaphus	angusticauda	Lack of information
				bootanicus	Lack of information
				sinensis	Lack of information
				unidentatus	Lack of information
				zayuensis	Lack of information
			Megalophasma	granulatum	Lack of information

Family	Subfamily	Tribe	Genus	Species	Screening category
			Micadina	brevioperculina	Very unlikely
				conifera	Very unlikely
				difficilis	Very unlikely
				fagi	Lack of information
				involuta	Very unlikely
				phluctainoides	Very unlikely
				yasumatsui	Very unlikely
			Necroscia	infelxipes	Lack of information
			Neohirasea	japonica	Very unlikely
			Neososibia		Very unlikely
			Nescicroa		Very unlikely
			Parasipyloidea	jinggangshanensis	Lack of information
			Parasosibia	microptera	Very unlikely
			Parastheneboea	foliculata	Very unlikely
				simianshanensis	Very unlikely
			Sinophasma	brevipenne	Very unlikely
				hainanensis	Very unlikely
				hoenei	Very unlikely
				klapperichi	Very unlikely
				largum	Very unlikely
				mirabile	Very unlikely
				obvium	Very unlikely
			Sipyloidea		Very unlikely

Family	Subfamily	Tribe	Genus	Species	Screening category
			Sosibia	brachyptera	Lack of information
				medogensis	Lack of information
			Trachythorax		Very unlikely
	Pachymorphinae	Gratidiini	Adelungella		Very unlikely
			Burria		Very unlikely
			Clonaria	beybienkoi	Lack of information
				inconspicua	Lack of information
			Gharianus		Very unlikely
			Gratidiinilobus		Very unlikely
			Ladakhomorpha		Very unlikely
			Leptynia		Very unlikely
			Linocerus		Lack of information
			Maransis		Very unlikely
			Paragongylopus		Very unlikely
			Phthoa		Very unlikely
			Pijnackeria		Very unlikely
			Sceptrophasma	bituberculatum	Lack of information
			Wattenwylia		Very unlikely
			Zangphasma		Very unlikely
			Zehntneria		Very unlikely
		Hemipachymorphini	Hemipachymorpha		Very unlikely

Family	Subfamily	Tribe	Genus	Species	Screening category
			Pseudopromachus		Very unlikely
			Spinotectarchus		Very unlikely
			Tectarchus	salebrosus	Potential ; found in New Zealand
		Pachymorphini	Acanthoderus		Very unlikely
			Asteliaphasma		Very unlikely
			Micrarchus	parvulus	Potential ; found in New Zealand
			Miniphasma		Very unlikely
			Niveaphasma	annulatum	Potential ; found in New Zealand
			Pachymorpha		Very unlikely
	Palophinae	Palophini	Bactrododema		Very unlikely
Phasmatidae	Cladomorphinae	Baculini			Very unlikely
		Cladomorphini			Very unlikely
		Cladoxerini			Very unlikely
		Cranidiini			Very unlikely
	Clitumninae	Clitumnini	Cuniculina		Very unlikely
			Ectentoria		Very unlikely
			Entoria	gracilis	Very unlikely
				ishigakiensis	Very unlikely
				japonica	Very unlikely
				magna	Very unlikely
				nuda	Very unlikely

Family	Subfamily	Tribe	Genus	Species	Screening category
				okinawaensis	Very unlikely
				wuyiensis	Very unlikely
			Erringtonia		Very unlikely
			Gongylopus		Very unlikely
			Lobofemora		Very unlikely
			Mesentoria		Very unlikely
			Metentoria		Very unlikely
			Parabaculum		Very unlikely
			Paraentoria		Very unlikely
			Paraleiophasma		Very unlikely
			Prosentoria		Very unlikely
			Ramulus	brunneus	Lack of information
				interdentatus	Very unlikely
				irregulariterdentatus	Lack of information
				nyalawense	Lack of information
				pingliense	Lack of information
				robinius	Very unlikely
				ussurianus	Lack of information
			Rhamphophasma	dianicum	Very unlikely
				japonicum	Lack of information
		Medaurini	Cnipsomorpha	apteris	Very unlikely

Family	Subfamily	Tribe	Genus	Species	Screening category
				cobrantis	Very unlikely
				erinacea	Very unlikely
			Interphasma	xinjiangense	Lack of information
			Medaura		Very unlikely
			Medauroidea		Very unlikely
			Parapachymorpha		Very unlikely
		Pharnaciini	Baculonistria		Very unlikely
			Pharnacia		Very unlikely
			Phobaeticus		Very unlikely
			Phryganistria		Very unlikely
			Tirachoidea		Very unlikely
	Extatosomatinae	Extatosomatini	Extatosoma		Very unlikely
	Lonchodinae	Eurycanthini			Very unlikely
		Lonchodini	Acanthomenexenus		Very unlikely
			Austrocarausius		Very unlikely
			Baculofractum		Very unlikely
			Breviphetes		Very unlikely
			Carausius		Very unlikely
			Chondrostethus		Very unlikely
			Cladomimus		Very unlikely
			Denhama		Very unlikely
			Echinothorax		Very unlikely
			Greenia		Very unlikely
			Hermagoras		Very unlikely

Family	Subfamily	Tribe	Genus	Species	Screening category
			Hyrtacus		Very unlikely
			Leprocaulinus		Very unlikely
			Lonchodes	huapingensis	Very unlikely
				parvus	Lack of information
			Lonchodiodes		Very unlikely
			Manduria		Very unlikely
			Matutumetes		Very unlikely
			Menexenus		Very unlikely
			Mithrenes		Very unlikely
			Mnesilochus		Very unlikely
			Mortites		Very unlikely
			Myronides		Very unlikely
			Paraprisomera		Very unlikely
			Pericentropus		Very unlikely
			Pericentrus		Very unlikely
			Periphetes		Very unlikely
			Phenacephorus		Very unlikely
			Phenacocephalus		Very unlikely
			Phraortes	chinensis	Very unlikely
				confucius	Very unlikely
				leishanensis	Very unlikely
				longshengensis	Very unlikely
				mikado	Very unlikely
				miyakoensis	Very unlikely

Family	Subfamily	Tribe	Genus	Species	Screening category
				nigricarinatus	Very unlikely
				similis	Very unlikely
				yonaguniensis	Very unlikely
				illepidus	Very unlikely
				koyansanensis	Very unlikely
				elongatus	Very unlikely
			Prisomera		Very unlikely
			Pseudostheneboea		Very unlikely
			Spinophetes		Very unlikely
			Stheneboea		Very unlikely
			Papuacocelus		Very unlikely
	Phasmatinae	Acanthomimini	Acanthomima		Very unlikely
			Anophelepis		Very unlikely
			Arphax		Very unlikely
			Mauritiophasma		Very unlikely
			Vasilissa		Very unlikely
		Acanthoxylini	Acanthoxyla	geisovii	Unlikely-very likely
				inermis	Unlikely-very likely
				prasina	Unlikely-very likely
			Argosarchus	horridus	Unlikely-very likely
			Clitarchus	hookeri	Unlikely-very likely
				rakauwhakanekeneke	Very unlikely
				tepaki	Very unlikely
			Pseudoclitarchus	sentus	Very unlikely

Family	Subfamily	Tribe	Genus	Species	Screening category
			Tepakiphasma	ngatikuri	Very unlikely
		Phasmatini	Acrophylla		Very unlikely
			Anchiale		Very unlikely
			Cigarrophasma		Very unlikely
			Ctenomorpha		Very unlikely
			Eurycnema		Very unlikely
			Onchestus		Very unlikely
			Paractenomorpha		Very unlikely
			Paracyphocrania		Very unlikely
			Paronchestus		Very unlikely
			Peloriana		Very unlikely
			Phasma		Very unlikely
	Platycraninae	Platycranini	Acanthograeffea		Very unlikely
			Apterograeffea		Very unlikely
			Davidrentzia		Very unlikely
			Echetlus		Very unlikely
			Elicius		Very unlikely
			Erastus		Very unlikely
			Graeffea		Very unlikely
			Megacrania		Very unlikely
			Ophicrania		Very unlikely
			Platycrana		Very unlikely
			Redtenbacherus		Very unlikely
			Xenomaches		Very unlikely

Family	Subfamily	Tribe	Genus	Species	Screening category
	Tropidoderinae	Gigantophasmatini	Gigantophasma		Very unlikely
		Monandropterini	Heterophasma		Very unlikely
			Monandroptera		Very unlikely
			Rhaphiderus		Very unlikely
		Tropidoderini	Lysicles		Very unlikely
			Melandania		Very unlikely
			Micropodacanthus		Very unlikely
			Parapodacanthus		Very unlikely
			Paratropidoderus		Very unlikely
			Podacanthus		Very unlikely
			Tropidoderus		Very unlikely
			Didymuria		Very unlikely
	Xeroderinae	Xeroderini	Caledoniophasma		Very unlikely
			Cnipsus		Very unlikely
			Cotylosoma		Very unlikely
			Dimorphodes		Very unlikely
			Epicharmus		Very unlikely
			Leosthenes		Very unlikely
			Nisyrus		Very unlikely
			Xenophasmina		Very unlikely
			Xeroderus		Very unlikely
		Achriopterini	Achrioptera		Very unlikely
			Glawiana		Very unlikely
		Stephananacridini	Diagoras		Very unlikely

Family	Subfamily	Tribe	Genus	Species	Screening category
			Eucarcharus		Very unlikely
			Hermarchus		Very unlikely
			Macrophasma		Very unlikely
			Nesiophasma		Very unlikely
			Phasmotaenia		Very unlikely
			Sadyattes		Very unlikely
			Stephanacris		Very unlikely
			Monoiognosis		Very unlikely
			Spathomorpha		Very unlikely

Initial screening of infraorder Areolatae

The initial screening of suborder Verophasmatodea is summarised below. Infraorder Areolatae contains four superfamilies with nine families and 158 genera in total. The initial screening is done solely based on climate conditions throughout the species' distributions. For the Phasmida we have used distribution maps provided by two internet resources; http://phasmida.speciesfile.org/ (Brock at al. 2016). Taxa thriving solely in areas where the climate conditions deviates substantially from those found in Norway, even in a 50 year perspective, are categorised as "very unlikely" with low potential for establishment in Norway

Superfamily	Family	Subfamily	Tribe	Genus	Species	Screening category
Agathemerodea	Agathemeridae	Agathemerinae	Agathemerini	Agathemera	(all 8 species)	Potential
Aschiphasmatoidea	Aschiphasmatidae	Aschiphasmatinae	Aschiphasmatini	Abrosoma		Very unlikely
				Anoplobistus		Very unlikely
				Aschiphasma		Very unlikely
				Chlorobistus		Very unlikely
				Coloratobistus		Very unlikely
				Dallaiphasma		Very unlikely
				Dinophasma		Very unlikely
				Eurybistus		Very unlikely
				Kerabistus		Very unlikely
				Leurophasma	dolichocercum	Unlikely-very likely
				Ommatopseudes		Very unlikely
				Orthomeria		Very unlikely
				Parabrosoma		Very unlikely
				Presbistus		Very unlikely
			Dajacini			Very unlikely

Superfamily	Family	Subfamily	Tribe	Genus	Species	Screening category
	Damasippoididae					Very unlikely
	Prisopodidae	Korinninae				Very unlikely
		Prisopodinae	Paraprisopodini			Very unlikely
			Prisopodini			Very unlikely
Bacilloidea	Anisacanthidae					Very unlikely
	Bacillidae	Antongiliinae				Very unlikely
		Bacillinae	Bacillini	Bacillus	atticus	Unlikely-very likely
					grandii	Very unlikely
					inermis	Lack of information
					lynceorum	Very unlikely
					lynceorum	Very unlikely
					rossius	Unlikely-very likely
					whitei	Unlikely-very likely
				Clonopsis	algerica	Very unlikely
					felicitatis	Very unlikely
					gallica	Unlikely-very likely
					maroccana	Very unlikely
					soumiae	Very unlikely
			Phalcini			Very unlikely
		Macyniinae				Very unlikely
	Heteropterygidae					Very unlikely

Superfamily	Family	Subfamily	Tribe	Genus	Species	Screening category
Phyllioidea	Phylliidae	Phylliinae	Nanophylliini			Very unlikely
			Phylliini	Chitoniscus		Very unlikely
				Microphyllium		Very unlikely
				Phylliini		
				Subgenus Phyllium	athanysus	Very unlikely
					bilobatum	Very unlikely
					bonifacioi	Very unlikely
					caudatum	Very unlikely
					celebicum	Very unlikely
					drunganum	Very unlikely
					elegans	Very unlikely
					ericoriai	Very unlikely
					gantungense	Very unlikely
					geryon	Very unlikely
					hausleithneri	Very unlikely
					jacobsoni	Very unlikely
					mabantai	Very unlikely
					mamasaense	Very unlikely
					mindorense	Very unlikely
					monteithi	Very unlikely
					palawanense	Very unlikely
					parum	Very unlikely
					philippinicum	Very unlikely
					rarum	Very unlikely

Superfamily	Family	Subfamily	Tribe	Genus	Species	Screening category
					rayongii	Very unlikely
					riedeli	Very unlikely
					siccifolium	Very unlikely
					telnovi	Very unlikely
					tibetense	Lack of information
					tobeloense	Very unlikely
					westwoodii	Very unlikely
					woodi	Very unlikely
					yunnanense	Very unlikely
					zomproi	Very unlikely
				Subgenus Pulchriphyllium		Very unlikely
Pseudophasmatoidea						Very unlikely
Timematoidea	Timematidae	Timematinae	Timematini	Timema		Very unlikely

Initial screening of Mantids

The table shows the potential likelihood that species within the order Mantodea can survive in nature in Norway. The likelihood for survival was assessed based on a comparison between the climate where the taxa presently can be found and the climate in Norway now and in 50 years. The species mentioned in the table were selected for the assessment based on an initial screening of all 2400 species within the order. Note that detailed information on the species distributions could not be found for some of the species (denoted *Lack of information* in the table). These are mostly species with a distribution in regions with highly variable altitude.

Family	Subfamily	Genus	Species	Synonym	Screening category
Acanthopidae	Acanthopinae				Very unlikely
	Acontistinae				Very unlikely
	Stenophyllinae				Very unlikely
Amorphoscelidae	Amorphoscelinae				Very unlikely
	Paraoxypilinae				Very unlikely
	Perlamantinae	*Perlamantis*	*alliberti*	*Discothera tunetana*	Very unlikely Voisin 2003; Grosso-Silva and Soares-Vieira 2004, Felpete 2014
Chaeteessidae	Chaeteessinae				Very unlikely
Empusidae	Blepharodinae				Very unlikely
	Empusinae	*Empusa*	*fasciata*	*E. longicollis*	Very unlikely Battiston and Massa 2008, Battiston et al 2010

Family	Subfamily	Genus	Species	Synonym	Screening category
			pennata	*E. brachyptera, E. clavata, E. egena, E. europaea, E. humbertiana, E. occidentalis, E. pauperata, E. pectinata, E. servillii, E. spuria, E. tricornis, E. unicornis, E. variabilis*	Very unlikely Battiston et al 2010. Ehrmann. 2002
Eremiaphilidae	Eremiaphilinae				Very unlikely
Galinthiadidae					Very unlikely
Hymenopodidae	Acromantinae	*Acromantis*	*elegans*		Lack of information Ehrmann and Borer 2015
			grandis		Lack of information Ehrmann and Borer 2015
	Hymenopodinae				Very unlikely
		Ephestiasula	*obscura*	*Parahestiasula obscura*	Lack of information Ehrmann and Borer 2015
	Phyllocraniinae				Very unlikely
	Phyllothelyinae				Very unlikely
	Sibyllinae				Very unlikely
Iridopterygidae	Hapalomantinae				Very unlikely
	Iridopteryginae				Very unlikely

Family	Subfamily	Genus	Species	Synonym	Screening category
	Nanomantinae	*Sceptuchus*	*baehri*		Lack of information Ehrmann and Borer 2015
	Nilomantinae				Very unlikely
	Tropidomantinae				Very unlikely
Liturgusidae	Liturgusinae				Very unlikely
Mantidae	Amelinae	*Ameles*	*abjecta*	*A. abiecta* *A. brevis* *A. spallanzania*	Very unlikely Ehrmann 2002, Keen 2006, Agabiti et al 2010
				Oxypilinae	Very unlikely Ehrmann 2002, Agabiti et al 2010
			decolor		Very unlikely Ehrmann 2002, Voisin 2003, Keen 2006
			fasciipennis		Very unlikely Ehrmann 2002, Agabiti et al. 2010

Family	Subfamily	Genus	Species	Synonym	Screening category
			heldreichi	*A. cypria, A. heldreichii, Parameles heidreichi, P. turica* *P. picteti, Apterameles rammei*	Unlikely-very likely Agabiti et al. 2010, Ehrmann 2002, Breckle et al. 2008
			nana	*A. brevis, Mantis nana,* *Parameles nana*	Very unlikely Agabiti et al. 2010, Ehrmann 2002, Battiston et al 2010
			paradecolor		Very unlikely Agabiti et al. 2010
			picteti		Very unlikely Agabiti et al. 2010, Ehrmann 2002
			soror	Not a valid species?	Very unlikely Ehrmann 2002, Agabiti et al 2010
			spallanzania	*A. nana, A. brevis, A. soror*	Very unlikely Ehrmann 2002, Agabiti et al 2010

Family	Subfamily	Genus	Species	Synonym	Screening category
			taurica	Not a valid species? See *A. heidreichi*	Unlikely-very likely Ehrmann 2002, Agabiti et al 2010
		Apteromantis	*aptera*	*Ameles aptera*	Very unlikely Grosso-Silva and Soares-Vieira 2004, Battiston et al. 2010
		Litaneutria	*borealis*	*Ameles borealis*	Unlikely-very likely Otte et al 2016
			longipennis		Very unlikely , Otte et al. 2016
			minor	*Stagmatoptera minor, Tithrone corseuli, T. clauseni*	Unlikely-very likely Eaton and Kaufman 2007, Scudder, 2013; Agudelo and Rivera 2015
			obscura		Very unlikely Otte et al. 2016
			skinneri		Very unlikely Otte et al. 2016

Family	Subfamily	Genus	Species	Synonym	Screening category
		Pseudoyersinia	*andreae*		Very unlikely Galvagni 1976, Otte et al 2016
			brevipennis		Very unlikely Defaut et al 2004, Ehrmann 2002
			lagrecai		Very unlikely Lombardo 1984, Ehrman 2002
			paui		Very unlikely Otte et al 2016. Battiston et al. 2010
		Yersiniops	*solitarius*	*Yersinia solitaria, Litaneutria minor*	Unlikely-very likely Ehrmann 2002, Hebard 1909. Otte et al. 2016
			sophronicus	*Yersiniops saphronica, Yersinia sophronica*	Very unlikely Otte et al. 2016, Otte et al. 1997
	Angelinae				Very unlikely
	Antemninae	*Alluandella*	*himalayensis*		Lack of information
	Choeradodinae				Very unlikely
	Chroicopterinae				Very unlikely

Family	Subfamily	Genus	Species	Synonym	Screening category
	Compsothespinae				Very unlikely
	Deroplatyinae				Very unlikely
	Dystactinae	*Armene*	*breviptera*		Lack of information Ehrman 2002, Hallan 2008, Otte et al. 2016
			fanica		Lack of information Ehrman 2002, Hallan 2008, Otte et al. 2016
			griseolata		Lack of information Ehrman 2002, Hallan 2008, Otte et al. 2016
			hissarica		Lack of information Ehrman 2002, Hallan 2008, Otte et al. 2016
			pusilla		Lack of information Ehrman 2002, Hallan 2008, Otte et al. 2016
			robusta		Lack of information Ehrman 2002, Hallan 2008, Otte et al. 2016

Family	Subfamily	Genus	Species	Synonym	Screening category
			seravshanica		Lack of information Ehrman 2002, Hallan 2008, Otte et al. 2016
			silvicola		Lack of information Ehrman 2002, Hallan 2008, Otte et al. 2016
	Mantinae	*Mantis (Mantes)*	*macroalata*		Lack of information Ehrman 2002, Hallan 2008, Otte et al. 2016
			macrocephala	*Mantts macrocephala*	Lack of information Ehrman 2002, Hallan 2008, Otte et al. 2016
			religiosa	*M. religiosus, M. sancta, M. striata, M. maroccana, M. pia, M. radiata, M. capensis, M. prasina, M. griveaudi, Gryllus religiosus*	Unlikely-very likely Voisin 2003, Eaton and Kaufman 2007, Ehrman 2002, Battiston et al 2010, Battiston and Massa 2008, Cannings 2007
			Splendida		Lack of information

Family	Subfamily	Genus	Species	Synonym	Screening category
		Hierodula	*tenuidentata*		Lack of information Hallan 2008, Otte et al. 2016
		Sphodromantis	*viridis*	*S. bimaculata, S. cavibrachia, S. guttata, S. vischeri, Mantis bimaculata, M. bloculata, M. guttata, Stagmatoptera vischeri*	Very unlikely Ehrmann 2002, Otte et al. 2016
		Tenodera	*sinensis*	*Tenodera aridifolia*	Unlikely-very likely Beckman and Hurd, 2003, Blatchley 1920, Whitney 2004
			intermedia	*Tenodera australasiae*	Very unlikely
	Mellierinae				Very unlikely
	Miomantinae	*Bolivaria*	*amnicola*		Very unlikely Otte et al. 2016, Hallan 2008
			xanthoptera	*Mantis xanthoptera*	Lack of information Hallan 2008, Otte et al. 2016
		Geomantis	*larvoides*		Very unlikely Jaskuła 2014, Battiston et al. 2010

Family	Subfamily	Genus	Species	Synonym	Screening category
		Miomantis	*caffra*		Unlikely-very likely Ramsay 1990, Fea 2011, Marabuto 2014
		Rivetina	*baetica*	*Mantis baetica, M. fasciata, M. maculipennis, M. pallasii, Fischeria baetica*	Very unlikely Sánchez-Vialas et al. 2015, Battiston et al 2010
			caucasica	*Iris caucasica, Fischeria caucasica, Eufischeriella caucasica, Kinzelbachia ragnari*	Lack of information Battiston and Massa 2008, Otte et al. 2016
			balcanica		Very unlikely Otte et al 2016
			beybienkoi		Lack of information Otte et al. 2015, Hallan 2008
			compacta		Lack of information Hallan 2008, Otte et al. 2015
			crassa		Lack of information Hallan 2008, Otte et al. 2016

Family	Subfamily	Genus	Species	Synonym	Screenin g category
			karadumi		Lack of information Otte et al. 2016; Hallan 2008
			monticola		Lack of information Otte et al. 2016; Hallen 2008
			karateginica		Lack of information Otte et al. 2016; Hallen 2008
			nana		Lack of information Kazakhstan . Otte et al. 2016; Hallen 2008
			parva		Lack of information Otte et al. 2016; Hallen 2008
			pulisangini		Lack of information Otte et al. 2016; Hallen 2008
			similis		Lack of information Otte et al. 2016; Hallen 2008
			syrica	*Iris syriaca, Fischeria festae*	Lack of information Otte et al. 2016; Hallen 2008

Family	Subfamily	Genus	Species	Synonym	Screening category
			tarda	*Rivetma tarda*	Lack of information Otte et al. 2016; Hallen 2008
			varsobica	*Rivetma varsobica*	Lack of information Otte et al. 2016; Hallen 2008
	Orthoderinae	*Orthodera*	*novaezealandiae*	*Mantis novaezealandiae*, *Tenodera intermedia*	Unlikely-very likely Ramsay (1990)
	Oxyothespinae	*Severinia*	*mistshenkoi*		Lack of information Hallan 2008, Otte et al. 2016
			obscurus		Lack of information Hallan 2008, Otte et al. 2016
	Photinainae	*Brunneria*	*borealis*		Unlikely-very likely Hallan 2008, Otte et al 2016. Taber and Fleenor 2003, James and Hebard 1909
	Schizocephalinae				Very unlikely
	Stagmatopterinae				Very unlikely
	Vatinae				Very unlikely
Mantoididae	Mantoidinae				Very unlikely

Family	Subfamily	Genus	Species	Synonym	Screening category
Metallyticidae	Metallyticinae				Very unlikely
Tarachodidae	Caliridinae				Very unlikely
	Tarachodinae	*Iris*	*oratoria*	*I. bella, I.dentata, I. minima*	Very unlikely Battiston et al 2010, Kment 2012
			orientalis		Lack of information Ehrmann and Borer 2015.
			polystictica		Very unlikely Battiston and Massa 2008
Thespidae	Hoplocoryphinae				Very unlikely
	Miopteryginae				Very unlikely
	Oligonicinae	*Oligonicella*	*scudderi*	*O. missouriensis, O. bolliana, Oligonyx uhleri, Oligonyx scudderi, Oligonyx bolliana*	Unlikely-very likely Otte et al 2016, Taber and Fleenor 2003
	Pseudomiopteriginae				Very unlikely
	Thespinae				Very unlikely
Toxoderidae	Toxoderinae				Very unlikely

Initial screening of Scorpiones

The results of the initial screening for order Scorpiones is presented below. Screening of five genera in the Pandinus complex and the genus Heterometrus in the subfamily Scorpioninae in the family Scorpinidae. These six genera contain 80 species in total. The screening is done solely based on climate conditions throughout the species' distributions. For the scorpions we have used information provided by the internet resource http://www.ntnu.no/ub/scorpion-files/scorpionidae.php (Rein 2015a), and the publications Kovarik (2009) and Rossi (2015). We have also had personal communications with Jan Ove Rein. Taxa thriving solely in areas where the climate conditions deviates substantially from those found in Norway, even in a 50 year perspective, is given screening category unlikely to be able to establish in Norway and was not assessed any further.

Family	Subfamily	Genus	Species	Distribution	Screening category
Scorpionidae	Scorpioninae	Pandinoides	cavimanus	Tanzania	Very unlikely
			platycheles	Ethiopia, Somalia	Very unlikely
		Pandinops	bellicosus	Ethiopia, Somalia	Very unlikely
			colei	Ethiopia, Somalia	Very unlikely
			eritreaensis	Ethiopia, Somalia, Eritrea	Very unlikely
			hawkeri	Ethiopia, Somalia	Very unlikely
			peeli	Somalia	Very unlikely
			pococki	Somalia	Very unlikely
		Pandinopsis	dictator	West Africa	Very unlikely
		Pandinurus	arabicus	Yemen	Very unlikely
			awashensis	Ethiopia	Very unlikely
			bartolozzii	DR Congo	Very unlikely
			cianferonii	Somalia	Very unlikely
			exitialis	Ethiopia, Somalia	Very unlikely
			flagellicauda	DR Congo	Very unlikely
			gregoryi	Kenya, Somalia ?	Very unlikely
			janae	Yemen	Very unlikely
			lorenzoi	Tanzania	Very unlikely
			lowei	DR Congo	Very unlikely
			magrettii	Eritrea, Ethiopia	Very unlikely
			meidensis	Somalia	Very unlikely
			nistriae	Djibouti, Ethiopia ?	Very unlikely
			pallidus	Somalia	Very unlikely
			pantinii	Malawi	Very unlikely
			percivali	Yemen	Very unlikely
			prendinii	South Africa	Very unlikely
			pygmaeus	DR Congo	Very unlikely
			somalilandus	Somalia	Very unlikely
			sudanicus	Sudan	Very unlikely
			vachoni	Tchad	Very unlikely
			viatoris	DR Congo, East Africa	Very unlikely
		Pandinus	boschisi	Somalia	Very unlikely
			camerounensis	Cameroon	Very unlikely
			gambiensis	Gambia, Senegal	Very unlikely
			imperator	West Africa	Very unlikely
			mazuchi	Ethiopia	Very unlikely
			nistriae	Cameroon	Very unlikely

Family	Subfamily	Genus	Species	Distribution	Screening category
			phillipsii	Somalia	Very unlikely
			riccardo	Ethiopia	Very unlikely
			roeseli	Cameroon	Very unlikely
			smithi	Somalia, Ethiopia	Very unlikely
			trailini	Ethiopia	Very unlikely
			ugandaensis	Uganda	Very unlikely
			ulderigoi	Central African Republic	Very unlikely
		Heterometrus	atrascorpius	India	Very unlikely
			beccaloniae	India	Very unlikely
			bengalensis	India, Bangladesh ?	Very unlikely
			cimrmani	Thailand, Vietnam	Very unlikely
			cyaneus	Indonesia, Philippines	Very unlikely
			flavimanus	India	Very unlikely
			fulvipes	India	Very unlikely
			gravimanus	India, Sri Lanka	Very unlikely
			indus	India	Very unlikely
			kanarensis	India	Very unlikely
			keralaensis	India	Very unlikely
			laoticus	Cambodia, Laos, Thailand, Vietnam	Very unlikely
			latimanus	India	Very unlikely
			liangi	Vietnam	Very unlikely
			liophysa	Indonesia	Very unlikely
			liurus	India	Very unlikely
			longimanus	Indonesia, Malaysia, Phillipines	Very unlikely
			madraspatensis	India	Very unlikely
			mysorensis	India	Very unlikely
			nepalensis	Nepal	Very unlikely
			petersii	Cambodia, Vietnam, Phillipines	Very unlikely
			phipsoni	India	Very unlikely
			rolciki	India	Very unlikely
			scaber	India	Very unlikely
			sejnai	Thailand	Very unlikely
			spinifer	Malaysia, Vietnam, Cambodia ? Thailand ?	Very unlikely
			swammerdami	India, Sri Lanka	Very unlikely
			telanganaensis	India	Very unlikely
			thorellii	Myanmar	Very unlikely
			tibetanus	Tibet	Lack of information
			tristis	India	Very unlikely
			ubicki	India	Very unlikely
			wroughtoni	India	Very unlikely
			xanthopus	India	Very unlikely

Family	Subfamily	Genus	Species	Distribution	Screening category
					Very unlikely

Initial screening Tarantulas

Initial screening for the assessment of 969 species and 132 genera of Theraphosidae (infraorder Mygalamorphae). The screening was based solely on a comparison between the climate found in the organism's current habitat and Norway.Taxonomy and systematics follow the World Spider Catalog v. 17.0 (http://www.wsc.nmbe.ch); The Tarantula Bibliography (http://exoticfauna.com/tarantulabibliography/) gives a region ("Costa Rica to Brazil"), country ("USA") or area within a country ("Western Ghat, India") for which each species has been recorded. Species found in regions, countries or areas with no cold environments (at least some nights well under freezing) were listed as unlikely to establish in Norwegian climate and not investigated further. For species from localities in which cold environments do occur, taxonomic literature was consulted (World Spider Catalog 2016) to see where the species was actually collected, and climate maps and meteorological websites were consulted. The 20 species collected from areas which seemed likely to experience at least some weeks of subzero temperatures were then assessed in detail (see chapter 3 and Appendix IV). The default source is the two websites cited above, used in combination. Where additional taxonomic works had to be consulted, these are given in the Additional Sources column.

Infraorder	Family	Subfamily	Genus	Species	Screening category	Additional Sources
Mygalomorphae	THERAPHOSIDAE	Aviculariinae			Very unlikely	West et al. 2008

Infraorder	Family	Subfamily	Genus	Species	Screening category	Additional Sources
		Eumenophorinae			Very unlikely	
		Harpactirinae			Very unlikely	
		Ischnocolinae			Very unlikely	Guadanucci 2007; Guadanucci & Gallon 2008
		Ornithoctoninae			Very unlikely	Zhu & Zhong 2008; Smith & Jacobi 2015
		Schismatothelinae			Very unlikely	Guadanucci & Weinmann 2014
		Selenocosmiinae			Very unlikely	Zhu & Zhong 2008, Keswani & Vankhede 2012, West et al. 2012, Hirst 1907, Schmidt & von Wirth 1996
		Selenogyrinae			Very unlikely	
		Stromatopelminae			Very unlikely	
		Theraphosinae	Acanthoscurria		Very unlikely	
			Aenigmarachne		Very unlikely	
			Agnostopelma		Very unlikely	
			Aguapanela		Very unlikely	

Infraorder	Family	Subfamily	Genus	Species	Screening category	Additional Sources
			Aphonopelma		Unlikely-very likely	
			Ami		Very unlikely	Kaderka 2014
			Bistriopelma		Unlikely-very likely	Kaderka 2015a
			Brachypelma		Very unlikely	
			Bonnetina		Very unlikely	
			Bumba		Very unlikely	
			Cardiopelma		Very unlikely	
			Catanduba		Very unlikely	
			Chromatopelma		Very unlikely	
			Citharacanthus		Very unlikely	
			Clavopelma		Very unlikely	
			Cotztetlana		Very unlikely	
			Crassicrus		Very unlikely	
			Cubanana		Very unlikely	
			Cyclosternum		Very unlikely	
			Cyriocosmus		Very unlikely	Kaderka 2015b
			Cyrtopholis		Very unlikely	
			Euathlus		Unlikely-very likely	Perafán & Pérez-Miles 2014a
			Eupalaestrus		Very unlikely	Perafán & Pérez-Miles 2014a
			Grammostola		Very unlikely	Ferretti et al 2013, Bucherl 1951, Ferretti et al. 2011

Infraorder	Family	Subfamily	Genus	Species	Screening category	Additional Sources
			Hapalopus		Very unlikely	
			Hapalotremus		Unlikely-very likely	Cavallo & Ferretti 2014
			Hemirrhagus		Very unlikely	Mendoza 2014
			Homoeomma		Very unlikely	Gerschman & Schiapelli 1972
			Kochiana		Very unlikely	
			Lasiodora		Very unlikely	Bertani 2001
			Lasiodorides		Very unlikely	
			Longilyra		Very unlikely	
			Magulla		Very unlikely	
			Megaphobema		Very unlikely	Smith 1991
			Melloleitaoina		Very unlikely	Perafán & Pérez-Miles 2014b
			Metriopelma		Very unlikely	
			Munduruku		Very unlikely	
			Mygalarachne		Very unlikely	
			Neostenotarsus		Very unlikely	
			Nesipelma		Very unlikely	
			Nhandu		Very unlikely	Bertani 2001
			Ozopactus		Very unlikely	
			Pamphobeteus		Very unlikely	
			Phormictopus		Very unlikely	
			Phrixotrichus		Unlikely-very likely	Perafán & Pérez-Miles 2014a, Ferretti 2015

Infraorder	Family	Subfamily	Genus	Species	Screening category	Additional Sources
			Plesiopelma		Very unlikely	
			Proshapalopus		Very unlikely	Bertani 2001
			Pseudhapalopus		Very unlikely	
			Pterinopelma		Very unlikely	
			Reversopelma		Very unlikely	
			Schizopelma		Very unlikely	
			Sericopelma		Very unlikely	
			Sphaerobothria		Very unlikely	
			Stichoplastoris		Very unlikely	
			Theraphosa		Very unlikely	
			Thrixopelma		Very unlikely	
			Tmesiphantes		Very unlikely	
			Vitalius		Very unlikely	Bertani 2001
			Xenesthis		Very unlikely	
Thrigmopoeinae					Very unlikely	Mirza et al. 2011

Appendix II

Specific changes made to the original version of the GB-NNRA questionnaire.

EU chappeau: Removed entirely as our focal area is Norway solely

Section A: Removed entirely, we have developed a tailored initial screening procedure for our purpose

Section B: Several aspects are deleted entirely, some are subject to minor alterations and some are merged together to better fit the purpose. In all instances "Europe" is changed to "Norway". We have removed all questions related to economic impact as none of the species have documented invasion histories in areas with climate conditions resembling Norway. For the sections "Probability of spread" and "Probability of impact" the questions have been rephrased to improve the language and to increase precision, and to make them better suited for this type of particular risk assessment. The scale of responses here is also changed and now follows the scale used in most of the questions under "Probability of entry" and "Probability of establishment". The scale of "Uncertainty" is reduced to three levels: "low", "medium" and "high" as the available information on the species we assessed is too course to allow for a finer scale of uncertainty. See list of detailed alterations below.

Probability of entry

3.1. "active pathways" are changed to "known pathways"
3.2. For this assessment we treat all known pathways together so there is no repetition of the questions 1.3-1.10
3.3. As is
3.4. As is
3.5. Deleted, the pathway is always intentional
3.6. Deleted, the pathway is always intentional
3.7. Deleted, the pathway is always intentional
3.8. Deleted, the pathway is always intentional
3.9. As is (now numbered 1.5)
3.10. As is (here numbered 1.6)
3.11. As is (here numbered 1.7)

Probability of entry

3.12. As is (here numbered 1.8)
3.13. As is (here numbered 1.9)
3.14. As is (here numbered 1.10)
3.15. As is (here numbered 1.11)
3.16. Removed. None of the species assessed are requiring particular host organisms
3.17. Merged with 1.18 and 1.19 to form 1.12

3.18. Merged with 1.17 and 1.19 to form 1.12
3.19. Merged with 1.17 and 1.18 to form 1.12
3.20. Deleted, not applicable
3.21. Deleted, not applicable
3.22. Merged with 1.23 and 1.24 to form 1.13
3.23. Merged with 1.22 and 1.24 to form 1.13
3.24. Merged with 1.22 and 1.23 to form 1.13
3.25. As is (here numbered 1.14)
3.26. As is (here numbered 1.15)
3.27. As is (here numbered 1.16)

Probability of spread

2.1 Rephrased
2.2 Rephrased
2.3 Rephrased
2.4 Rephrased
2.5 Removed. None of the species assessed have established in Norway
2.6 Removed. None of the species assessed have established in Norway
2.7 Removed. None of the species assessed have established in Norway
2.8 Removed. None of the species assessed have established in Norway
2.9 Rephrased (here numbered 2.5)

Probability of impact

2.10 Removed. Impossible to assess economic impact based on the limited information available
2.11 Removed. Impossible to assess economic impact based on the limited information available
2.12 Removed. Impossible to assess economic impact based on the limited information available
2.13 Removed. Impossible to assess economic impact based on the limited information available
2.14 Removed. Impossible to assess economic impact based on the limited information available
2.15 Rephrased (here numbered 2.6)
2.16 Removed. None of the species are currently established in Norway
2.17 Removed. None of the species are currently established in Norway
2.18 Removed. None of the species are currently established in Norway
2.19 Removed. None of the species are currently established in Norway
2.20 Removed. None of the species are currently established in Norway
2.21 Removed. None of the species are currently established in Norway
2.22 Rephrased (here numbered 2.7)

2.23 Removed. None of the species taken through a full risk assessment are causing harm in their native range
2.24 Rephrased (here numbered 2.8)
2.25 Rephrased (here numbered 2.9)
2.26 Rephrased (here numbered 2.10)
2.27 Rephrased (here numbered 2.11)

Additional questions – climate change

3.1 As is, but added that we are assessing a 50 year perspective
3.2 Removed. The focal perspective is 50 years
3.3 As is, but added al list of aspects to be assessed (here numbered 3.2)

Additional questions – Research

Removed

Risk summaries

As is

Appendix III

Referat fra møte med høringsekspert Erik Myhre 11.01.16

I Zoohandelen omsettes det et begrenset antall arter, men privatimport, og omsetning, omfatter ett vesentlig høyere antall (kanskje opp mot 70 arter). I utlandet er handelen vesentlig større. Nettsiden www.terraristik.com (tysk side) sier noe om hva som omsettes av insekter, edderkopper og skorpioner. Entusiastene er opptatt av nye arter, og de som blir populære i handelen er ofte fargerike, har vakkert mønster og/eller er store. Disse avles og spres raskt blant entusiastene. ("dvergarter" som *Cyriocosmus*- og *Hapalopus*-arter er små juveler som har blitt svært populære blant entusiaster. Blant disse dukker det stadig opp nye arter i handelen). Nye arter dukker opp hele tiden, og det er flere eksempler på arter som har vært i handel som kjæledyr lenge før de blir vitenskapelig beskrevet. Ett viktig poeng her er at handel med taranteller (og andre dyr for terrarier) er svært dynamisk. Nye arter og grupper kommer inn, mens andre blir mindre populære. Ett annet eksempel er biller, som ikke er spesielt populært i Norge, men meget populært i Tsjekkia og Japan. Dette kan endre seg relativt raskt, da disse dyra er tilgjengelige på internett og kan bestilles direkte. Et generelt forbud, med en begrenset «positivliste» kan derfor raskt bli utdatert (merk også de andre gruppene på positivlista, for eksempel biller). Når det gjelder edderkopper er privatimport gjerne «spiderlings» (unger). Disse er ofte vanskelig å artsbestemme, og det skjer at det blir omsatt arter med feil identifikasjon, noe som først avdekkes når eksemplarene blir større. Det er ikke slik at når man bestiller spiderlings fra utlandet vet man ikke hva man får. Men feilidentifikasjon og sammenblandinger skjer jo også hos entusiaster. Å føre kontroll på privatimport kan derfor bli vanskelig når det er snakk om små eksemplarer. Mange arter omsettes bare under «hevdnavn» uten kjennskap til vitenskapelig navn. Omsetningen i zoohandelen baserer seg i stor grad på store, viltfangede eksemplarer. Privat import og omsetning mellom entusiaster baserer seg i stor grad på spiderlings og ungdyr som er avlet i fangenskap. Vet ikke om denne "todelingen" av handelen er interessant å ha med eller er viktig i denne sammenhengen. (Tror forøvrig at privat import (antall arter og eksemplarer) er større enn omsetningen i zoohandelen, men har ikke belegg for dette).

Andre typer edderkopper kan også være interessante for entusiaster og bør derfor vurderes å bli tatt inn på en positivliste.

Når det gjelder entusiastenes forhold til regelverket er det grunn til å tro at en «negativliste» vil bli respektert, forutsatt at denne er utarbeidet på et faglig grunnlag. I så måte vil et forbud på grunn av fare for spredning til Norsk natur kunne virke.

Min generelle holdning er at Taranteller generelt bør kunne importeres, selv om det finnes noen fjellarter fra kjøligere klima. Disse er ikke i handel, men kan eventuelt legges inn på en «negativliste».

Referat fra møte med høringsekspert Thor Håkonsen 22.1.16

Marked for handel med evertebrater i Norge er, som i resten av verden, svært dynamisk.

Det er for eksempel sånn at det er populært å importere og holde biller i både Sverige og Danmark, og selv om noen arter slik som nesehornbiller og fruktbiller handles med i Norge, så er ikke dette noe stort marked foreløpig. Thor Håkonsen har hatt 150 individer og 30 arter av knelere, men han er en av bare noen få som har holdt knelere i Norge. Thor ser heller ikke at de plutselig skal bli kjempepopulære på markedet i Norge nå.

Pris og utvalg gjør at entusiastene vanligvis ikke kjøper fra pet bransjen. De vanligste artene kan anskaffes gjennom profesjonell zoo-handel, men for entusiastene som gjerne ønsker et større utvalg av arter så er det stort sett privat import. Dette skjer via post. Det er generelt det latinske (vitenskapelige) navnet (så langt dette er kjent) som brukes blant entusiaster og innen profesjonell zoo-handel.

Handel gjennom norske zoo-butikker er veldig ofte feilidentifiserte (anekdotisk) – "alt" dette kommer gjennom Tropeimporten/Imazo AB i Sverige. Fra privat import er arter stort sett riktig identifisert. Handel ved privat i import omhandler ofte individer i stadie L3 og oppover, noen sjeldne ganger eggsekker. Zoohandel selger ofte subadulte eller voksne individer

Ved import av knelere så er det for det private markedet vanlig med organismer som er avlet i fangenskap. Det er et stort marked for dyr som er avlet i fangenskap, det arrangeres messer, blant annet flere store i Tyskland hvor det handles med reptiler men også med insekter og edderkoppdyr. Her har private aktører også ofte stand.

Da de fleste entusiaster kjøper dyr som er avlet i fangenskap er det mest sannsynlig ikke noe stort problem i forhold til at noen av artene kan være truet i sitt kjerneområde. Men de finnes jo eksempler, *Empusa pennata* kan være lokalt truet, og disse er det noen som holder.

De artene av knelere som er vanlige å holde er arter innen slektene *Hierodula*, *Sphodromantis* og *Tenodera*, som er de "store grønne knelerne", i tillegg er de såkalte blomsterknelerne populære. Disse er bl.a i slektene *Creobotra*, *Pseudocreobotra*, *Hymenopus* og *Blepharophis*. Den såkalte spøkelseskneleren (*Phyllocrania paradoxa*) er også populær.

Knelere er relativt enkle å holde – de krever korrekt temperatur, som ofte er romtemperatur eller noe over, samt noenlunde korrekt fuktighet. Dette er ikke vanskelig å få til i et lite terrarium. Det krever kun lys/varme og lett spraying ved jevne mellomrom (1-4 ganger i uka, alt etter hvilken fuktighet man vil ha). De foretrekker jevn temperatur og tåler generelt sett ikke store temperaturforandringer. Egg kan overleve forholdsvis kalde vintre, mens det er nymfer og voksne er mindre robuste.

Ameles (én art) finnes naturlig i Italia, men den lever i en dal med kalde vintre og lang varm sommer. Eggsekker kan overvintre, men en lang og forholdsvis varm sommer blir sett som et kriterium for at de skal rekke å fullføre alle utviklingsstadiene, og det er sannsynlig at sommeren i Norge er i korteste laget for dette.

Mantis religiosa finnes naturlig i Polen og helt sør i Tyskland. I Nord-Amerika har denne arten blitt brukt som biologisk kontroll på åkre, og flere populasjoner har etablert seg og spredd seg. Det finnes også arter av pinnedyr fra New Zealand som har etablert seg sør i England. Det er likevel usannsynlig at disse dyrene vil kunne rekke å fullføre livssyklus i Norge. Slike arter kan eventuelt vurderes å settes på en negativliste over arter man er usikker på, med tanke på at risiko må vurderes ut i fra et 50-års perspektiv.

Pinnedyr er herbivorer og de fleste er vertsplantespesialister. De plantene som de vanligste artene spiser er lett tilgjengelig (men mange forekommer ikke i norsk natur), slik som sitronmelisse, bringebærblader, eukalyptus osv.

Når det gjelder sannsynligheten for at noen av gruppene rømmer fra et terrarium og etablerer seg i Norge så er den lav. Knelere holdes solitært så det er usannsynlig at de vil kunne reprodusere og etablere seg. Pinnedyr kan holdes i gruppe, men det er igjen usannsynlig at de vil kunne klare å etablere seg ute. For begge grupper vil mangel på mat og for kort vekstperiode være begrensende faktorer. Det er heller ikke registrert noen kjente sykdommer, og det er usannsynlig at de herbivore pinnedyrene kan overføre sykdommer til planter.

Hobbyen er foreløpig svært begrenset her i Norge. Men de som holder på med det vil nok hovedsakelig respektere et forbud, særlig hvis det er snakk om en liste med et lite knippe worst case scenario arter (en negativ liste).

Appendix IV

Detailed assessments of the probability of entry, establishment and spread and the risk of impact.

EU NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME
Name of organism: *Acanthoxyla geisovii* (Kaup, 1866) **Author:** Jan Ove Gjershaug **Risk Assessment Area:** Norway **Synonyms:** *Acanthoxyla prasina, Acanthoxyla huttoni, Acanthoderus geisovii, Acanthoderus fasciatus, Acanthoderus suteri, Bacillus geisovii, Clitarchus geisovii, Macracantha geisovii*

SECTION B – Detailed assessment

PROBABILITY OF ENTRY			
Important instructions: • Entry is the introduction of an organism into Norway. Not to be confused with spread, the movement of an organism within Norway. • For organisms which are already present in Norway, only complete the entry section for current active pathways of entry or if relevant potential future pathways. The entry section need not be completed for organisms which have entered in the past and have no current pathways of entry.			
QUESTION	**RESPONSE [chose one entry, delete all others]**	**UNCERTAINTY [chose one entry, delete all others]**	**COMMENT**
1.2. How many known pathways are relevant to the potential entry of this organism?	Very few	low	Species native in New Zealand and accidentally introduced into England. In trade, but the extent is unknown.
1.2. List relevant pathways through which the organism could enter. Where possible give detail about the specific origins and end points of the pathways. For each pathway answer questions 1.3 to 1.10 (copy and paste additional rows at the end of this section as necessary).	Commercial pet trade Private import		In trade
Pathway name:	Commercial pet trade and Private import		

1.3. Is entry along this pathway intentional (e.g. the organism is imported for trade) or accidental (the organism is a contaminant of imported goods)?	intentional	low	
1.4. How likely is it that large numbers of the organism will travel along this pathway from the point(s) of origin over the course of one year? Subnote: In your comment discuss how likely the organism is to get onto the pathway in the first place.	unlikely	low	In trade, but the extent is unknown.
1.5. How likely is the organism to be able to transfer from the pathway to a suitable habitat or host in Norwegian nature?	likely	low	
1.6. Estimate the overall likelihood of entry into Norwegian nature based on this pathway?	likely	low	
End of pathway assessment, repeat as necessary.			
1.7. Estimate the overall likelihood of entry into Norwegian nature based on all pathways (comment on the key issues that lead to this conclusion).	Moderately likely	medium	In trade, but the extent is unknown.

PROBABILITY OF ESTABLISHMENT			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
1.8. How likely is it that the organism will be able to establish in Norway based on the similarity between climatic conditions in Norway and the organism's current distribution?	likely	medium	Native range is New Zealand. It has been accidentally introduced with plant import into southern part of England in the 1903. The species is found in two main areas: in Devon around Torbay, and in Cornwall around St Mawes. It is also widespread in the Isles of Scilly (Lee 2013) The climate in Norway today is too harsh, but in a 50 year perspective, the temperature in southern parts of Norway will be similar to what we find in southern parts of England today (See Cap. 2.3).
1.9. How likely is it that the organism will be able to establish in Norway based on the similarity between other abiotic conditions in Norway and the organism's current distribution?	NA	NA	
1.10. How likely is it that the organism will become established in protected conditions (in which the environment is artificially maintained, such as wildlife parks, glasshouses, aquaculture facilities, terraria, zoological gardens) in Norway? Subnote: gardens are not considered protected conditions	likely	low	

1.11. How widespread are habitats or species necessary for the survival, development and multiplication of the organism in Norway?	isolated	medium	Gardens are probably the most useful habitat.
1.12. How likely is it that establishment will occur despite management practices (including eradication campaigns), competition from existing species or predators, parasites or pathogens in Norway?	likely	high	This is a large insect, which should be easy to locate as adults. Eggs might be harder to find and remove.
1.13. How likely are the biological characteristics (including adaptability and capacity of spread) of the organism to facilitate its establishment?	likely	medium	The species is parthenogenetic.
1.14. How likely is it that the organism could establish despite low genetic diversity in the founder population?	likely	medium	Generally insects are able to establish founder populations with low genetic diversity.
1.15. Based on the history of invasion by this organism elsewhere in the world, how likely is to establish in Norway? (If possible, specify the instances in the comments box.)	likely	medium	As the temperature in southern parts of Norway in a 50 year perspective will be similar to what we find in southern parts of England today, it is likely that it can establish also in Norway (See Cap. 2.3).
1.16. Estimate the overall likelihood of establishment in Norway (mention any key issues in the comment box).	Moderately likely	low	The climate in Norway in a 50 year perspective, may be similar to what we find in southern parts of England today (See Cap. 2.3).

PROBABILITY OF SPREAD			
Important notes: • Spread is defined as the expansion of the geographical distribution of an alien species within an area.			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
2.1. How likely is it that this organism will spread widely in Norway by natural means? (Please list and comment on the mechanisms for natural spread.)	very unlikely	low	Wings? No Parthenogenesis? Yes
2.2. How likely is it that this organism will spread widely in Norway by human assistance? (Please list and comment on the mechanisms for human-assisted spread.)	very unlikely	low	If trade in this species is initiated its spread would be by human assistance. However, massive trade is not expected. Plants with eggs from one garden to another garden is another potential for spreading.
2.3. How likely is it that the spread of the organism within Norway can be completely contained?	Moderately likely	medium	If established in a garden senter.
2.4. Based on the answers to questions on the potential for establishment and spread in Norway, define the area endangered by the organism.	Unknown	high	Southern parts of Norway
2.5. Estimate the overall potential for future spread for this organism in Norway (using the comment box to indicate any key issues).	unlikely	medium	This species is wingless and slow moving.

PROBABILITY OF ENVIRONMENTAL IMPACT			
Important instructions: • **When assessing potential future environmental impacts, climate change should not be taken into account. This is done in later questions at the end of the assessment.** • **Each set of questions starts with the impact elsewhere in the world, then considers impacts in Norway separating known impacts to date (i.e. past and current impacts) from potential future impacts. Key words are in bold for emphasis.**			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
2.6. How much environmental harm is caused by the organism within its existing geographic range excluding Norway?	minimal	low	**No serious harm to the environment has been reported from Southern England (Lee 2016).**
2.7. How much impact would there be, if genetic traits of the organism were to be transmitted to other species, modifying their genetic makeup and making their environmental effects more serious?	minimal	low	We have no related species in Norway.
2.8. How much impact does the organism have, as food, as a host, or as a symbiont or a vector for other damaging organisms (e.g. diseases)?	minimal	high	No known diseases for plants or insects are describes for this species.
2.9. How much impact do other factors have, factors which are not covered by previous questions (specify in the comment box)	NA	high	None known

2.10. How important are the expected impacts of the organism despite any natural control by other organisms, such as predators, parasites or pathogens that may already be present in Norway?	minimal	medium	
2.11. Indicate any parts of Norway where environmental impacts are particularly likely to occur (provide as much detail as possible).	none known	low	Based on the situation in Southern England no environmental impacts is likely to occur (Lee 2016).

ADDITIONAL QUESTIONS - CLIMATE CHANGE			
3.1. What aspects of climate change (in a 50 year perspective), if any, are most likely to affect the risk assessment for this organism?	increased temperature	medium	The temperature in southern parts of Norway will be similar to what we find in southern parts of England today (See Cap. 2.3).
3.2. What aspects of the risk assessment are most likely to change as a result of climate change? • Establishment • Spread • Impact on biodiversity • Impact on ecosystem functions	establishment spread	low	The temperature in southern parts of Norway will be similar to what we find in southern parts of England today (See Cap. 2.3).

RISK SUMMARIES			
	RESPONSE	**UNCERTAINTY**	**COMMENT**
Summarise Entry	moderately likely	medium	No current known trade to Norway, but the market is dynamic and this can change in the future.
Summarise Establishment	Moderately likely	low	The climate in Norway today is probably too harsh, but with climate change in the next 50 years, the climate in some parts of Norway may be similar to what we find in southern England today.
Summarise Spread	unlikely	medium	This species is wingless and therefor does not spread very well.
Summarise Impact	minimal	low	Based on the situation in England, the ecological impact is assumed to be minimal (Lee 2016)
Conclusion of the risk assessment	low	low	Though the potential for establishment and spread is present, the potential environmental impact is negligible, and therefore we conclude on low risk

REFERENCES:

Lee, M. 2013. The naturalised British stick insects. Phasmid Study Group. (http://phasmidstudygroup.org/index.ohp/phasmids/uk-phasmid-sighting)
Lee, M. 2016. Stick insects. Fast facts. (https://www.buglife.org.uk/bugs-and-habitats/stick-insects)
Phasmida Species file (http://phasmida.speciesfile.org/Common/basic/Taxa.aspx?TaxonNameID=1201266)

EU NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME

Name of organism: *Acanthoxyla inermis Salmon, 1955*

Author: Jan Ove Gjershaug

Risk Assessment Area: Norway

Synonyms: *Acanthoxyla prasina*

SECTION B – Detailed assessment

PROBABILITY OF ENTRY			
Important instructions: • Entry is the introduction of an organism into Norway. Not to be confused with spread, the movement of an organism within Norway. • For organisms which are already present in Norway, only complete the entry section for current active pathways of entry or if relevant potential future pathways. The entry section need not be completed for organisms which have entered in the past and have no current pathways of entry.			
QUESTION	**RESPONSE [chose one entry, delete all others]**	**UNCERTAINTY [chose one entry, delete all others]**	**COMMENT**
1.3. How many known pathways are relevant to the potential entry of this organism?	Very few	low	Species native in New Zealand and accidentally introduced into England. In trade, but the extent is unknown. Rarely kept in culture.
1.2. List relevant pathways through which the organism could enter. Where possible give detail about the specific origins and end points of the pathways. For each pathway answer questions 1.3 to 1.10 (copy and paste additional rows at the end of this section as necessary).	Commercial pet trade Private import		In trade
Pathway name:	Commercial pet trade and Private import		

1.3. Is entry along this pathway intentional (e.g. the organism is imported for trade) or accidental (the organism is a contaminant of imported goods)?	intentional	low	
1.4. How likely is it that large numbers of the organism will travel along this pathway from the point(s) of origin over the course of one year? Subnote: In your comment discuss how likely the organism is to get onto the pathway in the first place.	unlikely	low	In trade, but the extent is unknown.
1.5. How likely is the organism to be able to transfer from the pathway to a suitable habitat or host in Norwegian nature?	likely	low	
1.6. Estimate the overall likelihood of entry into Norwegian nature based on this pathway?	likely	low	
End of pathway assessment, repeat as necessary.			
1.7. Estimate the overall likelihood of entry into Norwegian nature based on all pathways (comment on the key issues that lead to this conclusion).	Moderately likely	medium	In trade, but the extent is unknown.

PROBABILITY OF ESTABLISHMENT			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
1.8. How likely is it that the organism will be able to establish in Norway based on the similarity between climatic conditions in Norway and the organism's current distribution?	likely	medium	Native range is New Zealand. It has been accidentally introduced with plant import into southern part of England in the 1920s. Most sites are in Cornwall, but also a few records from Devon and Dorset. The species is also found in SW Ireland (Lee 2013) The climate in Norway today is too harsh, but in a 50 year perspective, the temperature in southern parts of Norway will be similar to what we find in southern parts of England today (See Cap. 2.3).
1.9. How likely is it that the organism will be able to establish in Norway based on the similarity between other abiotic conditions in Norway and the organism's current distribution?	NA	NA	
1.10. How likely is it that the organism will become established in protected conditions (in which the environment is artificially maintained, such as wildlife parks, glasshouses, aquaculture facilities, terraria, zoological gardens) in Norway? Subnote: gardens are not considered protected conditions	likely	low	

1.11. How widespread are habitats or species necessary for the survival, development and multiplication of the organism in Norway?	isolated	medium	Gardens are probably the most useful habitat.
1.12. How likely is it that establishment will occur despite management practices (including eradication campaigns), competition from existing species or predators, parasites or pathogens in Norway?	likely	high	This is a large insect, which should be easy to locate as adults. Eggs might be harder to find and remove.
1.13. How likely are the biological characteristics (including adaptability and capacity of spread) of the organism to facilitate its establishment?	likely	medium	The species is parthenogenetic.
1.14. How likely is it that the organism could establish despite low genetic diversity in the founder population?	likely	medium	Generally insects are able to establish founder populations with low genetic diversity.
1.15. Based on the history of invasion by this organism elsewhere in the world, how likely is to establish in Norway? (If possible, specify the instances in the comments box.)	likely	medium	As the temperature in southern parts of Norway in a 50 year perspective will be similar to what we find in southern parts of England today, it is likely that it can establish also in Norway (See Cap. 2.3).
1.16. Estimate the overall likelihood of establishment in Norway (mention any key issues in the comment box).	Moderately likely	low	The climate in Norway in a 50 year perspective, may be similar to what we find in southern parts of England today (See Cap. 2.3).

PROBABILITY OF SPREAD			
Important notes: • Spread is defined as the expansion of the geographical distribution of an alien species within an area.			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
2.1. How likely is it that this organism will spread widely in Norway by natural means? (Please list and comment on the mechanisms for natural spread.)	very unlikely	low	Wings? No Parthenogenesis? Yes
2.2. How likely is it that this organism will spread widely in Norway by human assistance? (Please list and comment on the mechanisms for human-assisted spread.)	very unlikely	low	If trade in this species is initiated its spread would be by human assistance. However, massive trade is not expected. Plants with eggs from one garden to another garden is another potential for spreading.
2.3. How likely is it that the spread of the organism within Norway can be completely contained?	Moderately likely	medium	If established in a garden senter.
2.4. Based on the answers to questions on the potential for establishment and spread in Norway, define the area endangered by the organism.	Unknown	high	Southern parts of Norway
2.5. Estimate the overall potential for future spread for this organism in Norway (using the comment box to indicate any key issues).	unlikely	medium	This species is wingless and slow moving.

PROBABILITY OF ENVIRONMENTAL IMPACT			
Important instructions: • **When assessing potential future environmental impacts, climate change should not be taken into account. This is done in later questions at the end of the assessment.** • **Each set of questions starts with the impact elsewhere in the world, then considers impacts in Norway separating known impacts to date (i.e. past and current impacts) from potential future impacts. Key words are in bold for emphasis.**			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
2.6. How much environmental harm is caused by the organism within its existing geographic range excluding Norway?	minimal	low	**No serious harm to the environment has been reported from Southern England (Lee 2016).**
2.7. How much impact would there be, if genetic traits of the organism were to be transmitted to other species, modifying their genetic makeup and making their environmental effects more serious?	minimal	low	We have no related species in Norway.
2.8. How much impact does the organism have, as food, as a host, or as a symbiont or a vector for other damaging organisms (e.g. diseases)?	minimal	high	No known diseases for plants or insects are describes for this species.
2.9. How much impact do other factors have, factors which are not covered by previous questions (specify in the comment box)	NA	high	None known

2.10. How important are the expected impacts of the organism despite any natural control by other organisms, such as predators, parasites or pathogens that may already be present in Norway?	minimal	medium	
2.11. Indicate any parts of Norway where environmental impacts are particularly likely to occur (provide as much detail as possible).	none known	low	Based on the situation in Southern England no environmental impacts is likely to occur (Lee 2016).

ADDITIONAL QUESTIONS - CLIMATE CHANGE			
3.1. What aspects of climate change (in a 50 year perspective), if any, are most likely to affect the risk assessment for this organism?	increased temperature	medium	The temperature in southern parts of Norway will be similar to what we find in southern parts of England today (See Cap. 2.3).
3.2. What aspects of the risk assessment are most likely to change as a result of climate change? • Establishment • Spread • Impact on biodiversity • Impact on ecosystem functions	establishme nt spread	low	The temperature in southern parts of Norway will be similar to what we find in southern parts of England today (See Cap. 2.3).

RISK SUMMARIES			
	RESPONSE	**UNCERTAINTY**	**COMMENT**
Summarise Entry	moderately likely	medium	No current known trade to Norway, but the market is dynamic and this can change in the future.
Summarise Establishment	Moderately likely	low	The climate in Norway today is probably too harsh, but with climate change in the next 50 years, the climate in some parts of Norway may be similar to what we find in southern England today.
Summarise Spread	unlikely	medium	This species is wingless and therefor does not spread very well.
Summarise Impact	minimal	low	Based on the situation in England, the ecological impact is assumed to be minimal (Lee 2016)
Conclusion of the risk assessment	low	low	Though the potential for establishment and spread is present, the potential environmental impact is negligible, and therefore we conclude on low risk.

REFERENCES:

Lee, M. 2013. The naturalised British stick insects. Phasmid Study Group. (http://phasmidstudygroup.org/index.ohp/phasmids/uk-phasmid-sighting)

Lee, M. 2016. Stick insects. Fast facts. (https://www.buglife.org.uk/bugs-and-habitats/stick-insects)

Phasmida Species file (http://phasmida.speciesfile.org/Common/basic/Taxa.aspx?TaxonNameID=1201266)

EU NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME
Name of organism: *Acanthoxyla prasina (Westwood, 1859)* **Author:** Jan Ove Gjershaug **Risk Assessment Area:** Norway **Synonyms:** *Acanthoxyla intermedia, Acanthoxyla spinose, Bacillus atroarticulus, Bacillus filiformis*

SECTION B – Detailed assessment			
PROBABILITY OF ENTRY			
Important instructions: • Entry is the introduction of an organism into Norway. Not to be confused with spread, the movement of an organism within Norway. • For organisms which are already present in Norway, only complete the entry section for current active pathways of entry or if relevant potential future pathways. The entry section need not be completed for organisms which have entered in the past and have no current pathways of entry.			
QUESTION	**RESPONSE [chose one entry, delete all others]**	**UNCERTAINTY [chose one entry, delete all others]**	**COMMENT**
1.4. How many known pathways are relevant to the potential entry of this organism?	Very few	low	Species native in New Zealand In trade and in culture.
1.2. List relevant pathways through which the organism could enter. Where possible give detail about the specific origins and end points of the pathways. For each pathway answer questions 1.3 to 1.10 (copy and paste additional rows at the end of this section as necessary).	Commercial pet trade Private import		In trade
Pathway name:	Commercial pet trade and Private import		

1.3. Is entry along this pathway intentional (e.g. the organism is imported for trade) or accidental (the organism is a contaminant of imported goods)?	intentional	low	
1.4. How likely is it that large numbers of the organism will travel along this pathway from the point(s) of origin over the course of one year? Subnote: In your comment discuss how likely the organism is to get onto the pathway in the first place.	unlikely	low	Not known to be in trade in Norway.
1.5. How likely is the organism to be able to transfer from the pathway to a suitable habitat or host in Norwegian nature?	likely	low	
1.6. Estimate the overall likelihood of entry into Norwegian nature based on this pathway?	likely	low	
End of pathway assessment, repeat as necessary.			
1.7. Estimate the overall likelihood of entry into Norwegian nature based on all pathways (comment on the key issues that lead to this conclusion).	Moderately likely	medium	In trade, but the extent is unknown.

PROBABILITY OF ESTABLISHMENT			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
1.8. How likely is it that the organism will be able to establish in Norway based on the similarity between climatic conditions in Norway and the organism's current distribution?	likely	medium	Native range is New Zealand. The climate in Norway today is too harsh, but in a 50 year perspective, the temperature in southern parts of Norway will be similar to what we find in southern parts of England today (See Cap. 2.3).
1.9. How likely is it that the organism will be able to establish in Norway based on the similarity between other abiotic conditions in Norway and the organism's current distribution?	NA	NA	
1.10. How likely is it that the organism will become established in protected conditions (in which the environment is artificially maintained, such as wildlife parks, glasshouses, aquaculture facilities, terraria, zoological gardens) in Norway? Subnote: gardens are not considered protected conditions	likely	low	
1.11. How widespread are habitats or species necessary for the survival, development and multiplication of the organism in Norway?	isolated	medium	Gardens are probably the most useful habitat.

1.12. How likely is it that establishment will occur despite management practices (including eradication campaigns), competition from existing species or predators, parasites or pathogens in Norway?	likely	high	This is a large insect, which should be easy to locate as adults. Eggs might be harder to find and remove.
1.13. How likely are the biological characteristics (including adaptability and capacity of spread) of the organism to facilitate its establishment?	likely	medium	The species is parthenogenetic.
1.14. How likely is it that the organism could establish despite low genetic diversity in the founder population?	likely	medium	Generally insects are able to establish founder populations with low genetic diversity.
1.15. Based on the history of invasion by this organism elsewhere in the world, how likely is it to establish in Norway? (If possible, specify the instances in the comments box.)	likely	medium	As the temperature in southern parts of Norway in a 50 year perspective will be similar to what we find in southern parts of England today, it is likely that it can establish also in Norway (See Cap. 2.3).
1.16. Estimate the overall likelihood of establishment in Norway (mention any key issues in the comment box).	Moderately likely	low	The climate in Norway in a 50 year perspective, may be similar to what we find in southern parts of England today (See Cap. 2.3).

PROBABILITY OF SPREAD

Important notes:

- Spread is defined as the expansion of the geographical distribution of an alien species within an area.

QUESTION	RESPONSE	UNCERTAINTY	COMMENT
2.1. How likely is it that this organism will spread widely in Norway by natural means? (Please list and comment on the mechanisms for natural spread.)	very unlikely	low	Wings? No Parthenogenesis? Yes
2.2. How likely is it that this organism will spread widely in Norway by human assistance? (Please list and comment on the mechanisms for human-assisted spread.)	very unlikely	low	If trade in this species is initiated its spread would be by human assistance. However, massive trade is not expected. Plants with eggs from one garden to another garden is another potential for spreading.
2.3. How likely is it that the spread of the organism within Norway can be completely contained?	Moderately likely	medium	If established in a garden senter.
2.4. Based on the answers to questions on the potential for establishment and spread in Norway, define the area endangered by the organism.	Unknown	high	Southern parts of Norway
2.5. Estimate the overall potential for future spread for this organism in Norway (using the comment box to indicate any key issues).	unlikely	medium	This species is wingless and slow moving.

PROBABILITY OF ENVIRONMENTAL IMPACT			
Important instructions: • **When assessing potential future environmental impacts, climate change should not be taken into account. This is done in later questions at the end of the assessment.** • **Each set of questions starts with the impact elsewhere in the world, then considers impacts in Norway separating known impacts to date (i.e. past and current impacts) from potential future impacts. Key words are in bold for emphasis.**			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
2.6. How much environmental harm is caused by the organism within its existing geographic range excluding Norway?	minimal	low	No serious harm to the environment has been reported from Southern England (Lee 2016).
2.7. How much impact would there be, if genetic traits of the organism were to be transmitted to other species, modifying their genetic makeup and making their environmental effects more serious?	minimal	low	We have no related species in Norway.
2.8. How much impact does the organism have, as food, as a host, or as a symbiont or a vector for other damaging organisms (e.g. diseases)?	minimal	high	No known diseases for plants or insects are described for this species.
2.9. How much impact do other factors have, factors which are not covered by previous questions (specify in the comment box)	NA	high	None known

2.10. How important are the expected impacts of the organism despite any natural control by other organisms, such as predators, parasites or pathogens that may already be present in Norway?	minimal	medium	
2.11. Indicate any parts of Norway where environmental impacts are particularly likely to occur (provide as much detail as possible).	none known	low	Based on the situation in Southern England no environmental impacts is likely to occur (Lee 2016).

ADDITIONAL QUESTIONS - CLIMATE CHANGE			
3.1. What aspects of climate change (in a 50 year perspective), if any, are most likely to affect the risk assessment for this organism?	increased temperature	medium	The temperature in southern parts of Norway will be similar to what we find in southern parts of England today (See Cap. 2.3).
3.2. What aspects of the risk assessment are most likely to change as a result of climate change? • Establishment • Spread • Impact on biodiversity • Impact on ecosystem functions	establishment spread	low	The temperature in southern parts of Norway will be similar to what we find in southern parts of England today (See Cap. 2.3).

RISK SUMMARIES			
	RESPONSE	**UNCERTAINTY**	**COMMENT**
Summarise Entry	moderately likely	medium	No current known trade to Norway, but the market is dynamic and this can change in the future.
Summarise Establishment	Moderately likely	low	The climate in Norway today is probably too harsh, but with climate change in the next 50 years, the climate in some parts of Norway may be similar to what we find in southern England today.
Summarise Spread	unlikely	medium	This species is wingless and therefor does not spread very well.
Summarise Impact	minimal	low	Based on the situation for other New Zealand stick insects in England, the ecological impact is assumed to be minimal (Lee 2016)
Conclusion of the risk assessment	low	low	Though the potential for establishment and spread is present, the potential environmental impact is negligible, and therefore we conclude on low risk

REFERENCES:

Lee, M. 2016. Stick insects. Fast facts. (https://www.buglife.org.uk/bugs-and-habitats/stick-insects)
Phasmida Species file (http://phasmida.speciesfile.org/Common/basic/Taxa.aspx?TaxonNameID=1201270)

EU NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME

Name of organism: *Agathemera* Stål 1875, all 8 species

Author: Lawrence R. Kirkendall

Risk Assessment Area: Norway

Synonyms: *Paradoxomorpha* Brancsik, 1898

Common names: English, none commonly in use; several species locally called *chinche molle* in Spanish

SECTION B – Detailed assessment

PROBABILITY OF ENTRY

Important instructions:

- Entry is the introduction of an organism into Norway. Not to be confused with spread, the movement of an organism within Norway.
- For organisms which are already present in Norway, only complete the entry section for current active pathways of entry or if relevant potential future pathways. The entry section need not be completed for organisms which have entered in the past and have no current pathways of entry.

QUESTION	RESPONSE [chose one entry, delete all others]	UNCERTAINTY [chose one entry, delete all others]	COMMENT
1.5. How many known pathways are relevant to the potential entry of this organism?	None currently	low	Mountain and steppe species of southern S America, not currently traded
1.2. List relevant pathways through which the organism could enter. Where possible give detail about the specific origins and end points of the pathways. For each pathway answer questions 1.3 to 1.10 (copy and paste additional rows at the end of this section as necessary).	Private import		Not in trade
Pathway name:	Private import		

1.3. Is entry along this pathway intentional (e.g. the organism is imported for trade) or accidental (the organism is a contaminant of imported goods)?	intentional	low	
1.4. How likely is it that large numbers of the organism will travel along this pathway from the point(s) of origin over the course of one year? Subnote: In your comment discuss how likely the organism is to get onto the pathway in the first place.	Very unlikely	low	Not currently of interest to many hobbyists, and difficult to breed in captivity (Vera, pers. comm., http://www.phasmatodea.com/web/guest/agathemera-claraziana)
1.5. How likely is the organism to be able to transfer from the pathway to a suitable habitat or host in Norwegian nature?	Very unlikely	low	Little known about host acceptance behavior and host preferences for these species, but no plant spp in Norway in the genera known as native food plants
1.6. Estimate the overall likelihood of entry into Norwegian nature based on this pathway?	Very unlikely	low	Being rare in collections and difficult to breed (Vera, pers. comm.), hobbyists would be very careful to prevent escape
End of pathway assessment, repeat as necessary.			
1.7. Estimate the overall likelihood of entry into Norwegian nature based on all pathways (comment on the key issues that lead to this conclusion).	Very unlikely	low	Being rare in collections and difficult to breed (Vera, pers. comm.), hobbyists would be very careful to prevent escape

PROBABILITY OF ESTABLISHMENT			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
1.8. How likely is it that the organism will be able to establish in Norway based on the similarity between climatic conditions in Norway and the organism's current distribution?	Likely	medium	Native range is the mountains, steppes, and lowlands of Chile and Argentinam with a few species ranging into Bolivia. All species have high elevation populations, some up to limits of vegetation. 5/8 species live in climate zones with mean annual temperatures of 4 – 12 degrees C, the others in slightly warmer climates but with no certain knowledge about temperature tolerances.
1.9. How likely is it that the organism will be able to establish in Norway based on the similarity between other abiotic conditions in Norway and the organism's current distribution?	NA	NA	
1.10. How likely is it that the organism will become established in protected conditions (in which the environment is artificially maintained, such as wildlife parks, glasshouses, aquaculture facilities, terraria, zoological gardens) in Norway? Subnote: gardens are not considered protected conditions	Moderately likely	medium	Little known about ecology, especially about diet breadth; might be protected environments which have acceptable food plants

1.11. How widespread are habitats or species necessary for the survival, development and multiplication of the organism in Norway?	Moderately widespread	high	Too little known about ecology
1.12. How likely is it that establishment will occur despite management practices (including eradication campaigns), competition from existing species or predators, parasites or pathogens in Norway?	Very unlikely	low	Unlikely species would be well adapted, plus very low propagule pressure (few introduced individuals near enough to start a population)
1.13. How likely are the biological characteristics (including adaptability and capacity of spread) of the organism to facilitate its establishment?	likely	medium	Sexual species; wingless; nothing known about adaptability
1.14. How likely is it that the organism could establish despite low genetic diversity in the founder population?	likely	medium	Generally, insects are able to establish founder populations with low genetic diversity.
1.15. Based on the history of invasion by this organism elsewhere in the world, how likely is to establish in Norway? (If possible, specify the instances in the comments box.)	Very unlikely	low	No history of invasion
1.16. Estimate the overall likelihood of establishment in Norway (mention any key issues in the comment box).	Unlikely	low	The climate in Norway in a 50 year perspective may be favorable, but unlikely that enough individuals would colonize any situation simultaneously to start a viable population; in addition, no known host plants occur in Norwegian nature, though some (such as Citrus) might occur in greenhouses.

PROBABILITY OF SPREAD			
Important notes: • Spread is defined as the expansion of the geographical distribution of an alien species within an area.			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
2.1. How likely is it that this organism will spread widely in Norway by natural means? (Please list and comment on the mechanisms for natural spread.)	very unlikely	low	
2.2. How likely is it that this organism will spread widely in Norway by human assistance? (Please list and comment on the mechanisms for human-assisted spread.)	unlikely	low	If commercial or private trade in this species is initiated its spread would be by human assistance. However, massive trade is not expected.
2.3. How likely is it that the spread of the organism within Norway can be completely contained?	Moderately likely	high	Likely, if established in a protected environment. Otherwise, very difficult to say. Lack of good food plants is likely to limit spread in nature, should a population get established, unless they can feed successfully on a widespread plant. Likelihood of finding an acceptable food plant is higher in cities and towns where there is a higher diversity of exotic species.
2.4. Based on the answers to questions on the potential for establishment and spread in Norway, define the area endangered by the organism.	Unknown	high	Southern and warmer coastal parts of Norway? Depends on food plants.

2.5. Estimate the overall potential for future spread for this organism in Norway (using the comment box to indicate any key issues).	unlikely	medium	Depends on number of establishments and their population sizes, and on ability to feed and reproduce using plants which are common enough to support populations, and then depends on the distribution of those plants.

PROBABILITY OF ENVIRONMENTAL IMPACT			
Important instructions: • **When assessing potential future environmental impacts, climate change should not be taken into account. This is done in later questions at the end of the assessment.** • **Each set of questions starts with the impact elsewhere in the world, then considers impacts in Norway separating known impacts to date (i.e. past and current impacts) from potential future impacts. Key words are in bold for emphasis.**			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
2.6. How much environmental harm is caused by the organism within its existing geographic range excluding Norway?	minimal	low	**No reports of outbreaks**
2.7. How much impact would there be, if genetic traits of the organism were to be transmitted to other species, modifying their genetic makeup and making their environmental effects more serious?	minimal	low	No related species in Norway
2.8. How much impact does the organism have, as food, as a host, or as a symbiont or a vector for other damaging organisms (e.g. diseases)?	minimal	high	No known diseases for plants or insects are described for these species.
2.9. How much impact do other factors have, factors which are not covered by previous questions (specify in the comment box)	NA	high	None known

2.10. How important are the expected impacts of the organism despite any natural control by other organisms, such as predators, parasites or pathogens that may already be present in Norway?	minimal	high	Impossible to predict interactions with native species
2.11. Indicate any parts of Norway where environmental impacts are particularly likely to occur (provide as much detail as possible).	none known	low	

ADDITIONAL QUESTIONS - CLIMATE CHANGE			
3.1. What aspects of climate change (in a 50 year perspective), if any, are most likely to affect the risk assessment for this organism?	Shorter winters, longer growing season, warmer temperatures	medium	
3.2. What aspects of the risk assessment are most likely to change as a result of climate change? • Establishment • Spread • Impact on biodiversity • Impact on ecosystem functions	establishment spread	high	High uncertainty because many impacts on natural ecosystems are difficult to predict

RISK SUMMARIES			
	RESPONSE	**UNCERTAINTY**	**COMMENT**
Summarise Entry	Very unlikely	low	Unattractive insects, might be of interest because of rarity in collections. Difficult currently to breed, so likely to remain rare in private holdings generally, so probably very unusual to have them in Norway.
Summarise Establishment	Moderately likely	low	Simultaneous escape locally of enough individuals to start a population is very unlikely; though not much is known of diet breadth, none of the known host plant genera occur in Norwegian nature.
Summarise Spread	unlikely	medium	Very hard to predict, since we don’t know if it could feed on any widespread plants in Norway.
Summarise Impact	minimal	medium	Not known to be outbreak species in their native environments, not known to be able to feed on common plants in Norway
Conclusion of the risk assessment	low	low	The likelihood of establishment of viable populations is minimal, and spread unlikely.

REFERENCES:

Dominguez, M. C., G. San Blas, F. Agrain, S. A. Roig-Juñent, A. M. Scollo, and G. O. Debandi. 2009. Cladistic, biogeographic and environmental niche analysis of the species of *Agathemera* Stål (Phasmatida, Agathemeridae). Zootaxa 2308:43-57.

Vera, A., L. Pastenes, C. Veloso, and M. A. Méndez. 2012. Phylogenetic relationships in the genus *Agathemera* (Insecta: Phasmatodea) inferred from the genes 16S, COI and H3. Zoological Journal of the Linnean Society 165:63-72.

https://en.wikipedia.org/wiki/Climate_of_Argentina#/media/File:Temperature_map_of_Argentina_and_Falkland_Islands.png

EU NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME

Name of organism: *Argosarchus horridus (White, 1846)*

Author: Jan Ove Gjershaug

Risk Assessment Area: Norway

Synonyms: *Argosarchus spiniger*

SECTION B – Detailed assessment

PROBABILITY OF ENTRY

Important instructions:

- Entry is the introduction of an organism into Norway. Not to be confused with spread, the movement of an organism within Norway.
- For organisms which are already present in Norway, only complete the entry section for current active pathways of entry or if relevant potential future pathways. The entry section need not be completed for organisms which have entered in the past and have no current pathways of entry.

QUESTION	RESPONSE [chose one entry, delete all others]	UNCERTAINTY [chose one entry, delete all others]	COMMENT
1.6. How many known pathways are relevant to the potential entry of this organism?	Very few	low	Species native in New Zealand Not known to be in trade.
1.2. List relevant pathways through which the organism could enter. Where possible give detail about the specific origins and end points of the pathways. For each pathway answer questions 1.3 to 1.10 (copy and paste additional rows at the end of this section as necessary).	Commercial pet trade Private import		Not known to be in trade.
Pathway name:	Commercial pet trade and Private import		

1.3. Is entry along this pathway intentional (e.g. the organism is imported for trade) or accidental (the organism is a contaminant of imported goods)?	intentional	low	
1.4. How likely is it that large numbers of the organism will travel along this pathway from the point(s) of origin over the course of one year? Subnote: In your comment discuss how likely the organism is to get onto the pathway in the first place.	unlikely	low	Not known to be in trade.
1.5. How likely is the organism to be able to transfer from the pathway to a suitable habitat or host in Norwegian nature?	likely	low	
1.6. Estimate the overall likelihood of entry into Norwegian nature based on this pathway?	likely	low	
End of pathway assessment, repeat as necessary.			
1.7. Estimate the overall likelihood of entry into Norwegian nature based on all pathways (comment on the key issues that lead to this conclusion).	Moderately likely	medium	Not known to be in trade.

PROBABILITY OF ESTABLISHMENT			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
1.8. How likely is it that the organism will be able to establish in Norway based on the similarity between climatic conditions in Norway and the organism's current distribution?	likely	medium	Native range is New Zealand. The climate in Norway today is too harsh, but in a 50 year perspective, the temperature in southern parts of Norway will be similar to what we find in southern parts of England today (See Cap. 2.3).
1.9. How likely is it that the organism will be able to establish in Norway based on the similarity between other abiotic conditions in Norway and the organism's current distribution?	NA	NA	
1.10. How likely is it that the organism will become established in protected conditions (in which the environment is artificially maintained, such as wildlife parks, glasshouses, aquaculture facilities, terraria, zoological gardens) in Norway? Subnote: gardens are not considered protected conditions	likely	low	
1.11. How widespread are habitats or species necessary for the survival, development and multiplication of the organism in Norway?	isolated	medium	Gardens are probably the most useful habitat.

1.12. How likely is it that establishment will occur despite management practices (including eradication campaigns), competition from existing species or predators, parasites or pathogens in Norway?	likely	high	This is a large insect, which should be easy to locate as adults. Eggs might be harder to find and remove.
1.13. How likely are the biological characteristics (including adaptability and capacity of spread) of the organism to facilitate its establishment?	likely	medium	The species is parthenogenetic.
1.14. How likely is it that the organism could establish despite low genetic diversity in the founder population?	likely	medium	Generally insects are able to establish founder populations with low genetic diversity.
1.15. Based on the history of invasion by this organism elsewhere in the world, how likely is to establish in Norway? (If possible, specify the instances in the comments box.)	likely	medium	As the temperature in southern parts of Norway in a 50 year perspective will be similar to what we find in southern parts of England today, it is likely that it can establish also in Norway (See Cap. 2.3).
1.16. Estimate the overall likelihood of establishment in Norway (mention any key issues in the comment box).	Moderately likely	low	The climate in Norway in a 50 year perspective, may be similar to what we find in southern parts of England today (See Cap. 2.3).

PROBABILITY OF SPREAD			
Important notes: • Spread is defined as the expansion of the geographical distribution of an alien species within an area.			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
2.1. How likely is it that this organism will spread widely in Norway by natural means? (Please list and comment on the mechanisms for natural spread.)	very unlikely	low	Wings? No Parthenogenesis? Yes
2.2. How likely is it that this organism will spread widely in Norway by human assistance? (Please list and comment on the mechanisms for human-assisted spread.)	very unlikely	low	If trade in this species is initiated its spread would be by human assistance. However, massive trade is not expected. Plants with eggs from one garden to another garden is another potential for spreading.
2.3. How likely is it that the spread of the organism within Norway can be completely contained?	Moderately likely	medium	If established in a garden senter.
2.4. Based on the answers to questions on the potential for establishment and spread in Norway, define the area endangered by the organism.	Unknown	high	Southern parts of Norway
2.5. Estimate the overall potential for future spread for this organism in Norway (using the comment box to indicate any key issues).	unlikely	medium	This species is wingless and slow moving.

PROBABILITY OF ENVIRONMENTAL IMPACT			
Important instructions: • **When assessing potential future environmental impacts, climate change should not be taken into account. This is done in later questions at the end of the assessment.** • **Each set of questions starts with the impact elsewhere in the world, then considers impacts in Norway separating known impacts to date (i.e. past and current impacts) from potential future impacts. Key words are in bold for emphasis.**			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
2.6. How much environmental harm is caused by the organism within its existing geographic range excluding Norway?	minimal	low	**No serious harm to the environment has been reported from Southern England (Lee 2016).**
2.7. How much impact would there be, if genetic traits of the organism were to be transmitted to other species, modifying their genetic makeup and making their environmental effects more serious?	minimal	low	We have no related species in Norway.
2.8. How much impact does the organism have, as food, as a host, or as a symbiont or a vector for other damaging organisms (e.g. diseases)?	minimal	high	No known diseases for plants or insects are describes for this species.
2.9. How much impact do other factors have, factors which are not covered by previous questions (specify in the comment box)	NA	high	None known

2.10. How important are the expected impacts of the organism despite any natural control by other organisms, such as predators, parasites or pathogens that may already be present in Norway?	minimal	medium	
2.11. Indicate any parts of Norway where environmental impacts are particularly likely to occur (provide as much detail as possible).	none known	low	Based on the situation in Southern England no environmental impacts is likely to occur (Lee 2016).

ADDITIONAL QUESTIONS - CLIMATE CHANGE			
3.1. What aspects of climate change (in a 50 year perspective), if any, are most likely to affect the risk assessment for this organism?	increased temperature	medium	The temperature in southern parts of Norway will be similar to what we find in southern parts of New Zealand where the species lives (Buckley et al. 2009). (See Cap. 2.3).
3.2. What aspects of the risk assessment are most likely to change as a result of climate change? • Establishment • Spread • Impact on biodiversity • Impact on ecosystem functions	establishment spread	low	The temperature in southern parts of Norway will be similar to what we find in southern parts of New Zealand where the species lives (Buckley et al. 2009). (See Cap. 2.3).

RISK SUMMARIES			
	RESPONSE	**UNCERTAINTY**	**COMMENT**
Summarise Entry	moderately likely	medium	No current known trade to Norway, but the market is dynamic and this can change in the future.
Summarise Establishment	Moderately likely	low	The temperature in southern parts of Norway will be similar to what we find in southern parts of New Zealand where the species lives (Buckley et al. 2009). (See Cap. 2.3).
Summarise Spread	unlikely	medium	This species is wingless and therefor does not spread very well.
Summarise Impact	minimal	low	Based on the situation of other New Zealand stick insects in England, the ecological impact is assumed to be minimal (Lee 2016)
Conclusion of the risk assessment	low	low	Though the potential for establishment and spread is present, the potential environmental impact is negligible, and therefore we conclude on low risk

REFERENCES:

Buckley, T. R., Marske, K. A. & Attanayake, D. 2009. Identifying glacial refugia in a geographic parthenogen using palaeoclimatic modelling and phylogeography: the New Zealand stick insect Argosarchus horridus (White). Molecular Ecology 18: 4650-4663.
Lee, M. 2016. Stick insects. Fast facts. (https://www.buglife.org.uk/bugs-and-habitats/stick-insects)
Phasmida Species file (http://phasmida.speciesfile.org/Common/basic/Taxa.aspx?TaxonNameID=1201278)

EU NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME
Name of organism: *Bacillus atticus (atticus)* Brunner v. W., 1882 Subspecies: *B.a. atticus* (Brunner von Wattenwyl, 1882) [synonyms: *B.a. creticus* (Mantovani & Scali, 1993), *B.a. diplocarius* (Mantovani & Scali, 1989) *B.a. caprai* Nascetti & Bullini, 1982 *B.a. muelleri*(Bullini, 1982)], *B.a. carius* (Mantovani & Scali, 1985) [synonym: *B.a. rhodius* (Mantovani & Scali, 1985)] *B.a. cyprius* (Uvarov, 1936) **Author:** Anders Nielsen **Risk Assessment Area:** Norway **Draft:**

SECTION B – Detailed assessment

PROBABILITY OF ENTRY			
Important instructions: • Entry is the introduction of an organism into Norway. Not to be confused with spread, the movement of an organism within Europe. • For organisms which are already present in Norway, only complete the entry section for current active pathways of entry or if relevant potential future pathways. The entry section need not be completed for organisms which have entered in the past and have no current pathways of entry.			
QUESTION	**RESPONSE [chose one entry, delete all others]**	**UNCERTAINTY [chose one entry, delete all others]**	**COMMENT**
1.7. How many known pathways are relevant to the potential entry of this organism?	very few	low	Mediterranean species possible to hold in captivity, appears to be lost from culture and are currently not in trade.
1.2. List relevant pathways through which the organism could enter. Where possible give detail about the specific origins and end points of the pathways. For each pathway answer questions 1.3 to 1.10 (copy and paste additional rows at the end of this section as necessary).	Commercial pet trade Private import		Not in trade

Pathway name:	Commercial pet trade and private import		
1.3. Is entry along this pathway intentional (e.g. the organism is imported for trade) or accidental (the organism is a contaminant of imported goods)?	intentional	low	
1.4. How likely is it that large numbers of the organism will travel along this pathway from the point(s) of origin over the course of one year? Subnote: In your comment discuss how likely the organism is to get onto the pathway in the first place.	very unlikely	low	The species can be caught in the wild and kept as pet. Degree of trade is unknown though most likely limited or currently non-existent.
1.5. How likely is the organism to be able to transfer from the pathway to a suitable habitat or host?	very unlikely	low	
1.6. Estimate the overall likelihood of entry into Norway based on this pathway?	very unlikely	Low	
End of pathway assessment, repeat as necessary.			
1.7. Estimate the overall likelihood of entry into Norway based on all pathways (comment on the key issues that lead to this conclusion).	very unlikely	low	Since the species has been in trade entry is expected, however very unlikely

PROBABILITY OF ESTABLISHMENT			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
1.8. How likely is it that the organism will be able to establish in Norway based on the similarity between climatic conditions in Norway and the organism's current distribution?	unlikely	high	Native range is the Eastern Mediterranean, but it has recently spread westwards in the Mediterranean region (Italy). It can survive temperatures below 25 degrees Celsius. Climate requirements for egg survival is unknown
1.9. How likely is it that the organism will be able to establish in Norway based on the similarity between other abiotic conditions in Norway and the organism's current distribution?	NA	NA	
1.10. How likely is it that the organism will become established in protected conditions (in which the environment is artificially maintained, such as wildlife parks, glasshouses, aquaculture facilities, terraria, zoological gardens) in Norway? Subnote: gardens are not considered protected conditions	likely	medium	
1.11. How widespread are habitats or species necessary for the survival, development and multiplication of the organism in Norway?	isolated	high	Gardens are most likely the potential habitat where the species can potentially establish in Norway.

1.12. How likely is it that establishment will occur despite management practices (including eradication campaigns), competition from existing species or predators, parasites or pathogens in Norway?	likely	high	Large insects that should be easy to locate as adults. Eggs might harder to find and remove.
1.13. How likely are the biological characteristics (including adaptability and capacity of spread) of the organism to facilitate its establishment?	unlikely	high	No data on species relevant biologically characteristics exist.
1.14. How likely is it that the organism could establish despite low genetic diversity in the founder population?	likely	high	The species is parthenogenetic
1.15. Based on the history of invasion by this organism elsewhere in the world, how likely is to establish in Norway? (If possible, specify the instances in the comments box.)	NA	NA	
1.16. Estimate the overall likelihood of establishment in Norway (mention any key issues in the comment box).	very unlikely	high	Mediterranean species. Not currently in trade.

PROBABILITY OF SPREAD			
Important notes: • Spread is defined as the expansion of the geographical distribution of an alien species within an area.			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
2.1. How likely is it that this organism will spread widely in Norway by *natural means*? (Please list and comment on the mechanisms for natural spread.)	very unlikely	high	The species is wingless and slow moving
2.2. How likely is it that this organism will spread widely in Norway by *human assistance*? (Please list and comment on the mechanisms for human-assisted spread.)	very unlikely	medium	If trade in this species is initiated its spread would be by human assistance. However, massive trade is not expected
2.3. How likely is it that spread of the organism within Norway can be completely contained?	moderately likely	medium	If established in a garden centres the species might be spread as eggs in soil
2.4. Based on the answers to questions on the potential for establishment and spread in Norway, define the area endangered by the organism.	Southern Norway	low	Southern Norway is the warmest part of the country and temperature is a limiting factor for this species. However, there are no records of this species establishing beyond the Mediterranean region.
2.5. Estimate the overall potential for future spread for this organism in Norway (using the comment box to indicate any key issues).	very unlikely	medium	*Bacillus atticus* are wingless insects and slow moving.

PROBABILITY OF ENVIRONMENTAL IMPACT			
Important instructions: • **When assessing potential future environmental impacts, climate change should not be taken into account. This is done in later questions at the end of the assessment.** • **Each set of questions starts with the impact elsewhere in the world, then considers impacts in Norway separating known impacts to date (i.e. past and current impacts) from potential future impacts. Key words are in bold for emphasis.**			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
2.6. How much environmental harm is caused by the organism within its existing geographic range, excluding Norway?	minimal	low	**No harmful environmental impact recorded where it has established in the Western Mediterranean.**
2.7. How much impact would there be, if genetic traits of the organism were to be transmitted to other species, modifying their genetic makeup and making their environmental effects more serious?	minimal	low	
2.8. How much impact does the organism have, as food, as a host, or as a symbiont or a vector for other damaging organisms (e.g. diseases)?	minimal	high	No known diseases for plants or insects described on this species. No recordings of environmental impact recorded from the Western Mediterranean
2.9. How much impact do other factors have, factors which are not covered by previous questions (specify in the comment box)	NA	high	None known

2.10. How important are the expected impacts of the organism despite any natural control by other organisms, such as predators, parasites or pathogens that may already be present in Norway?	minimal	medium	
2.11. Indicate any parts of Norway where environmental impacts are particularly likely to occur (provide as much detail as possible).	None known	low	The warmest, southern parts of Norway

ADDITIONAL QUESTIONS - CLIMATE CHANGE			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
3.1. What aspects of climate change (in a 50 year perspective), if any, are most likely to affect the risk assessment for this organism?	Increased temperatures	medium	Eastern Mediterranean origin, but is currently spreading westwards
3.2. What aspects of the risk assessment are most likely to change as a result of climate change? • Establishment • Spread • Impact on biodiversity • Impact on ecosystem functions	Establishment Spread	low	Increased temperatures will increase the probability of establishment, whether winter survival or summer temperatures (during adult stage) is the limiting factor is unknown

RISK SUMMARIES			
	RESPONSE	**UNCERTAINTY**	**COMMENT**
Summarise Entry	very unlikely	low	Not currently trade, but the market is dynamic and this can change in the future.
Summarise Establishment	very unlikely	low	Native range is the Eastern Mediterranean, but can survive temperatures down to 15 degrees Celsius. Climate requirements for egg survival is unknown, but are most likely limiting factors as the species has not established beyond the Mediterranean region
Summarise Spread	very slowly	medium	*Bacillus atticus* are wingless insects. Generally stick insect does not spread very well.
Summarise Impact	minimal	low	Based on the establishment of the species beyond its native range the ecological impact is assumed to be minimal
Conclusion of the risk assessment	low	low	We see no potential for establishment and spread in Norway and the potential environmental impact is negligible and therefore we conclude on low risk

REFERENCES:

http://phasmidstudygroup.org/index.php/phasmids/psg-culture-list
Brock, P.D., Büscher, T. & Baker, E. Phasmida Species File Online. Version 5.0/5.0. [April 2016] (http://phasmida.speciesfile.org/Common/basic/Taxa.aspx?TaxonNameID=1200075)
Fausto Tinti & Valerio Scali (1991) C-banding, Ag-NOR localization and chromosomal repatterning in Sardinian Bacillus atticus (Insecta, Phasmatodea), Bolletino di zoologia, 58:3, 235-243, DOI: 10.1080/11250009109355759

EU NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME

Name of organism: *Bacillus rossius (rossius)* Rossi 1788,

Subspecies: *B.r. catalauniae* (Bullini, 1982*), B.r. lobipes* (Lucas, 1849), *B.r. medeae* (Nascetti & Bullini, 1983), *B.r. montalentii* (Bullini, 1982), *B.r. redtenbacheri* (Padewieth, 1899*), B.r. rossius* (Rossi, 1790) [synonyms: *B.r. chopardi* (Capra, 1937), *B.r. dentatus* (Brunner von Wattenwyl, 1907*), B.r. filiformis* (Cyrillo, 1787)], *B.r. tripolitanus* (Haan, 1842)

Common name: Mediterranean Stick Insect

Author: Anders Nielsen

Risk Assessment Area: Norway

Draft:

SECTION B – Detailed assessment			
PROBABILITY OF ENTRY			
Important instructions: • Entry is the introduction of an organism into Norway. Not to be confused with spread, the movement of an organism within Europe. • For organisms which are already present in Norway, only complete the entry section for current active pathways of entry or if relevant potential future pathways. The entry section need not be completed for organisms which have entered in the past and have no current pathways of entry.			
QUESTION	**RESPONSE [chose one entry, delete all others]**	**UNCERTAINTY [chose one entry, delete all others]**	**COMMENT**
1.8. How many known pathways are relevant to the potential entry of this organism?	very few	low	Mediterranean species in trade.
1.2. List relevant pathways through which the organism could enter. Where possible give detail about the specific origins and end points of the pathways. For each pathway answer questions 1.3 to 1.10 (copy and paste additional rows at the end of this section as necessary).	Commercial pet trade Private import		In trade
Pathway name:	Commercial pet trade and private import		

1.3. Is entry along this pathway intentional (e.g. the organism is imported for trade) or accidental (the organism is a contaminant of imported goods)?	intentional	low	
1.4. How likely is it that large numbers of the organism will travel along this pathway from the point(s) of origin over the course of one year? Subnote: In your comment discuss how likely the organism is to get onto the pathway in the first place.	very unlikely	low	The species can be caught in the wild and kept as pet. Degree of trade is unknown though most likely limited.
1.5. How likely is the organism to be able to transfer from the pathway to a suitable habitat or host?	very unlikely	low	
1.6. Estimate the overall likelihood of entry into Norway based on this pathway?	very unlikely	low	
End of pathway assessment, repeat as necessary.			
1.7. Estimate the overall likelihood of entry into Norway based on all pathways (comment on the key issues that lead to this conclusion).	very unlikely	low	Since the species is in trade entry is expected, however not in large numbers

PROBABILITY OF ESTABLISHMENT			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
1.8. How likely is it that the organism will be able to establish in Norway based on the similarity between climatic conditions in Norway and the organism's current distribution?	unlikely	high	Native range is the Mediterranean, but can survive temperatures down to 15 degrees Celsius. Climate requirements for egg survival is unknown
1.9. How likely is it that the organism will be able to establish in Norway based on the similarity between other abiotic conditions in Norway and the organism's current distribution?	NA	NA	
1.10. How likely is it that the organism will become established in protected conditions (in which the environment is artificially maintained, such as wildlife parks, glasshouses, aquaculture facilities, terraria, zoological gardens) in Norway? Subnote: gardens are not considered protected conditions	likely	low	
1.11. How widespread are habitats or species necessary for the survival, development and multiplication of the organism in Norway?	isolated	high	Gardens are most likely the potential habitat where the species can potentially establish in Norway. In England the species preferred food plant is Bramble, but it can also survive on other food plants such as *Leylandii* hedges

1.12. How likely is it that establishment will occur despite management practices (including eradication campaigns), competition from existing species or predators, parasites or pathogens in Norway?	likely	high	Large insects that should be easy to locate as adults. Eggs might harder to find and remove.
1.13. How likely are the biological characteristics (including adaptability and capacity of spread) of the organism to facilitate its establishment?	unlikely	high	Species is both parthenogenetic and sexually reproducing, but only females have been observed where it has established in England. Further information on species biologically characteristics are lacking. The species have shown the potential of hybridize with other species within the genus *Bacillus*, but the biology of hybrids are not documented
1.14. How likely is it that the organism could establish despite low genetic diversity in the founder population?	likely	medium	The species is parthenogenetic. Generally insects are able to establish founder populations with low genetic diversity
1.15. Based on the history of invasion by this organism elsewhere in the world, how likely is to establish in Norway? (If possible, specify the instances in the comments box.)	NA	NA	Limited establishment recorded in Southern England, but no known invasions
1.16. Estimate the overall likelihood of establishment in Norway (mention any key issues in the comment box).	moderately likely	low	Mediterranean species, but climate conditions in Southern parts of Norway is, in a 50 year perspective, is expected to resemble those found in Southern England today, where the species has established.

PROBABILITY OF SPREAD			
Important notes: • Spread is defined as the expansion of the geographical distribution of an alien species within an area.			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
2.1. How likely is it that this organism will spread widely in Norway by *natural means*? (Please list and comment on the mechanisms for natural spread.)	very unlikely	high	The species is wingless and slow moving
2.2. How likely is it that this organism will spread widely in Norway by *human assistance*? (Please list and comment on the mechanisms for human-assisted spread.)	moderately likely	low	*Bacillius rossius* is in trade and spread in Norway is expected. Spread might also be facilitated by movement of plants containing eggs among gardens
2.3. How likely is it that spread of the organism within Norway can be completely contained?	moderately likely	medium	If established in a garden centres the species might be spread as eggs in soil
2.4. Based on the answers to questions on the potential for establishment and spread in Norway, define the area endangered by the organism.	Southern Norway	high	Southern Norway is the only area where the climate is expected to resemble that of Southern England (where the species has established) in a 50 year perspective.
2.5. Estimate the overall potential for future spread for this organism in Norway (using the comment box to indicate any key issues).	very unlikely	medium	*Bacillus rossius* are wingless insects and slow moving, with low spreading potential. It has not spread widely in Southern England where it has established.

PROBABILITY OF ENVIRONMENTAL IMPACT			
Important instructions: • **When assessing potential future environmental impacts, climate change should not be taken into account. This is done in later questions at the end of the assessment.** • **Each set of questions starts with the impact elsewhere in the world, then considers impacts in Norway separating known impacts to date (i.e. past and current impacts) from potential future impacts. Key words are in bold for emphasis.**			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
2.6. How much environmental harm is caused by the organism within its existing geographic range, excluding Norway?	minimal	low	**No harmful environmental impact recorded where it has established in Southern England.**
2.7. How much impact would there be, if genetic traits of the organism were to be transmitted to other species, modifying their genetic makeup and making their environmental effects more serious?	minimal	low	No closely related species are in Norway
2.8. How much impact does the organism have, as food, as a host, or as a symbiont or a vector for other damaging organisms (e.g. diseases)?	minimal	high	No known diseases for plants or insects described on this species. No recordings of environmental impact recorded from Southern England.
2.9. How much impact do other factors have, factors which are not covered by previous questions (specify in the comment box)	NA	high	None known

2.10. How important are the expected impacts of the organism despite any natural control by other organisms, such as predators, parasites or pathogens that may already be present in Norway?	minimal	medium	
2.11. Indicate any parts of Norway where environmental impacts are particularly likely to occur (provide as much detail as possible).	None known	low	Based on information from established populations in Southern England no environmental impact is expected anywhere in Norway.

ADDITIONAL QUESTIONS - CLIMATE CHANGE			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
3.1. What aspects of climate change (in a 50 year perspective), if any, are most likely to affect the risk assessment for this organism?	Increased temperatures	medium	Mediterranean origin, but established in Southern England.
3.2. What aspects of the risk assessment are most likely to change as a result of climate change? • Establishment • Spread • Impact on biodiversity • Impact on ecosystem functions	Establishment Spread	low	Increased temperatures will increase the probability of establishment, whether winter survival or summer temperatures (during adult stage) is the limiting factor is unknown.

RISK SUMMARIES			
	RESPONSE	**UNCERTAINTY**	**COMMENT**
Summarise Entry	Moderately likely	low	In trade, but no records of escapes in Norway. In Southern England the species has established
Summarise Establishment	unlikely	low	Native range is the Mediterranean, but can survive temperatures down to 15 degrees Celsius. Climate requirements for egg survival are unknown, but are most likely limiting factors as the species has only established in Southern England.
Summarise Spread	very slowly	medium	*Bacillus rossius* are wingless insects. Generally, stick insect does not spread very well.
Summarise Impact	minimal	low	Based on the establishment of the species beyond its native range the ecological impact is assumed to be minimal
Conclusion of the risk assessment	low	low	Though the potential for establishment and spread is present, the potential environmental impact is negligible and therefore we conclude on low risk

REFERENCES:

EU NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME
Name of organism: *Bacillus whitei* Nascetti & Bullini, 1981 **Author:** Anders Nielsen **Risk Assessment Area:** Norway **Draft:**

SECTION B – Detailed assessment

PROBABILITY OF ENTRY			
Important instructions: • Entry is the introduction of an organism into Norway. Not to be confused with spread, the movement of an organism within Europe. • For organisms which are already present in Norway, only complete the entry section for current active pathways of entry or if relevant potential future pathways. The entry section need not be completed for organisms which have entered in the past and have no current pathways of entry.			
QUESTION	**RESPONSE [chose one entry, delete all others]**	**UNCERTAINTY [chose one entry, delete all others]**	**COMMENT**
1.9. How many known pathways are relevant to the potential entry of this organism?	very few	low	Mediterranean species in trade.
1.2. List relevant pathways through which the organism could enter. Where possible give detail about the specific origins and end points of the pathways. For each pathway answer questions 1.3 to 1.10 (copy and paste additional rows at the end of this section as necessary).	Commercial pet trade Private import		In trade
Pathway name:	Commercial pet trade and private import		

1.3. Is entry along this pathway intentional (e.g. the organism is imported for trade) or accidental (the organism is a contaminant of imported goods)?	intentional	low	
1.4. How likely is it that large numbers of the organism will travel along this pathway from the point(s) of origin over the course of one year? Subnote: In your comment discuss how likely the organism is to get onto the pathway in the first place.	very unlikely	low	The species can be caught in the wild and kept as pet. Degree of trade is unknown though most likely limited.
1.5. How likely is the organism to be able to transfer from the pathway to a suitable habitat or host?	very unlikely	low	
1.6. Estimate the overall likelihood of entry into Norway based on this pathway?	very unlikely	low	
End of pathway assessment, repeat as necessary.			
1.7. Estimate the overall likelihood of entry into Norway based on all pathways (comment on the key issues that lead to this conclusion).	very unlikely	low	Since the species is in trade entry is expected, however not in large numbers

PROBABILITY OF ESTABLISHMENT			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
1.8. How likely is it that the organism will be able to establish in Norway based on the similarity between climatic conditions in Norway and the organism's current distribution?	unlikely	high	Native range is the Mediterranean, but can survive temperatures down to 15 degrees Celsius. Climate requirements for egg survival is unknown
1.9. How likely is it that the organism will be able to establish in Norway based on the similarity between other abiotic conditions in Norway and the organism's current distribution?	NA	NA	
1.10. How likely is it that the organism will become established in protected conditions (in which the environment is artificially maintained, such as wildlife parks, glasshouses, aquaculture facilities, terraria, zoological gardens) in Norway? Subnote: gardens are not considered protected conditions	likely	low	
1.11. How widespread are habitats or species necessary for the survival, development and multiplication of the organism in Norway?	isolated	high	Gardens are most likely the potential habitat where the species can potentially establish in Norway.
1.12. How likely is it that establishment will occur despite management practices (including eradication	unlikely	high	Large insects that should be easy to locate as adults. Eggs are harder to find and remove.

campaigns), competition from existing species or predators, parasites or pathogens in Norway?			
1.13. How likely are the biological characteristics (including adaptability and capacity of spread) of the organism to facilitate its establishment?	unlikely	high	Species is parthenogenetic. Further information on species biologically characteristics are lacking.
1.14. How likely is it that the organism could establish despite low genetic diversity in the founder population?	likely	medium	The species is parthenogenetic. . Generally insects are able to establish founder populations with low genetic diversity
1.15. Based on the history of invasion by this organism elsewhere in the world, how likely is to establish in Norway? (If possible, specify the instances in the comments box.)	NA	NA	Limited establishment recorded in Southern England, but no known invasions
1.16. Estimate the overall likelihood of establishment in Norway (mention any key issues in the comment box).	moderately likely	low	Mediterranean species, but climate conditions in Southern parts of Norway is, in a 50 year perspective, is expected to resemble those found in Southern England today, where the species has established.

PROBABILITY OF SPREAD			
Important notes: • Spread is defined as the expansion of the geographical distribution of an alien species within an area.			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
2.1. How likely is it that this organism will spread widely in Norway by *natural means*? (Please list and comment on the mechanisms for natural spread.)	very unlikely	high	The species is wingless and slow moving
2.2. How likely is it that this organism will spread widely in Norway by *human assistance*? (Please list and comment on the mechanisms for human-assisted spread.)	Moderately likely	high	*Bacillius whitei* is in trade and spread in Norway is expected. Spread might also be facilitated by movement of plants containing eggs among gardens
2.3. How likely is it that spread of the organism within Norway can be completely contained?	Moderately likely	medium	If established in a garden centres the species might be spread as eggs in soil
2.4. Based on the answers to questions on the potential for establishment and spread in Norway, define the area endangered by the organism.	Southern Norway	high	Southern Norway is the only area where the climate is expected to resemble that of Southern England (where the species has established) in a 50 year perspective.
2.5. Estimate the overall potential for future spread for this organism in Norway (using the comment box to indicate any key issues).	very unlikely	medium	*Bacillus whitei* are wingless insects and slow moving, with low spreading potential. It has not spread widely in Southern England where it has established.

PROBABILITY OF ENVIRONMENTAL IMPACT			
Important instructions: • **When assessing potential future environmental impacts, climate change should not be taken into account. This is done in later questions at the end of the assessment.** • **Each set of questions starts with the impact elsewhere in the world, then considers impacts in Norway separating known impacts to date (i.e. past and current impacts) from potential future impacts. Key words are in bold for emphasis.**			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
2.6. How much environmental harm is caused by the organism within its existing geographic range, excluding Norway?	minimal	low	**No harmful environmental impact recorded where it has established in Southern England.**
2.7. How much impact would there be, if genetic traits of the organism were to be transmitted to other species, modifying their genetic makeup and making their environmental effects more serious?	minimal	low	No closely related species are in Norway
2.8. How much impact does the organism have, as food, as a host, or as a symbiont or a vector for other damaging organisms (e.g. diseases)?	minimal	high	No known diseases for plants or insects described on this species. No recordings of environmental impact recorded from Southern England.
2.9. How much impact do other factors have, factors which are not covered by previous questions (specify in the comment box)	NA	high	None known

2.10. How important are the expected impacts of the organism despite any natural control by other organisms, such as predators, parasites or pathogens that may already be present in Norway?	minimal	medium	
2.11. Indicate any parts of Norway where environmental impacts are particularly likely to occur (provide as much detail as possible).	None known	low	Based on information from established populations in Southern England no environmental impact is expected anywhere in Norway.

ADDITIONAL QUESTIONS - CLIMATE CHANGE			
3.1. What aspects of climate change (in a 50 year perspective), if any, are most likely to affect the risk assessment for this organism?	Increased temperatures	low	Mediterranean origin, but established in Southern England.
3.2. What aspects of the risk assessment are most likely to change as a result of climate change? • Establishment • Spread • Impact on biodiversity • Impact on ecosystem functions	Establishment Spread	low	Increased temperatures will increase the probability of establishment, whether winter survival or summer temperatures (during adult stage) is the limiting factor is unknown

RISK SUMMARIES			
	RESPONSE	**UNCERTAINTY**	**COMMENT**
Summarise Entry	Moderately likely	low	In trade, but no records of escapes in Norway. In Southern England the species has established
Summarise Establishment	unlikely	low	Native range is the Mediterranean, but can survive temperatures down to 15 degrees Celsius. Climate requirements for egg survival are unknown, but are most likely limiting factors as the species has only established in Southern England.
Summarise Spread	very slowly	medium	*Bacillus whitei* are wingless insects. Generally, stick insect does not spread very well.
Summarise Impact	minimal	low	Based on the establishment of the species beyond its native range the ecological impact is assumed to be minimal
Conclusion of the risk assessment	low	low	Though the potential for establishment and spread is present, the potential environmental impact is negligible and therefore we conclude on low risk.

Barnard, P. C. 2011. Order Phasmida: The Stick-Insects. Oxford, UK: Wiley-Blackwell, Oxford, UK.
Phasmida Species File (http://phasmida.speciesfile.org/Common/basic/Taxa.aspx?TaxonNameID= 1200102)
http://phasmidstudygroup.org/index.php/phasmids/psg-culture-list

EU NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME

Name of organism: *Clitarchus hookeri (White, 1846)*

Author: Jan Ove Gjershaug

Risk Assessment Area: Norway

Synonyms: *Bacillus coloreus, Bacillus minimus, Clitarchus interruptelineatus, Clitarchus laeviusculus, Clitarchus multidentatus, Clitarchus reductus, Clitarchus tuberculatus*

SECTION B – Detailed assessment

PROBABILITY OF ENTRY

Important instructions:

- Entry is the introduction of an organism into Norway. Not to be confused with spread, the movement of an organism within Norway.
- For organisms which are already present in Norway, only complete the entry section for current active pathways of entry or if relevant potential future pathways. The entry section need not be completed for organisms which have entered in the past and have no current pathways of entry.

QUESTION	RESPONSE [chose one entry, delete all others]	UNCERTAINTY [chose one entry, delete all others]	COMMENT
1.10. How many known pathways are relevant to the potential entry of this organism?	Very few	low	Species native in New Zealand and accidentally introduced into Isles of Scilly, UK. In trade. Has been in culture.
1.2. List relevant pathways through which the organism could enter. Where possible give detail about the specific origins and end points of the pathways. For each pathway answer questions 1.3 to 1.10 (copy and paste additional rows at the end of this section as necessary).	Commercial pet trade Private import		In trade. Has been in culture.
Pathway name:	Commercial pet trade and Private import		

1.3. Is entry along this pathway intentional (e.g. the organism is imported for trade) or accidental (the organism is a contaminant of imported goods)?	intentional	low	
1.4. How likely is it that large numbers of the organism will travel along this pathway from the point(s) of origin over the course of one year? Subnote: In your comment discuss how likely the organism is to get onto the pathway in the first place.	unlikely	low	In trade. Has been in culture.
1.5. How likely is the organism to be able to transfer from the pathway to a suitable habitat or host in Norwegian nature?	likely	low	
1.6. Estimate the overall likelihood of entry into Norwegian nature based on this pathway?	likely	low	
End of pathway assessment, repeat as necessary.			
1.7. Estimate the overall likelihood of entry into Norwegian nature based on all pathways (comment on the key issues that lead to this conclusion).	Moderately likely	medium	In trade. Has been in culture.

PROBABILITY OF ESTABLISHMENT			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
1.8. How likely is it that the organism will be able to establish in Norway based on the similarity between climatic conditions in Norway and the organism's current distribution?	likely	medium	Native range is New Zealand. It has been accidentally introduced with plant import into Isles of Scilly, where it was first reported from Tresco Abbey Gardens in 1949 (Lee 2013). The climate in Norway today is too harsh, but in a 50 year perspective, the temperature in southern parts of Norway will be similar to what we find in southern parts of England today (See Cap. 2.3).
1.9. How likely is it that the organism will be able to establish in Norway based on the similarity between other abiotic conditions in Norway and the organism's current distribution?	NA	NA	
1.10. How likely is it that the organism will become established in protected conditions (in which the environment is artificially maintained, such as wildlife parks, glasshouses, aquaculture facilities, terraria, zoological gardens) in Norway? Subnote: gardens are not considered protected conditions	likely	low	

1.11. How widespread are habitats or species necessary for the survival, development and multiplication of the organism in Norway?	isolated	medium	Gardens are probably the most useful habitat.
1.12. How likely is it that establishment will occur despite management practices (including eradication campaigns), competition from existing species or predators, parasites or pathogens in Norway?	likely	high	This is a large insect, which should be easy to locate as adults. Eggs might be harder to find and remove.
1.13. How likely are the biological characteristics (including adaptability and capacity of spread) of the organism to facilitate its establishment?	likely	medium	The species is parthenogenetic.
1.14. How likely is it that the organism could establish despite low genetic diversity in the founder population?	likely	medium	Generally insects are able to establish founder populations with low genetic diversity.
1.15. Based on the history of invasion by this organism elsewhere in the world, how likely is to establish in Norway? (If possible, specify the instances in the comments box.)	likely	medium	As the temperature in southern parts of Norway in a 50 year perspective will be similar to what we find in southern parts of England today, it is likely that it can establish also in Norway (See Cap. 2.3).
1.16. Estimate the overall likelihood of establishment in Norway (mention any key issues in the comment box).	Moderately likely	low	The climate in Norway in a 50 year perspective, may be similar to what we find in southern parts of England today (See Cap. 2.3).

PROBABILITY OF SPREAD			
Important notes: • Spread is defined as the expansion of the geographical distribution of an alien species within an area.			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
2.1. How likely is it that this organism will spread widely in Norway by natural means? (Please list and comment on the mechanisms for natural spread.)	very unlikely	low	Wings? No Parthenogenesis? Yes
2.2. How likely is it that this organism will spread widely in Norway by human assistance? (Please list and comment on the mechanisms for human-assisted spread.)	very unlikely	low	If trade in this species is initiated its spread would be by human assistance. However, massive trade is not expected. Plants with eggs from one garden to another garden is another potential for spreading.
2.3. How likely is it that the spread of the organism within Norway can be completely contained?	Moderately likely	medium	If established in a garden senter.
2.4. Based on the answers to questions on the potential for establishment and spread in Norway, define the area endangered by the organism.	Unknown	high	Southern parts of Norway
2.5. Estimate the overall potential for future spread for this organism in Norway (using the comment box to indicate any key issues).	unlikely	medium	This species is wingless and slow moving.

PROBABILITY OF ENVIRONMENTAL IMPACT			
Important instructions: • **When assessing potential future environmental impacts, climate change should not be taken into account. This is done in later questions at the end of the assessment.** • **Each set of questions starts with the impact elsewhere in the world, then considers impacts in Norway separating known impacts to date (i.e. past and current impacts) from potential future impacts. Key words are in bold for emphasis.**			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
2.6. How much environmental harm is caused by the organism within its existing geographic range excluding Norway?	minimal	low	**No serious harm to the environment has been reported from Southern England (Lee 2016).**
2.7. How much impact would there be, if genetic traits of the organism were to be transmitted to other species, modifying their genetic makeup and making their environmental effects more serious?	minimal	low	We have no related species in Norway.
2.8. How much impact does the organism have, as food, as a host, or as a symbiont or a vector for other damaging organisms (e.g. diseases)?	minimal	high	No known diseases for plants or insects are describes for this species.
2.9. How much impact do other factors have, factors which are not covered by previous questions (specify in the comment box)	NA	high	None known

2.10. How important are the expected impacts of the organism despite any natural control by other organisms, such as predators, parasites or pathogens that may already be present in Norway?	minimal	medium	
2.11. Indicate any parts of Norway where environmental impacts are particularly likely to occur (provide as much detail as possible).	none known	low	Based on the situation in Southern England no environmental impacts is likely to occur (Lee 2016).

ADDITIONAL QUESTIONS - CLIMATE CHANGE			
3.1. What aspects of climate change (in a 50 year perspective), if any, are most likely to affect the risk assessment for this organism?	increased temperature	medium	The temperature in southern parts of Norway will be similar to what we find in southern parts of England today. (See Cap. 2.3).
3.2. What aspects of the risk assessment are most likely to change as a result of climate change? • Establishment • Spread • Impact on biodiversity • Impact on ecosystem functions	establishment spread	low	The temperature in southern parts of Norway will be similar to what we find in southern parts of England today. (See Cap. 2.3).

RISK SUMMARIES			
	RESPONSE	**UNCERTAINTY**	**COMMENT**
Summarise Entry	moderately likely	medium	No current known trade to Norway, but the market is dynamic and this can change in the future.
Summarise Establishment	Moderately likely	low	The temperature in southern parts of Norway will be similar to what we find in southern parts of England today. (See Cap. 2.3).
Summarise Spread	unlikely	medium	This species is wingless and therefor does not spread very well.
Summarise Impact	minimal	low	Based on the situation this species in Isles of Scilly, the ecological impact is assumed to be minimal (Lee 2016)
Conclusion of the risk assessment	low	low	Though the potential for establishment and spread is present, the potential environmental impact is negligible, and therefore we conclude on Low.

REFERENCES:

Lee, M. 2013. The naturalised British stick insects. Phasmid Study Group. (http://phasmidstudygroup.org/index.ohp/phasmids/uk-phasmid-sighting)

Lee, M. 2016. Stick insects. Fast facts. (https://www.buglife.org.uk/bugs-and-habitats/stick-insects)

Phasmida Species file (http://phasmida.speciesfile.org/Common/basic/Taxa.aspx?TaxonNameID=1201286)

EU NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME

Name of organism: *Clonopsis gallica* Charpentier, 1825

Synonyms: *C. affinis* (Salfi, 1925), *C. granulatus* (Brullé, 1832), *C. occidentalis* (Bolívar, 1894)

Common name: French stick insect

Author: Anders Nielsen

Risk Assessment Area: Norway

Draft:

SECTION B – Detailed assessment			
PROBABILITY OF ENTRY			
Important instructions: • Entry is the introduction of an organism into Norway. Not to be confused with spread, the movement of an organism within Europe. • For organisms which are already present in Norway, only complete the entry section for current active pathways of entry or if relevant potential future pathways. The entry section need not be completed for organisms which have entered in the past and have no current pathways of entry.			
QUESTION	**RESPONSE [chose one entry, delete all others]**	**UNCERTAINTY [chose one entry, delete all others]**	**COMMENT**
1.11. How many known pathways are relevant to the potential entry of this organism?	very few	low	Mediterranean species in trade.
1.2. List relevant pathways through which the organism could enter. Where possible give detail about the specific origins and end points of the pathways. For each pathway answer questions 1.3 to 1.10 (copy and paste additional rows at the end of this section as necessary).	Commercial pet trade Private import		In trade
Pathway name:	Commercial pet trade and private import		

1.3. Is entry along this pathway intentional (e.g. the organism is imported for trade) or accidental (the organism is a contaminant of imported goods)?	intentional	low	
1.4. How likely is it that large numbers of the organism will travel along this pathway from the point(s) of origin over the course of one year? Subnote: In your comment discuss how likely the organism is to get onto the pathway in the first place.	very unlikely	low	Degree of trade is unknown though most likely limited.
1.5. How likely is the organism to be able to transfer from the pathway to a suitable habitat or host?	very unlikely	low	
1.6. Estimate the overall likelihood of entry into Norway based on this pathway?	very unlikely	low	
End of pathway assessment, repeat as necessary.			
1.7. Estimate the overall likelihood of entry into Norway based on all pathways (comment on the key issues that lead to this conclusion).	very unlikely	low	Since the species is in trade entry is expected, however not in large numbers

PROBABILITY OF ESTABLISHMENT			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
1.8. How likely is it that the organism will be able to establish in Norway based on the similarity between climatic conditions in Norway and the organism's current distribution?	unlikely	high	Native range is the Mediterranean, but can survive temperatures down to 15 degrees Celsius. Climate requirements for egg survival is unknown
1.9. How likely is it that the organism will be able to establish in Norway based on the similarity between other abiotic conditions in Norway and the organism's current distribution?	NA	NA	
1.10. How likely is it that the organism will become established in protected conditions (in which the environment is artificially maintained, such as wildlife parks, glasshouses, aquaculture facilities, terraria, zoological gardens) in Norway? Subnote: gardens are not considered protected conditions	likely	low	
1.11. How widespread are habitats or species necessary for the survival, development and multiplication of the organism in Norway?	isolated	high	Gardens are most likely the potential habitat where the species can potentially establish in Norway.
1.12. How likely is it that establishment will occur despite management practices (including eradication	likely	high	Large insects that should be easy to locate as adults. Eggs might harder to find and remove.

campaigns), competition from existing species or predators, parasites or pathogens in Norway?			
1.13. How likely are the biological characteristics (including adaptability and capacity of spread) of the organism to facilitate its establishment?	unlikely	high	Species is parthenogenetic. Further information on species biologically characteristics are lacking.
1.14. How likely is it that the organism could establish despite low genetic diversity in the founder population?	unlikely	medium	The species is parthenogenetic. Generally insects are able to establish founder populations with low genetic diversity
1.15. Based on the history of invasion by this organism elsewhere in the world, how likely is to establish in Norway? (If possible, specify the instances in the comments box.)	NA	NA	Limited establishment recorded in Southern England, but no known invasions
1.16. Estimate the overall likelihood of establishment in Norway (mention any key issues in the comment box).	very unlikely	low	Mediterranean species, but climate conditions in Southern parts of Norway is, in a 50 year perspective, is expected to resemble those found in Southern England today, where the species has established.

PROBABILITY OF SPREAD			
Important notes: • Spread is defined as the expansion of the geographical distribution of an alien species within an area.			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
2.1. How likely is it that this organism will spread widely in Norway by *natural means*? (Please list and comment on the mechanisms for natural spread.)	very unlikely	high	The species is wingless and slow moving
2.2. How likely is it that this organism will spread widely in Norway by *human assistance*? (Please list and comment on the mechanisms for human-assisted spread.)	moderately likely	low	*Clonopsis gallica* is in trade and spread in Norway is expected. Spread might also be facilitated by movement of plants containing eggs among gardens
2.3. How likely is it that spread of the organism within Norway can be completely contained?	moderately likely	medium	If established in a garden centres the species might be spread as eggs in soil
2.4. Based on the answers to questions on the potential for establishment and spread in Norway, define the area endangered by the organism.	Southern Norway	high	Southern Norway is the only area where the climate is expected to resemble that of Southern England (where the species has established) in a 50 year perspective.
2.5. Estimate the overall potential for future spread for this organism in Norway (using the comment box to indicate any key issues).	very unlikely	medium	*Clonopsis gallica* are wingless insects and slow moving, with low spreading potential. It has not spread widely in Southern England where it has established.

PROBABILITY OF ENVIRONMENTAL IMPACT			
Important instructions: • **When assessing potential future environmental impacts, climate change should not be taken into account. This is done in later questions at the end of the assessment.** • **Each set of questions starts with the impact elsewhere in the world, then considers impacts in Norway separating known impacts to date (i.e. past and current impacts) from potential future impacts. Key words are in bold for emphasis.**			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
2.6. How much environmental harm is caused by the organism within its existing geographic range, excluding Norway?	minimal	low	**No harmful environmental impact recorded where it has established in Southern England.**
2.7. How much impact would there be, if genetic traits of the organism were to be transmitted to other species, modifying their genetic makeup and making their environmental effects more serious?	minimal	low	No closely related species are in Norway
2.8. How much impact does the organism have, as food, as a host, or as a symbiont or a vector for other damaging organisms (e.g. diseases)?	minimal	high	No known diseases for plants or insects described on this species. No recordings of environmental impact recorded from Southern England.
2.9. How much impact do other factors have, factors which are not covered by previous questions (specify in the comment box)	NA	high	None known

2.10. How important are the expected impacts of the organism despite any natural control by other organisms, such as predators, parasites or pathogens that may already be present in Norway?	minimal	medium	
2.11. Indicate any parts of Norway where environmental impacts are particularly likely to occur (provide as much detail as possible).	None known	low	Based on information from established populations in Southern England no environmental impact is expected anywhere in Norway.

ADDITIONAL QUESTIONS - CLIMATE CHANGE			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
3.1. What aspects of climate change (in a 50 year perspective), if any, are most likely to affect the risk assessment for this organism?	Increased temperatures	medium	Mediterranean origin, but established in Southern England.
3.2. What aspects of the risk assessment are most likely to change as a result of climate change? • Establishment • Spread • Impact on biodiversity • Impact on ecosystem functions	Establishment Spread	low	Increased temperatures will increase the probability of establishment, whether winter survival or summer temperatures (during adult stage) is the limiting factor is unknown.

RISK SUMMARIES			
	RESPONSE	**CONFIDENCE**	**COMMENT**
Summarise Entry	Moderately likely	low	In trade, but no records of escapes in Norway. In Southern England the species has established
Summarise Establishment	unlikely	low	Native range is the Mediterranean, but can survive temperatures down to 15 degrees Celsius. Climate requirements for egg survival are unknown, but are most likely limiting factors as the species has only established in Southern England.
Summarise Spread	very slowly	medium	*Clonopsis gallica* are wingless insects. Generally, stick insect does not spread very well.
Summarise Impact	minimal	low	Based on the establishment of the species beyond its native range the ecological impact is assumed to be minimal
Conclusion of the risk assessment	low	low	Though the potential for establishment and spread is present, the potential environmental impact is negligible and therefore we conclude on low risk

REFERENCES:

Phasmida Species File (http://phasmida.speciesfile.org/Common/basic/Taxa.aspx?TaxonNameID= 1200105)
http://phasmidstudygroup.org/index.php/phasmids/psg-culture-list
Milani, L., V. Scali & M. Passamonti. 2009. The Clonopsis gallica puzzle: Mendelian species, polyploid parthenogens with karyotype re-diploidization and clonal androgens in Moroccan stick insects (Phasmida). Journal of Zoological Systeematics and Evolutionary research 47(2): 132-140.

EU NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME
Name of organism: Micarchus parvulus Carl, 1913 **Author:** Jan Ove Gjershaug **Risk Assessment Area:** Norway **Draft:**

SECTION B – Detailed assessment

PROBABILITY OF ENTRY

Important instructions:

- Entry is the introduction of an organism into Norway. Not to be confused with spread, the movement of an organism within Norway.
- For organisms which are already present in Norway, only complete the entry section for current active pathways of entry or if relevant potential future pathways. The entry section need not be completed for organisms which have entered in the past and have no current pathways of entry.

QUESTION	**RESPONSE [chose one entry, delete all others]**	**UNCERTAINTY [chose one entry, delete all others]**	**COMMENT**
1.12. How many known pathways are relevant to the potential entry of this organism?	Very few	low	Species native in New Zealand. Not known to be in trade.
1.2. List relevant pathways through which the organism could enter. Where possible give detail about the specific origins and end points of the pathways. For each pathway answer questions 1.3 to 1.10 (copy and paste additional rows at the end of this section as necessary).	Commercial pet trade Private import	high	Not known to be in trade
Pathway name:	Commercial pet trade and Private import		

1.3. Is entry along this pathway intentional (e.g. the organism is imported for trade) or accidental (the organism is a contaminant of imported goods)?	intentional	low	
1.4. How likely is it that large numbers of the organism will travel along this pathway from the point(s) of origin over the course of one year? Subnote: In your comment discuss how likely the organism is to get onto the pathway in the first place.	Very unlikely	low	Not known to be in trade
1.5. How likely is the organism to be able to transfer from the pathway to a suitable habitat or host in Norwegian nature?	unlikely	low	
1.6. Estimate the overall likelihood of entry into Norwegian nature based on this pathway?	unlikely	low	
End of pathway assessment, repeat as necessary.			
1.7. Estimate the overall likelihood of entry into Norwegian nature based on all pathways (comment on the key issues that lead to this conclusion).	unlikely	low	Not known to be in trade.

PROBABILITY OF ESTABLISHMENT			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
1.8. How likely is it that the organism will be able to establish in Norway based on the similarity between climatic conditions in Norway and the organism's current distribution?	likely	medium	Native range is New Zealand, both in the South and North Island. The climate in Norway today is too harsh, but in a 50 year perspective, the temperature in southern parts of Norway will be similar to what we find in parts of New Zealand (See Cap. 2.3). The species has survived minus 5°C cold shock, and probably survive low temperature in their habitat by supercooling and avoiding internal ice formation. Deep snow cover in their habitat likely buffering temperatures so it remains unfrozen through most of the winter (Dennis et al. 2015). Many New Zealand stick insect eggs can survive lengthy periods of frost (Lee 1993).
1.9. How likely is it that the organism will be able to establish in Norway based on the similarity between other abiotic conditions in Norway and the organism's current distribution?	NA	NA	
1.10. How likely is it that the organism will become established in protected conditions (in which the environment is artificially maintained, such as wildlife parks, glasshouses, aquaculture facilities, terraria, zoological gardens) in Norway?	likely	low	

Subnote: gardens are not considered protected conditions			
1.11. How widespread are habitats or species necessary for the survival, development and multiplication of the organism in Norway?	isolated	medium	Gardens are probably the most useful habitat.
1.12. How likely is it that establishment will occur despite management practices (including eradication campaigns), competition from existing species or predators, parasites or pathogens in Norway?	likely	high	This is a large insect, which should be easy to locate as adults. Eggs might be harder to find and remove.
1.13. How likely are the biological characteristics (including adaptability and capacity of spread) of the organism to facilitate its establishment?	likely	medium	The species is parthenogenetic.
1.14. How likely is it that the organism could establish despite low genetic diversity in the founder population?	likely	medium	Generally insects are able to establish founder populations with low genetic diversity.
1.15. Based on the history of invasion by this organism elsewhere in the world, how likely is to establish in Norway? (If possible, specify the instances in the comments box.)	likely	medium	As the temperature in southern parts of Norway in a 50 year perspective will be similar to what we find in parts of New Zealand, it is likely that it can establish also in Norway (See Cap. 2.3).
1.16. Estimate the overall likelihood of establishment in Norway (mention any key issues in the comment box).	Moderately likely	low	As the temperature in southern parts of Norway in a 50 year perspective will be similar to what we find in parts of New Zealand, it is

			likely that it can establish also in Norway (See Cap. 2.3).

PROBABILITY OF SPREAD			
Important notes: • Spread is defined as the expansion of the geographical distribution of an alien species within an area.			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
2.1. How likely is it that this organism will spread widely in Norway by natural means? (Please list and comment on the mechanisms for natural spread.)	very unlikely	low	Wings? No Parthenogenesis? Yes
2.2. How likely is it that this organism will spread widely in Norway by human assistance? (Please list and comment on the mechanisms for human-assisted spread.)	very unlikely	low	If trade in this species is initiated its spread would be by human assistance. However, massive trade is not expected. Plants with eggs from one garden to another garden is another potential for spreading.
2.3. How likely is it that the spread of the organism within Norway can be completely contained?	Moderately likely	medium	If established in a garden senter.
2.4. Based on the answers to questions on the potential for establishment and spread in Norway, define the area endangered by the organism.	Unknown	high	Southern parts of Norway
2.5. Estimate the overall potential for future spread for this organism in Norway (using the comment box to indicate any key issues).	unlikely	medium	This species is wingless and slow moving.

PROBABILITY OF ENVIRONMENTAL IMPACT			
Important instructions: • **When assessing potential future environmental impacts, climate change should not be taken into account. This is done in later questions at the end of the assessment.** • **Each set of questions starts with the impact elsewhere in the world, then considers impacts in Norway separating known impacts to date (i.e. past and current impacts) from potential future impacts. Key words are in bold for emphasis.**			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
2.6. How much environmental harm is caused by the organism within its existing geographic range excluding Norway?	minimal	low	**No serious harm to the environment has been reported from other New Zealand stick insects in Southern England (Lee 2016).**
2.7. How much impact would there be, if genetic traits of the organism were to be transmitted to other species, modifying their genetic makeup and making their environmental effects more serious?	minimal	low	We have no related species in Norway.
2.8. How much impact does the organism have, as food, as a host, or as a symbiont or a vector for other damaging organisms (e.g. diseases)?	minimal	high	No known diseases for plants or insects are describes for this species.
2.9. How much impact do other factors have, factors which are not covered by previous questions (specify in the comment box)	NA	high	None known

2.10. How important are the expected impacts of the organism despite any natural control by other organisms, such as predators, parasites or pathogens that may already be present in Norway?	minimal	medium	
2.11. Indicate any parts of Norway where environmental impacts are particularly likely to occur (provide as much detail as possible).	none known	low	Based on the situation in Southern England from other species of stick insects from New Zealand, no environmental impacts is likely to occur (Lee 2016).

ADDITIONAL QUESTIONS - CLIMATE CHANGE			
3.1. What aspects of climate change (in a 50 year perspective), if any, are most likely to affect the risk assessment for this organism?	increased temperature	medium	The temperature in southern parts of Norway will be similar to what we find in parts of New Zealand (See Cap. 2.3).
3.2. What aspects of the risk assessment are most likely to change as a result of climate change? • Establishment • Spread • Impact on biodiversity • Impact on ecosystem functions	establishme nt spread	low	The temperature in southern parts of Norway will be similar to what we find in parts of New Zealand (See Cap. 2.3).

RISK SUMMARIES			
	RESPONSE	**UNCERTAINTY**	**COMMENT**
Summarise Entry	moderately likely	medium	No current known trade to Norway, but the market is dynamic and this can change in the future.
Summarise Establishment	Moderately likely	low	The climate in Norway today is probably too harsh, but with climate change in the next 50 years, the climate in some parts of Norway may be similar to what we find in parts of New Zealand.
Summarise Spread	unlikely	medium	This species is wingless and therefor does not spread very well.
Summarise Impact	minimal	low	Based on the situation in England from other species of New Zealand stick insects, the ecological impact is assumed to be minimal (Lee 2016)
Conclusion of the risk assessment	low	low	Though the potential for establishment and spread is present, the potential environmental impact is negligible, and therefore we conclude on Low.

REFERENCES: Brock, P. D. & Jewell, T. 2015. An updated Checklist of New Zealand Phasmids. The Phasmid Study Group 134: 13-14.
Dennis, A. B., Dunning, L. T., Sinclair, B. J. & Buckley, T. R. 2015. Parallel molecular routes to cold adaptation in eight genera of New Zealand stick insects. Scientific reports 5:13965 (DOI: 10.1038/srep13965).
Lee, M. 1993. A survey of the distribution of the unarmed stick insect Acanthoxyla inermis in Port Gaverne and Port Isaac, north Cornwall in 1992. Phasmid Studies 2: 25-32.
Lee, M. 2016. Stick insects. Fast facts. (https://www.buglife.org.uk/bugs-and-habitats/stick-insects)
Phasmida Species file (http://phasmida.speciesfile.org/Common/basic/Taxa.aspx?TaxonNameID=1203793)

EU NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME

Name of organism: *Niveaphasma annulatum* (Hutton, 1898)

Author: Jan Ove Gjershaug

Risk Assessment Area: Norway

Synonyms: *Pachymorpha bouvieri*

SECTION B – Detailed assessment

PROBABILITY OF ENTRY

Important instructions:

- Entry is the introduction of an organism into Norway. Not to be confused with spread, the movement of an organism within Norway.
- For organisms which are already present in Norway, only complete the entry section for current active pathways of entry or if relevant potential future pathways. The entry section need not be completed for organisms which have entered in the past and have no current pathways of entry.

QUESTION	**RESPONSE [chose one entry, delete all others]**	**UNCERTAINTY [chose one entry, delete all others]**	**COMMENT**
1.13. How many known pathways are relevant to the potential entry of this organism?	Very few	low	Species native in New Zealand. Not known to be in trade.
1.2. List relevant pathways through which the organism could enter. Where possible give detail about the specific origins and end points of the pathways. For each pathway answer questions 1.3 to 1.10 (copy and paste additional rows at the end of this section as necessary).	Commercial pet trade Private import	high	Not known to be in trade
Pathway name:	Commercial pet trade and Private import		

1.3. Is entry along this pathway intentional (e.g. the organism is imported for trade) or accidental (the organism is a contaminant of imported goods)?	intentional	low	
1.4. How likely is it that large numbers of the organism will travel along this pathway from the point(s) of origin over the course of one year? Subnote: In your comment discuss how likely the organism is to get onto the pathway in the first place.	Very unlikely	low	Not known to be in trade
1.5. How likely is the organism to be able to transfer from the pathway to a suitable habitat or host in Norwegian nature?	unlikely	low	
1.6. Estimate the overall likelihood of entry into Norwegian nature based on this pathway?	unlikely	low	
End of pathway assessment, repeat as necessary.			
1.7. Estimate the overall likelihood of entry into Norwegian nature based on all pathways (comment on the key issues that lead to this conclusion).	unlikely	low	Not known to be in trade.

PROBABILITY OF ESTABLISHMENT			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
1.8. How likely is it that the organism will be able to establish in Norway based on the similarity between climatic conditions in Norway and the organism's current distribution?	likely	medium	Native range is New Zealand, both in the South and North Island, from sea level to approximately. 1000 m a.s.l.. The climate in Norway today is too harsh, but in a 50 year perspective, the temperature in southern parts of Norway will be similar to what we find in parts of New Zealand (See Cap. 2.3). The species is freeze tolerant, and can survive in localities with winter temperatures as low as minus 11,6˚C (Dennis et al. 2015). Many New Zealand stick insect eggs can survive lengthy periods of frost (Lee 1993).
1.9. How likely is it that the organism will be able to establish in Norway based on the similarity between other abiotic conditions in Norway and the organism's current distribution?	NA	NA	
1.10. How likely is it that the organism will become established in protected conditions (in which the environment is artificially maintained, such as wildlife parks, glasshouses, aquaculture facilities, terraria, zoological gardens) in Norway? Subnote: gardens are not considered protected conditions	likely	low	

1.11. How widespread are habitats or species necessary for the survival, development and multiplication of the organism in Norway?	isolated	medium	Gardens are probably the most useful habitat.
1.12. How likely is it that establishment will occur despite management practices (including eradication campaigns), competition from existing species or predators, parasites or pathogens in Norway?	likely	high	This is a large insect, which should be easy to locate as adults. Eggs might be harder to find and remove.
1.13. How likely are the biological characteristics (including adaptability and capacity of spread) of the organism to facilitate its establishment?	likely	medium	The species is parthenogenetic.
1.14. How likely is it that the organism could establish despite low genetic diversity in the founder population?	likely	medium	Generally insects are able to establish founder populations with low genetic diversity.
1.15. Based on the history of invasion by this organism elsewhere in the world, how likely is to establish in Norway? (If possible, specify the instances in the comments box.)	likely	medium	As the temperature in southern parts of Norway in a 50 year perspective will be similar to what we find in parts of New Zealand, it is likely that it can establish also in Norway (See Cap. 2.3).
1.16. Estimate the overall likelihood of establishment in Norway (mention any key issues in the comment box).	Moderately likely	low	As the temperature in southern parts of Norway in a 50 year perspective will be similar to what we find in parts of New Zealand, it is likely that it can establish also in Norway (See Cap. 2.3).

PROBABILITY OF SPREAD			
Important notes: • Spread is defined as the expansion of the geographical distribution of an alien species within an area.			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
2.1. How likely is it that this organism will spread widely in Norway by natural means? (Please list and comment on the mechanisms for natural spread.)	very unlikely	low	Wings? No Parthenogenesis? Yes
2.2. How likely is it that this organism will spread widely in Norway by human assistance? (Please list and comment on the mechanisms for human-assisted spread.)	very unlikely	low	If trade in this species is initiated its spread would be by human assistance. However, massive trade is not expected. Plants with eggs from one garden to another garden is another potential for spreading.
2.3. How likely is it that the spread of the organism within Norway can be completely contained?	Moderately likely	medium	If established in a garden senter.
2.4. Based on the answers to questions on the potential for establishment and spread in Norway, define the area endangered by the organism.	Unknown	high	Southern parts of Norway
2.5. Estimate the overall potential for future spread for this organism in Norway (using the comment box to indicate any key issues).	unlikely	medium	This species is wingless and slow moving.

PROBABILITY OF ENVIRONMENTAL IMPACT			
Important instructions: • **When assessing potential future environmental impacts, climate change should not be taken into account. This is done in later questions at the end of the assessment.** • **Each set of questions starts with the impact elsewhere in the world, then considers impacts in Norway separating known impacts to date (i.e. past and current impacts) from potential future impacts. Key words are in bold for emphasis.**			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
2.6. How much environmental harm is caused by the organism within its existing geographic range excluding Norway?	minimal	low	**No serious harm to the environment has been reported from other New Zealand stick insects in Southern England (Lee 2016).**
2.7. How much impact would there be, if genetic traits of the organism were to be transmitted to other species, modifying their genetic makeup and making their environmental effects more serious?	minimal	low	We have no related species in Norway.
2.8. How much impact does the organism have, as food, as a host, or as a symbiont or a vector for other damaging organisms (e.g. diseases)?	minimal	high	No known diseases for plants or insects are describes for this species.
2.9. How much impact do other factors have, factors which are not covered by previous questions (specify in the comment box)	NA	high	None known

2.10. How important are the expected impacts of the organism despite any natural control by other organisms, such as predators, parasites or pathogens that may already be present in Norway?	minimal	medium	
2.11. Indicate any parts of Norway where environmental impacts are particularly likely to occur (provide as much detail as possible).	none known	low	Based on the situation in Southern England from other species of stick insects from New Zealand, no environmental impacts is likely to occur (Lee 2016).

ADDITIONAL QUESTIONS - CLIMATE CHANGE			
3.1. What aspects of climate change (in a 50 year perspective), if any, are most likely to affect the risk assessment for this organism?	increased temperature	medium	The temperature in southern parts of Norway will be similar to what we find in parts of New Zealand (See Cap. 2.3).
3.2. What aspects of the risk assessment are most likely to change as a result of climate change? • Establishment • Spread • Impact on biodiversity • Impact on ecosystem functions	establishme nt spread	low	The temperature in southern parts of Norway will be similar to what we find in parts of New Zealand (See Cap. 2.3).

RISK SUMMARIES			
	RESPONSE	**UNCERTAINTY**	**COMMENT**
Summarise Entry	moderately likely	medium	No current known trade to Norway, but the market is dynamic and this can change in the future.
Summarise Establishment	Moderately likely	low	The climate in Norway today is probably too harsh, but with climate change in the next 50 years, the climate in some parts of Norway may be similar to what we find in parts of New Zealand.
Summarise Spread	unlikely	medium	This species is wingless and therefor does not spread very well.
Summarise Impact	minimal	low	Based on the situation in England from other species of New Zealand stick insects, the ecological impact is assumed to be minimal (Lee 2016)
Conclusion of the risk assessment	low	low	Though the potential for establishment and spread is present, the potential environmental impact is negligible, and therefore we conclude on Low.

REFERENCES:

Dennis, A. B., Dunning, L. T., Sinclair, B. J. & Buckley, T. R. 2015. Parallel molecular routes to cold adaptation in eight genera of New Zealand stick insects. Scientific reports 5:13965 (DOI: 10.1038/srep13965).

Lee, M. 1993. A survey of the distribution of the unarmed stick insect Acanthoxyla inermis in Port Gaverne and Port Isaac, north Cornwall in 1992. Phasmid Studies 2: 25-32.

Lee, M. 2016. Stick insects. Fast facts. (https://www.buglife.org.uk/bugs-and-habitats/stick-insects)

Phasmida Species file (http://phasmida.speciesfile.org/Common/basic/Taxa.aspx?TaxonNameID=1203813)

EU NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME

Name of organism: Tectarchus salebrosus (Hutton, 1899)

Author: Jan Ove Gjershaug

Risk Assessment Area: Norway

Synonyms: *Tectarchus tuberculatus, Mimarchus salebrosus, Pachymorpha salebrosa*

SECTION B – Detailed assessment

PROBABILITY OF ENTRY

Important instructions:

- Entry is the introduction of an organism into Norway. Not to be confused with spread, the movement of an organism within Norway.
- For organisms which are already present in Norway, only complete the entry section for current active pathways of entry or if relevant potential future pathways. The entry section need not be completed for organisms which have entered in the past and have no current pathways of entry.

QUESTION	RESPONSE [chose one entry, delete all others]	UNCERTAINTY [chose one entry, delete all others]	COMMENT
1.14. How many known pathways are relevant to the potential entry of this organism?	Very few	low	Species native in New Zealand. Not known to be in trade.
1.2. List relevant pathways through which the organism could enter. Where possible give detail about the specific origins and end points of the pathways. For each pathway answer questions 1.3 to 1.10 (copy and paste additional rows at the end of this section as necessary).	Commercial pet trade Private import	high	Not known to be in trade
Pathway name:	Commercial pet trade and Private import		

1.3. Is entry along this pathway intentional (e.g. the organism is imported for trade) or accidental (the organism is a contaminant of imported goods)?	intentional	low	
1.4. How likely is it that large numbers of the organism will travel along this pathway from the point(s) of origin over the course of one year? Subnote: In your comment discuss how likely the organism is to get onto the pathway in the first place.	Very unlikely	low	Not known to be in trade
1.5. How likely is the organism to be able to transfer from the pathway to a suitable habitat or host in Norwegian nature?	unlikely	low	
1.6. Estimate the overall likelihood of entry into Norwegian nature based on this pathway?	unlikely	low	
End of pathway assessment, repeat as necessary.			
1.7. Estimate the overall likelihood of entry into Norwegian nature based on all pathways (comment on the key issues that lead to this conclusion).	unlikely	low	Not known to be in trade.

PROBABILITY OF ESTABLISHMENT			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
1.8. How likely is it that the organism will be able to establish in Norway based on the similarity between climatic conditions in Norway and the organism's current distribution?	likely	medium	Native range is New Zealand, both in the South and North Island. The climate in Norway today is too harsh, but in a 50 year perspective, the temperature in southern parts of Norway will be similar to what we find in parts of New Zealand (See Cap. 2.3). The species have survived 6 h frozen, which suggest that it may also survive sub-zero conditions via freeze tolerance (Dennis et al. 2015). Many New Zealand stick insect eggs can survive lengthy periods of frost (Lee 1993).
1.9. How likely is it that the organism will be able to establish in Norway based on the similarity between other abiotic conditions in Norway and the organism's current distribution?	NA	NA	
1.10. How likely is it that the organism will become established in protected conditions (in which the environment is artificially maintained, such as wildlife parks, glasshouses, aquaculture facilities, terraria, zoological gardens) in Norway? Subnote: gardens are not considered protected conditions	likely	low	

1.11. How widespread are habitats or species necessary for the survival, development and multiplication of the organism in Norway?	isolated	medium	Gardens are probably the most useful habitat.
1.12. How likely is it that establishment will occur despite management practices (including eradication campaigns), competition from existing species or predators, parasites or pathogens in Norway?	likely	high	This is a large insect, which should be easy to locate as adults. Eggs might be harder to find and remove.
1.13. How likely are the biological characteristics (including adaptability and capacity of spread) of the organism to facilitate its establishment?	likely	medium	The species is parthenogenetic.
1.14. How likely is it that the organism could establish despite low genetic diversity in the founder population?	likely	medium	Generally insects are able to establish founder populations with low genetic diversity.
1.15. Based on the history of invasion by this organism elsewhere in the world, how likely is to establish in Norway? (If possible, specify the instances in the comments box.)	likely	medium	As the temperature in southern parts of Norway in a 50 year perspective will be similar to what we find in parts of New Zealand, it is likely that it can establish also in Norway (See Cap. 2.3).
1.16. Estimate the overall likelihood of establishment in Norway (mention any key issues in the comment box).	Moderately likely	low	As the temperature in southern parts of Norway in a 50 year perspective will be similar to what we find in parts of New Zealand, it is likely that it can establish also in Norway (See Cap. 2.3).

PROBABILITY OF SPREAD			
Important notes: • Spread is defined as the expansion of the geographical distribution of an alien species within an area.			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
2.1. How likely is it that this organism will spread widely in Norway by natural means? (Please list and comment on the mechanisms for natural spread.)	very unlikely	low	Wings? No Parthenogenesis? Yes
2.2. How likely is it that this organism will spread widely in Norway by human assistance? (Please list and comment on the mechanisms for human-assisted spread.)	very unlikely	low	If trade in this species is initiated its spread would be by human assistance. However, massive trade is not expected. Plants with eggs from one garden to another garden is another potential for spreading.
2.3. How likely is it that the spread of the organism within Norway can be completely contained?	Moderately likely	medium	If established in a garden senter.
2.4. Based on the answers to questions on the potential for establishment and spread in Norway, define the area endangered by the organism.	Unknown	high	Southern parts of Norway
2.5. Estimate the overall potential for future spread for this organism in Norway (using the comment box to indicate any key issues).	unlikely	medium	This species is wingless and slow moving.

PROBABILITY OF ENVIRONMENTAL IMPACT			
Important instructions: • **When assessing potential future environmental impacts, climate change should not be taken into account. This is done in later questions at the end of the assessment.** • **Each set of questions starts with the impact elsewhere in the world, then considers impacts in Norway separating known impacts to date (i.e. past and current impacts) from potential future impacts. Key words are in bold for emphasis.**			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
2.6. How much environmental harm is caused by the organism within its existing geographic range excluding Norway?	minimal	low	**No serious harm to the environment has been reported from other New Zealand stick insects in Southern England (Lee 2016).**
2.7. How much impact would there be, if genetic traits of the organism were to be transmitted to other species, modifying their genetic makeup and making their environmental effects more serious?	minimal	low	We have no related species in Norway.
2.8. How much impact does the organism have, as food, as a host, or as a symbiont or a vector for other damaging organisms (e.g. diseases)?	minimal	high	No known diseases for plants or insects are describes for this species.
2.9. How much impact do other factors have, factors which are not covered by previous questions (specify in the comment box)	NA	high	None known

2.10. How important are the expected impacts of the organism despite any natural control by other organisms, such as predators, parasites or pathogens that may already be present in Norway?	minimal	medium	
2.11. Indicate any parts of Norway where environmental impacts are particularly likely to occur (provide as much detail as possible).	none known	low	Based on the situation in Southern England from other species of stick insects from New Zealand, no environmental impacts is likely to occur (Lee 2016).

ADDITIONAL QUESTIONS - CLIMATE CHANGE			
3.1. What aspects of climate change (in a 50 year perspective), if any, are most likely to affect the risk assessment for this organism?	increased temperature	medium	The temperature in southern parts of Norway will be similar to what we find in parts of New Zealand (See Cap. 2.3).
3.2. What aspects of the risk assessment are most likely to change as a result of climate change? • Establishment • Spread • Impact on biodiversity • Impact on ecosystem functions	establishment spread	low	The temperature in southern parts of Norway will be similar to what we find in parts of New Zealand (See Cap. 2.3).

RISK SUMMARIES			
	RESPONSE	**UNCERTAINTY**	**COMMENT**
Summarise Entry	moderately likely	medium	No current known trade to Norway, but the market is dynamic and this can change in the future.
Summarise Establishment	Moderately likely	low	The climate in Norway today is probably too harsh, but with climate change in the next 50 years, the climate in some parts of Norway may be similar to what we find in parts of New Zealand.
Summarise Spread	unlikely	medium	This species is wingless and therefor does not spread very well.
Summarise Impact	minimal	low	Based on the situation in England from other species of New Zealand stick insects, the ecological impact is assumed to be minimal (Lee 2016)
Conclusion of the risk assessment	low	low	Though the potential for establishment and spread is present, the potential environmental impact is negligible, and therefore we conclude on Low.

REFERENCES:

Dennis, A. B., Dunning, L. T., Sinclair, B. J. & Buckley, T. R. 2015. Parallel molecular routes to cold adaptation in eight genera of New Zealand stick insects. Scientific reports 5:13965 (DOI: 10.1038/srep13965).

Lee, M. 1993. A survey of the distribution of the unarmed stick insect Acanthoxyla inermis in Port Gaverne and Port Isaac, north Cornwall in 1992. Phasmid Studies 2: 25-32.

Lee, M. 2016. Stick insects. Fast facts. (https://www.buglife.org.uk/bugs-and-habitats/stick-insects)

Phasmida Species file (http://phasmida.speciesfile.org/Common/basic/Taxa.aspx?TaxonNameID=1203786)

MANTIDS

EU NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME
Name of organism: *Ameles heldreichi* Brunner, 1882 **Author:** Gaute Velle **Risk Assessment Area:** Norway **Synonyms:** *A. cypria, A. heldreichii, Parameles heidreichi, P. turica, P. picteti, Apterameles rammei* **Common names:** None known

SECTION B – Detailed assessment			
PROBABILITY OF ENTRY			
Important instructions: • Entry is the introduction of an organism into Norway. Not to be confused with spread, the movement of an organism within Norway. • For organisms which are already present in Norway, only complete the entry section for current active pathways of entry or if relevant potential future pathways. The entry section need not be completed for organisms which have entered in the past and have no current pathways of entry.			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**

1.15. How many known pathways are relevant to the potential entry of this organism?	very few (two)	low	Euro-Mediterranean species held as pet. It is not expected to reach Norway by natural means.
1.2. List relevant pathways through which the organism could enter. Where possible give detail about the specific origins and end points of the pathways.	commercial zoo trade private import	medium	Species is kept as pet. Uncertain how many specimens that are imported to Norway.
Pathway name:	Commercial zoo trade and private import		
1.3. Is entry along this pathway intentional (e.g. the organism is imported for trade) or accidental (the organism is a contaminant of imported goods)?	intentional	low	
1.4. How likely is it that large numbers of the organism will travel along this pathway from the point(s) of origin over the course of one year? Point(s) of origin include natural settings or captivity. Large numbers refers to many specimens or multiple points of origin.	unlikely	medium	Degree of trade of *A. heldreichi* in Norway is not known.
1.5. How likely is the organism to be able to transfer from the pathway to a suitable habitat or host in Norwegian nature?	unlikely	medium	Number of escapees from captivity is low, but exact numbers are not known.
1.6. Estimate the overall likelihood of entry into Norwegian nature based on this pathway?	unlikely	medium	
1.7. Estimate the overall likelihood of entry into Norwegian nature based on all pathways.	moderately likely	medium	The species is common in its native area, is easy to keep in captivity and is currently in trade. Need to escape from captivity in order to spread to nature.

PROBABILITY OF ESTABLISHMENT			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
1.8. How likely is it that the organism will be able to establish in Norway based on the similarity between	unlikely	medium	The egg can survive sub-zero temperatures during winters. In captivity, the adults prefer at least 30°C during daytime, suggesting that

climatic conditions in Norway and the organism's current distribution?			temperatures in Norway may be too cold during summers.
1.9. How likely is it that the organism will be able to establish in Norway based on the similarity between other abiotic conditions in Norway and the organism's current distribution?	unlikely	medium	A full ecological requirement of species in the wild is not known. Native range is eastern regions of the Mediterranean basin, from the Balkan peninsular to the Caspian Sea. The species prefer warm summer temperatures than presently found in Norway. It also thrives in arid dune ecosystems that are not found in Norway.
1.10. How likely is it that the organism will become established in protected conditions (in which the environment is artificially maintained, such as wildlife parks, glasshouses, aquaculture facilities, terraria, zoological gardens) in Norway?	likely	low	It is already kept as a pet in protected conditions.
1.11. How widespread are habitats or species necessary for the survival, development and multiplication of the organism in Norway?	isolated in southern Norway	medium	Full ecological requirements of species not known. Temperatures in Norway may be too cold during summers.
1.12. How likely is it that establishment will occur despite management practices (including eradication campaigns), competition from existing species or predators, parasites or pathogens in Norway?	likely	medium	In general, it may be hard to control insect population sizes in geographical areas where the species is present and the fundamental niche of the species can be fulfilled.
1.13. How likely are the biological characteristics (including adaptability and capacity of spread) of the organism to facilitate its establishment?	unlikely	high	
1.14. How likely is it that the organism could establish despite low genetic diversity in the founder population?	likely	high	Data on genetic plasticity of species is lacking. In general, insects can establish with a small founder population.
1.15. Based on the history of invasion by this organism elsewhere in the world, how likely is to establish in Norway?	na	na	

1.16. Estimate the overall likelihood of establishment in Norway (mention any key issues in the comment box).	unlikely	high	Ecological requirements of the species in the wild are poorly known. The egg can survive sub-zero temperatures during winters. Summer temperatures in Norway are too cold now and likely too cold in 50 years. It is a generalist predator and can be expected to acquire food in Norway.
PROBABILITY OF SPREAD			
Important notes: • Spread is defined as the expansion of the geographical distribution of an alien species within an area.			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
2.1. How likely is it that this organism will spread widely in Norway by *natural means*? (Please list and comment on the mechanisms for natural spread.)	unlikely	medium	Female lack wings, does not presently occur naturally north of southern France
2.2. How likely is it that this organism will spread widely in Norway by *human assistance*? (Please list and comment on the mechanisms for human-assisted spread.)	moderately likely	medium	The species is kept as pet. Uncertain how many specimens are transported to- and within Norway
2.3. How likely is it that spread of the organism within Norway can be completely contained?	likely	medium	
2.4. Based on the answers to questions on the potential for establishment and spread in Norway, define the area endangered by the organism.		low	Continental southern Norway with warm summers
2.5. Estimate the overall potential for future spread for this organism in Norway.	unlikely	medium	Female lack wings that may suggest limited capacity of spread. However, ecological requirements and spreading capacity of the species are poorly known. In general, mantids are considered to have a low capacity of spread.
PROBABILITY OF ENVIRONMENTAL IMPACT			
Important instructions:			

• When assessing potential future environmental impacts, climate change should not be taken into account. This is done in later questions at the end of the assessment. • Each set of questions starts with the impact elsewhere in the world, then considers impacts in Norway separating known impacts to date (i.e. past and current impacts) from potential future impacts. Key words are in bold for emphasis.			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
2.6. How much environmental harm is caused by the organism within its existing geographic range, excluding Norway?	minimal	medium	
2.7. How much impact would there be, if genetic traits of the organism were to be transmitted to other species, modifying their genetic makeup and making their environmental effects more serious?	minimal	medium	
2.8. How much impact does the organism have, as food, as a host, or as a symbiont or a vector for other damaging organisms (e.g. diseases)?	minimal	high	
2.9. How much impact do other factors have, factors which are not covered by previous questions (specify in the comment box)	na		Not known
2.10. How important are the expected impacts of the organism despite any natural control by other organisms, such as predators, parasites or pathogens that may already be present in Norway?	na		Not known
2.11. Indicate any parts of Norway where environmental impacts are particularly likely to occur (provide as much detail as possible).	no known areas	medium	
ADDITIONAL QUESTIONS - CLIMATE CHANGE			
3.1. What aspects of climate change (in a 50 year perspective), if any, are most likely to affect the risk assessment for this organism?	Increased temperatures	medium	Species need warm summers. Uncertainty related to scenario RCP 8.5

3.2. What aspects of the risk assessment are most likely to change as a result of climate change? • Establishment • Spread • Impact on biodiversity • Impact on ecosystem functions	Establishment Spread	low	Increased temperatures beyond scenario RCP 8.5 will increase the probability of establishment.
RISK SUMMARIES			
Ameles heldreichi Brunner, 1882	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
Summarise Entry	moderately likely	medium	*A. heldreichi* is held as pet. Need to escape from captivity in areas of Norway with the warmest summers in order to survive in nature.
Summarise Establishment	unlikely	high	Ecological requirements of the species in the wild are poorly known. The egg can survive sub-zero temperatures in Norway during winters. Summer temperatures in Norway are too cold now and likely too cold in a 50 year perspective. It is a generalist predator and can be expected to acquire food in Norway.
Summarise Spread	unlikely	medium	Female lack wings that may suggest limited capacity of spread. However, ecological requirements and spreading capacity of the species are poorly known. In general, mantids are considered to have a low capacity of spread.
Summarise Impact	minimal	high	No known impact. However, information is lacking.
Conclusion of the risk assessment	low	medium	There is a potential for establishment in very limited, if any, areas. The impact is unknown.

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Battiston, R., Picciau, P., Fontana, P. and Marshall, J. 2010. Mantids of the Euro-Mediterranean Area. WBA HANDBOOKS 2, World Biodiversity Association, Verona, Italy. 239 pages

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EU NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME
Name of organism: *Brunneria borealis* Scudder, 1896 **Author:** Gaute Velle **Risk Assessment Area:** Norway **Synonyms:** Non known **Common names:** Brunner's mantis, Brunner's stick mantis, northern grass mantis

SECTION B – Detailed assessment			
PROBABILITY OF ENTRY			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
1.16. How many known pathways are relevant to the potential entry of this organism?	very few	low	*B. borealis* is found in USA (north to Ohio). Will likely not reach Norway by natural means.
1.2. List relevant pathways through which the organism could enter. Where possible give detail about the specific origins and end points of the pathways.	commercial zoo trade private import	low	*B. borealis* is kept as pet.
Pathway name:	Commercial zoo trade and private import		
1.3. Is entry along this pathway intentional (e.g. the organism is imported for trade) or accidental (the organism is a contaminant of imported goods)?	intentional	low	

1.4. How likely is it that large numbers of the organism will travel along this pathway from the point(s) of origin over the course of one year? Point(s) of origin include natural settings or captivity. Large numbers refers to many specimens or multiple points of origin.	unlikely	high	Uncertain how many specimens are imported to Norway.
1.5. How likely is the organism to be able to transfer from the pathway to a suitable habitat or host in Norwegian nature?	unlikely	medium	Number of escapees from captivity is low, but exact numbers are not known.
1.6. Estimate the overall likelihood of entry into Norwegian nature based on this pathway?	unlikely	medium	Need to escape from captivity in areas of Norway with the warmest summers in order to survive.
1.7. Estimate the overall likelihood of entry into Norwegian nature based on all pathways.	unlikely	medium	*B. borealis* is common in its native area and is in trade.

PROBABILITY OF ESTABLISHMENT

QUESTION	RESPONSE	UNCERTAINTY	COMMENT
1.8. How likely is it that the organism will be able to establish in Norway based on the similarity between climatic conditions in Norway and the organism's current distribution?	unlikely	medium	The egg of *B. borealis* can survive cold temperatures during winters. However, the adult may prefer warmer temperatures during summers than that found in Norway today.
1.9. How likely is it that the organism will be able to establish in Norway based on the similarity between other abiotic conditions in Norway and the organism's current distribution?	unlikely	medium	Prefers grassland and dry areas.
1.10. How likely is it that the organism will become established in protected conditions (in which the environment is artificially maintained, such as wildlife parks, glasshouses, aquaculture facilities, terraria, zoological gardens) in Norway?	likely	low	It is already kept as a pet in protected conditions.

1.11. How widespread are habitats or species necessary for the survival, development and multiplication of the organism in Norway?	isolated in southern Norway	low	
1.12. How likely is it that establishment will occur despite management practices (including eradication campaigns), competition from existing species or predators, parasites or pathogens in Norway?	likely	high	In general, it may be hard to control insect population sizes in geographical areas where the species is present and the fundamental niche of the species can be fulfilled.
1.13. How likely are the biological characteristics (including adaptability and capacity of spread) of the organism to facilitate its establishment?	moderately likely	medium	*B. borealis* species is truly parthenogenetic. Males are not known
1.14. How likely is it that the organism could establish despite low genetic diversity in the founder population?	likely	low	The species is truly parthenogenetic. It can establish with a small founder population.
1.15. Based on the history of invasion by this organism elsewhere in the world, how likely is to establish in Norway?	na	na	
1.16. Estimate the overall likelihood of establishment in Norway (mention any key issues in the comment box).	unlikely	medium	The species is truly parthenogenetic, suggesting that it can establish with a small founder population. Summer temperatures in Norway are too cold now and likely also in 50 years. It is a generalist predator and can be expected to acquire food in Norway.

PROBABILITY OF SPREAD

QUESTION	RESPONSE	UNCERTAINTY	COMMENT
2.1. How likely is it that this organism will spread widely in Norway by *natural means*? (Please list and comment on the mechanisms for natural spread.)	unlikely	medium	
2.2. How likely is it that this organism will spread widely in Norway by *human assistance*? (Please list	unlikely	medium	

and comment on the mechanisms for human-assisted spread.)			
2.3. How likely is it that spread of the organism within Norway can be completely contained?	likely	medium	Only the warmest areas include potential habitats
2.4. Based on the answers to questions on the potential for establishment and spread in Norway, define the area endangered by the organism.		medium	Continental southern Norway with warm summers
2.5. Estimate the overall potential for future spread for this organism in Norway (using the comment box to indicate any key issues).	unlikely	medium	Unlikely since areas where it potentially can survive are few and scattered, if they exist. In general, mantids are considered to have a low capacity of spread.

PROBABILITY OF ENVIRONMENTAL IMPACT

QUESTION	RESPONSE	UNCERTAINTY	COMMENTS
2.6. How much environmental harm is caused by the organism within its existing geographic range, excluding Norway?	minimal	medium	
2.7. How much impact would there be, if genetic traits of the organism were to be transmitted to other species, modifying their genetic makeup and making their environmental effects more serious?	minimal	medium	
2.8. How much impact does the organism have, as food, as a host, or as a symbiont or a vector for other damaging organisms (e.g. diseases)?	minimal	high	Not known
2.9. How much impact do other factors have, factors which are not covered by previous questions (specify in the comment box)	na		Not known
2.10. How important are the expected impacts of the organism despite any natural control by other organisms, such as predators, parasites or pathogens that may already be present in Norway?	minimal	high	

2.11. Indicate any parts of Norway where environmental impacts are particularly likely to occur (provide as much detail as possible).	no known areas	medium	
ADDITIONAL QUESTIONS - CLIMATE CHANGE			
3.1. What aspects of climate change (in a 50 year perspective), if any, are most likely to affect the risk assessment for this organism?	increased temperatures	medium	Species need warm summers. Uncertainty related to scenario RCP 8.5
3.2. What aspects of the risk assessment are most likely to change as a result of climate change? • Establishment • Spread • Impact on biodiversity • Impact on ecosystem functions	Establishment Spread	medium	Increased temperatures beyond scenario RCP 8.5 will increase the probability of establishment.
RISK SUMMARIES			
Brunneria borealis Scudder, 1896	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
Summarise Entry	unlikely	medium	*B. borealis* species is common in its native area in USA (north to Ohio), and is in trade.
Summarise Establishment	unlikely	medium	The species is truly parthenogenetic, suggesting that it can establish with a small founder population. Summer temperatures in Norway are too cold now and likely also in 50 years. It is a generalist predator and can be expected to acquire food in Norway.
Summarise Spread	unlikely	medium	Unlikely since areas where it potentially can survive are few and scattered, if they exist. In general, mantids are considered to have a low capacity of spread.
Summarise Impact	minimal	high	No known impact.
Conclusion of the risk assessment	low	medium	Very few areas in Norway will be warm enough in a 50 year perspective. *B. borealis* species is

			parthenogenetic and can establish with a small founder population. The impact is unknown.

REFERENCES:

Hallan, J.K. (ed) 2008. Biology catalog (Last Updated: March 24, 2008). Texas A & M University. http://insects.tamu.edu/research/collection/hallan/

Otte, D., Spearman, L. and Stiewe, M.B.D. Mantodea Species File Online. Version 5.0/5.0, Feb 2016 [Retrieved Jan-April 2016]. <http://Mantodea.SpeciesFile.org>

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EU NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME

Name of organism: *Litaneutria minor* Scudder, 1896

Author: Gaute Velle

Risk Assessment Area: Norway

Synonyms: *Stagmatoptera minor, Tithrone corseuli , T. clauseni*

Common names: Agile ground mantid, lesser ground mantid, minor ground mantid, robust prairie mantid, minor mantid

SECTION B – Detailed assessment

PROBABILITY OF ENTRY

QUESTION	RESPONSE	UNCERTAINTY	COMMENT
1.17. How many known pathways are relevant to the potential entry of this organism?	very few	low	*L. minor* is found in drier regions of southwestern Canada and most states of USA. Is not expected to enter Norway by natural means.
1.2. List relevant pathways through which the organism could enter. Where possible give detail about the specific origins and end points of the pathways.	commercial zoo trade private import	medium	The species is kept as pet, but only to a limited extent. It is difficult to breed due to their aggressive nature and because of their small size it can be hard to find suitable food.
Pathway name:	Commercial zoo trade and private import		
1.3. Is entry along this pathway intentional (e.g. the organism is imported for trade) or accidental (the organism is a contaminant of imported goods)?	intentional	low	

1.4. How likely is it that large numbers of the organism will travel along this pathway from the point(s) of origin over the course of one year? Point(s) of origin include natural settings or captivity. Large numbers refers to many specimens or multiple points of origin.	unlikely	medium	Limited small numbers are in trade and *L. minor* cannot be imported in large groups due to strong cannibalism.
1.5. How likely is the organism to be able to transfer from the pathway to a suitable habitat or host in Norwegian nature?	unlikely	medium	Number of escapees from captivity is low, but exact numbers are not known
1.6. Estimate the overall likelihood of entry into Norwegian nature based on this pathway?	unlikely	medium	Need to escape from captivity in areas in Norway with the warmest and driest summers.
1.7. Estimate the overall likelihood of entry into Norwegian nature based on all pathways (comment on the key issues that lead to this conclusion).	unlikely	medium	*L. minor* is common in its native area. It is only to a limited extent kept as a pet and only small numbers are in trade. *L. minor* cannot be imported in large groups due to strong cannibalism. It is difficult to breed due to their aggressive nature and because of their small size it can be hard to find suitable food for specimen in captivity.
PROBABILITY OF ESTABLISHMENT			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
1.8. How likely is it that the organism will be able to establish in Norway based on the similarity between climatic conditions in Norway and the organism's current distribution?	unlikely	medium	The annual mean temperature in Norway will be above the temperature of areas where the species is present today. The egg can survive sub-zero temperatures during winters. However, the adult may prefer warmer and dryer temperatures during summers than that found in Norway today.
1.9. How likely is it that the organism will be able to establish in Norway based on the similarity between	unlikely	medium	Full environmental requirement of the species in the wild is not known. Native range is dry regions of USA and southwestern Canada.

other abiotic conditions in Norway and the organism's current distribution?			
1.10. How likely is it that the organism will become established in protected conditions (in which the environment is artificially maintained, such as wildlife parks, glasshouses, aquaculture facilities, terraria, zoological gardens) in Norway?	likely	medium	*L. minor* is already kept as a pet in protected conditions.
1.11. How widespread are habitats or species necessary for the survival, development and multiplication of the organism in Norway?	isolated in southern Norway	low	Full environmental requirement of the species is not known. Temperatures in Norway may be too cold and wet during summers.
1.12. How likely is it that establishment will occur despite management practices (including eradication campaigns), competition from existing species or predators, parasites or pathogens in Norway?	likely	medium	Difficult to catch the species since it is small and fast. In general, it may be hard to control insect population sizes if the environmental gradient is within the tolerance of the species.
1.13. How likely are the biological characteristics (including adaptability and capacity of spread) of the organism to facilitate its establishment?	unlikely	high	
1.14. How likely is it that the organism could establish despite low genetic diversity in the founder population?	likely	high	Data on genetic plasticity of species is lacking. In general, insects can establish with a small founder population.
1.15. Based on the history of invasion by this organism elsewhere in the world, how likely is to establish in Norway? (If possible, specify the instances in the comments box.)	na	na	
1.16. Estimate the overall likelihood of establishment in Norway (mention any key issues in the comment box).	unlikely	medium	The egg can survive sub-zero temperatures during winters. Adults prefer warmer and drier conditions than found in Norway today, but suitable conditions may arise in a 50-year perspective. It is a generalist predator and can be expected to acquire food in Norway.
PROBABILITY OF SPREAD			

QUESTION	RESPONSE	UNCERTAINTY	COMMENT
2.1. How likely is it that this organism will spread widely in Norway by *natural means*? (Please list and comment on the mechanisms for natural spread.)	unlikely	medium	
2.2. How likely is it that this organism will spread widely in Norway by *human assistance*? (Please list and comment on the mechanisms for human-assisted spread.)	unlikely	medium	*L. minor* is only to a limited extent kept as a pet. Uncertain how many specimens are transported to- and within Norway.
2.3. How likely is it that spread of the organism within Norway can be completely contained?	likely	medium	
2.4. Based on the answers to questions on the potential for establishment and spread in Norway, define the area endangered by the organism.		medium	Continental southern Norway with warm summers
2.5. Estimate the overall potential for future spread for this organism in Norway (using the comment box to indicate any key issues).	unlikely	medium	Fairly agile species, but capacity of spread is not known. Spread is still unlikely since areas where it potentially can survive are few and scattered.
PROBABILITY OF ENVIRONMENTAL IMPACT			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
2.6. How much environmental harm is caused by the organism within its existing geographic range, excluding Norway?	minimal	high	
2.7. How much impact would there be, if genetic traits of the organism were to be transmitted to other species, modifying their genetic makeup and making their environmental effects more serious?	minimal	medium	
2.8. How much impact does the organism have, as food, as a host, or as a symbiont or a vector for other damaging organisms (e.g. diseases)?	na		Not known
2.9. How much impact do other factors have, factors which are not covered by previous questions (specify in the comment box)	na		Not known

2.10. How important are the expected impacts of the organism despite any natural control by other organisms, such as predators, parasites or pathogens that may already be present in Norway?	minimal	high	
2.11. Indicate any parts of Norway where environmental impacts are particularly likely to occur (provide as much detail as possible).	no known areas	medium	
ADDITIONAL QUESTIONS - CLIMATE CHANGE			
3.1. What aspects of climate change (in a 50 year perspective), if any, are most likely to affect the risk assessment for this organism?	increased temperatures	medium	Species need warm and dry summers. Uncertainty related to scenario RCP 8.5
3.2. What aspects of the risk assessment are most likely to change as a result of climate change? • Establishment • Spread • Impact on biodiversity • Impact on ecosystem functions	establishment spread	medium	Increased temperatures beyond scenario RCP 8.5 will increase the probability of establishment.
RISK SUMMARIES			
Litaneutria minor Scudder, 1896	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
Summarise Entry	unlikely	medium	*L. minor* is common in its native area. The species is only to a limited extent kept as a pet and only small numbers are in trade. *L. minor* cannot be imported in large groups due to strong cannibalism. It is difficult to breed due to their aggressive nature and because of their small size it can be hard to find suitable food for specimen in captivity.
Summarise Establishment	unlikely	medium	The egg can survive sub-zero temperatures during winters. Adults prefer warmer and drier conditions than found in Norway today, but suitable

			conditions may arise in a 50-year perspective. It is a generalist predator and can be expected to acquire food in Norway.
Summarise Spread	unlikely	medium	Fairly agile species, but capacity of spread is not known. Spread is still unlikely since areas where it potentially can survive are few and scattered.
Summarise Impact	minimal	high	No known impact. High uncertainty because many impacts on natural ecosystems are difficult to predict.
Conclusion of the risk assessment	low	medium	There is potential for establishment in limited areas based on climatic requirements, however this is not expected since entry is unlikely. The impact is unknown.

REFERENCES:

Otte, D., Spearman, L. and Stiewe, M.B.D. Mantodea Species File Online. Version 5.0/5.0, Feb 2016 [Retrieved Jan-April 2016]. <http://Mantodea.SpeciesFile.org>

Roberts RA (1937) Biology of the Minor Mantid, Litaneutria Minor Scudder (Orthoptera, Mantidae). *Annals of the Entomological Society of America* 30: 111-121.

Eaton and Kaufman. Kaufman Field Guide to Insects of North America. Houghton Mifflin Harcourt 2007, 391 pp

SAMUEL H. SCUDDER (2013) Entomological Society Of Canada. pp. 207-210. *The Canadian Entomologist* (Vol. 28). London: Forgotten Books. (Original work published 1896)

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EU NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME

Name of organism: *Litaneutria borealis* Brunner, 1893

Author: Gaute Velle

Risk Assessment Area: Norway

Synonyms: *Ameles borealis*

Common names: None known

SECTION B – Detailed assessment

PROBABILITY OF ENTRY			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
1.18. How many known pathways are relevant to the potential entry of this organism?	very few to none	low	*L. borealis* is found in North-Central USA (Nebraska). Will likely not reach Norway by natural means.
1.2. List relevant pathways through which the organism could enter. Where possible give detail about the specific origins and end points of the pathways.	commercial zoo trade private import	high	Degree of trade at the present is unknown.
Pathway name:	Commercial zoo trade and private import		
1.3. Is entry along this pathway intentional (e.g. the organism is imported for trade) or accidental (the organism is a contaminant of imported goods)?	intentional	low	

1.4. How likely is it that large numbers of the organism will travel along this pathway from the point(s) of origin over the course of one year? Point(s) of origin include natural settings or captivity. Large numbers refers to many specimens or multiple points of origin.	unlikely	high	*L. borealis* is little mentioned in the scientific literature and among pet enthusiasts, suggesting it is not in trade. However, the marked of insect trade is dynamic.
1.5. How likely is the organism to be able to transfer from the pathway to a suitable habitat or host in Norwegian nature?	unlikely	high	Number of escapees from captivity is low, but exact numbers are not known.
1.6. Estimate the overall likelihood of entry into Norwegian nature based on this pathway?	unlikely	medium	Need to escape from captivity in areas of Norway with the warmest summers.
1.7. Estimate the overall likelihood of entry into Norwegian nature based on all pathways (comment on the key issues that lead to this conclusion).	unlikely	medium	*L. borealis* does not seem to be common in its native area. No information has been found that suggests that the species is in trade.
PROBABILITY OF ESTABLISHMENT			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
1.8. How likely is it that the organism will be able to establish in Norway based on the similarity between climatic conditions in Norway and the organism's current distribution?	unlikely	medium	The annual mean temperature in Norway will be above the temperature of areas where the species is present today. The egg can survive sub-zero temperatures during winters. However, the adult may prefer warmer temperatures during summers than that found in Norway.
1.9. How likely is it that the organism will be able to establish in Norway based on the similarity between other abiotic conditions in Norway and the organism's current distribution?	unlikely	high	Full environmental requirement of the species is not known. Native range is North-Central USA.
1.10. How likely is it that the organism will become established in protected conditions (in which the environment is artificially maintained, such as wildlife	likely	medium	

parks, glasshouses, aquaculture facilities, terraria, zoological gardens) in Norway?			
1.11. How widespread are habitats or species necessary for the survival, development and multiplication of the organism in Norway?	isolated in southern Norway	low	In general, it may be hard to control insect population sizes in geographical areas where the species is present and the fundamental niche of the species can be fulfilled.
1.12. How likely is it that establishment will occur despite management practices (including eradication campaigns), competition from existing species or predators, parasites or pathogens in Norway?	likely	high	In general, it may be hard to control insect population sizes if the environmental gradient is within the tolerance of the species.
1.13. How likely are the biological characteristics (including adaptability and capacity of spread) of the organism to facilitate its establishment?	unlikely	high	
1.14. How likely is it that the organism could establish despite low genetic diversity in the founder population?	likely	high	Data on genetic plasticity of species is lacking. In general, insects can establish with a small founder population.
1.15. Based on the history of invasion by this organism elsewhere in the world, how likely is to establish in Norway? (If possible, specify the instances in the comments box.)	na	na	
1.16. Estimate the overall likelihood of establishment in Norway (mention any key issues in the comment box).	unlikely	medium	Ecological requirement of *L. borealis* is not known. The egg can survive sub-zero temperatures during winters. Summer temperatures in Norway are too cold now and likely also in 50 years.
PROBABILITY OF SPREAD			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
2.1. How likely is it that this organism will spread widely in Norway by *natural means*? (Please list and comment on the mechanisms for natural spread.)	unlikely	medium	

2.2. How likely is it that this organism will spread widely in Norway by *human assistance*? (Please list and comment on the mechanisms for human-assisted spread.)	unlikely	high	Uncertain how many specimens are transported to- and within Norway, but the number is likely none to very few.
2.3. How likely is it that spread of the organism within Norway can be completely contained?	likely	high	
2.4. Based on the answers to questions on the potential for establishment and spread in Norway, define the area endangered by the organism.		medium	Continental southern Norway with warm summers
2.5. Estimate the overall potential for future spread for this organism in Norway (using the comment box to indicate any key issues).	unlikely	high	Capacity of spread is unknown. In general, mantids are considered to have a low capacity of spread.
PROBABILITY OF ENVIRONMENTAL IMPACT			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
2.6. How much environmental harm is caused by the organism within its existing geographic range, excluding Norway?	minimal	high	
2.7. How much impact would there be, if genetic traits of the organism were to be transmitted to other species, modifying their genetic makeup and making their environmental effects more serious?	minimal	medium	
2.8. How much impact does the organism have, as food, as a host, or as a symbiont or a vector for other damaging organisms (e.g. diseases)?	minimal	high	Not known
2.9. How much impact do other factors have, factors which are not covered by previous questions (specify in the comment box)	na		Not known
2.10. How important are the expected impacts of the organism despite any natural control by other organisms, such as predators, parasites or pathogens that may already be present in Norway?	minimal	high	

2.11. Indicate any parts of Norway where environmental impacts are particularly likely to occur (provide as much detail as possible).	no known areas	medium	
ADDITIONAL QUESTIONS - CLIMATE CHANGE			
3.1. What aspects of climate change (in a 50 year perspective), if any, are most likely to affect the risk assessment for this organism?	increased temperatures	medium	Species need warm summers. Uncertainty related to scenario RCP 8.5
3.2. What aspects of the risk assessment are most likely to change as a result of climate change? • Establishment • Spread • Impact on biodiversity • Impact on ecosystem functions	establishment spread	medium	Increased temperatures beyond scenario RCP 8.5 will increase the probability of establishment.
RISK SUMMARIES			
Litaneutria borealis Brunner, 1893	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
Summarise Entry	unlikely	high	*L. borealis* does not seem to be common in its native area. No information has been found that suggests that the species is in trade.
Summarise Establishment	unlikely	medium	Ecological requirement of *L. borealis* is not known. The egg can survive sub-zero temperatures during winters. Summer temperatures in Norway are too cold now and likely also in 50 years.
Summarise Spread	unlikely	high	Capacity of spread is unknown. In general, mantids are considered to have a low capacity of spread.
Summarise Impact	minimal	high	No known impact. However, information is lacking.
Conclusion of the risk assessment	low	medium	The likelihood of entry is low, and there is some potential for establishment in very limited areas. Information on spread and impact is lacking.

REFERENCES:

Otte, D., Spearman, L. and Stiewe, M.B.D. Mantodea Species File Online. Version 5.0/5.0, Feb 2016 [Retrieved Jan-April 2016]. <http://Mantodea.SpeciesFile.org>

EU NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME

Name of organism: *Mantis religiosa* (Linnaeus, 1758)

Author: Gaute Velle

Risk Assessment Area: Norway

Synonyms: *M. religious, M. sancta, M. striata, M. maroccana, M. pia, M. radiate, M. capensis, M. prasina, M. griveaudi, Mantes religiosa, Gryllus religiosus*

Common names: praying mantis, European mantis

SECTION B – Detailed assessment

PROBABILITY OF ENTRY

QUESTION	RESPONSE	UNCERTAINTY	COMMENT
1.19. How many known pathways are relevant to the potential entry of this organism?	few	medium	Cosmopolitan insect, its distribution is in continuous expansion. Occurs in temperate regions of Europe, North America, Asia and Africa. May enter by trade, as hitchhiker on goods and vehicles or on a longer time span by natural range expansions.
1.2. List relevant pathways through which the organism could enter. Where possible give detail about the specific origins and end points of the pathways.	commercial zoo trade private import	medium	*M. religiosa* is kept as pet by mantis enthusiasts and is used as used as biological control agent in North America.

	passenger on imported goods		
Pathway name:	Commercial zoo trade and private import		
1.3. Is entry along this pathway intentional (e.g. the organism is imported for trade) or accidental (the organism is a contaminant of imported goods)?	Intentional or accidental	low	
1.4. How likely is it that large numbers of the organism will travel along this pathway from the point(s) of origin over the course of one year? Point(s) of origin include natural settings or captivity. Large numbers refers to many specimens or multiple points of origin.	moderately likely	medium	The species is common in its native area and is kept as pet. It may also enter as hitchhiker. *Mantis religiosa* are solitary insects and will not enter in groups unless transported as egg in ootheca.
1.5. How likely is the organism to be able to transfer from the pathway to a suitable habitat or host in Norwegian nature?	unlikely	medium	Number of escapees from captivity is not known, but the species is large suggesting few escapes. Number of hitchhikers with human transport is not known.
1.6. Estimate the overall likelihood of entry into Norwegian nature based on this pathway?	moderately likely	medium	Need to enter areas with warm and summers in order to successfully establish. Currently occurs north to 50 degrees and is spreading.
1.7. Estimate the overall likelihood of entry into Norwegian nature based on all pathways (comment on the key issues that lead to this conclusion).	moderately likely	medium	*M. religiosa* is common in its native area, and is currently spreading northward in Europe and in North America. May enter by trade, as hitchhiker on goods and vehicles or on a longer time span by natural range expansions.

PROBABILITY OF ESTABLISHMENT			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
1.8. How likely is it that the organism will be able to establish in Norway based on the similarity between	unlikely	medium	The annual mean temperature in Norway will be above the temperature of areas where the species is present today. The egg can survive

climatic conditions in Norway and the organism's current distribution?			sub-zero temperatures during winters. However, the adult may prefer warmer temperatures during summers than that found in Norway now and in a 50 year perspective.
1.9. How likely is it that the organism will be able to establish in Norway based on the similarity between other abiotic conditions in Norway and the organism's current distribution?	likely	medium	
1.10. How likely is it that the organism will become established in protected conditions (in which the environment is artificially maintained, such as wildlife parks, glasshouses, aquaculture facilities, terraria, zoological gardens) in Norway?	very likely	high	It is already kept as a pet in protected conditions.
1.11. How widespread are habitats or species necessary for the survival, development and multiplication of the organism in Norway?	common in southern Norway	medium	Areas with warm summers.
1.12. How likely is it that establishment will occur despite management practices (including eradication campaigns), competition from existing species or predators, parasites or pathogens in Norway?	likely	medium	The species is currently spreading and is considered invasive in North America. In general, it may be hard to control insect population sizes in geographical areas where the species is present and the fundamental niche of the species can be fulfilled.
1.13. How likely are the biological characteristics (including adaptability and capacity of spread) of the organism to facilitate its establishment?	very likely	low	The species was introduced by humans to USA in the 1890s and is still spreading, also northward in Canada.
1.14. How likely is it that the organism could establish despite low genetic diversity in the founder population?	likely	high	Data on genetic plasticity of species is lacking. In general, insects can establish with a small founder population.
1.15. Based on the history of invasion by this organism elsewhere in the world, how likely is to	likely	low	The species was introduced to USA in the 1890s and is still spreading, also northward in Canada where it is considered invasive.

establish in Norway? (If possible, specify the instances in the comments box.)			
1.16. Estimate the overall likelihood of establishment in Norway (mention any key issues in the comment box).	likely	medium	The egg can survive sub-zero temperatures during winters. The adult may prefer warmer temperatures than found in Norway today, but the temperatures are likely to be within its tolerance in a 50 year perspective. It is a generalist predator and can be expected to acquire food in Norway.
PROBABILITY OF SPREAD			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
2.1. How likely is it that this organism will spread widely in Norway by *natural means*? (Please list and comment on the mechanisms for natural spread.)	moderately likely	medium	*Mantis religiosa* is currently spreading in Europe and in North America.
2.2. How likely is it that this organism will spread widely in Norway by *human assistance*? (Please list and comment on the mechanisms for human-assisted spread.)	moderate	medium	Commercial zoo trade and private import, as hitchhiker on goods and vehicles. The species is kept as pet. Uncertain how many specimens are transported to- and within Norway.
2.3. How likely is it that spread of the organism within Norway can be completely contained?	unlikely	low	
2.4. Based on the answers to questions on the potential for establishment and spread in Norway, define the area endangered by the organism.	southern Norway	medium	Continental southern Norway with warm summers.
2.5. Estimate the overall potential for future spread for this organism in Norway (using the comment box to indicate any key issues).	moderately likely	medium	*M. religiosa* is currently spreading in Europe, Australia and in North America, suggesting a large capacity to spread.
PROBABILITY OF ENVIRONMENTAL IMPACT			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**

2.6. How much environmental harm is caused by the organism within its existing geographic range, excluding Norway?	moderate	high	They have a great appetite and are used as biological control agents. However, as generalist predators, they eat anything they can catch. Thus, their usefulness as biological control agents of pest insects is questionable since they eat beneficial species as well as pest insects.
2.7. How much impact would there be, if genetic traits of the organism were to be transmitted to other species, modifying their genetic makeup and making their environmental effects more serious?	minimal	medium	
2.8. How much impact does the organism have, as food, as a host, or as a symbiont or a vector for other damaging organisms (e.g. diseases)?	na		Not known
2.9. How much impact do other factors have, factors which are not covered by previous questions (specify in the comment box)	na		Not known
2.10. How important are the expected impacts of the organism despite any natural control by other organisms, such as predators, parasites or pathogens that may already be present in Norway?	moderate	high	It is difficult to predict impacts on natural ecosystems.
2.11. Indicate any parts of Norway where environmental impacts are particularly likely to occur (provide as much detail as possible).	no known areas	medium	Areas with warm summers.
ADDITIONAL QUESTIONS - CLIMATE CHANGE			
3.1. What aspects of climate change (in a 50 year perspective), if any, are most likely to affect the risk assessment for this organism?	increased temperatures	high	Species need warm summers. Uncertainty related to scenario RCP 8.5.
3.2. What aspects of the risk assessment are most likely to change as a result of climate change? • Establishment • Spread	establishment spread Impact on biodiversity	medium	Increased temperatures beyond scenario RCP 8.5 will increase the probability of establishment. The length of the life cycle will decrease at increasing temperatures, allowing higher pressure on nature.

• Impact on biodiversity • Impact on ecosystem functions			
RISK SUMMARIES			
Mantis religiosa (Linnaeus, 1758)	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
Summarise Entry	Moderately likely	medium	*M. religiosa* is common in its native area, and is currently spreading northward in Europe and in North America. May enter by trade, as hitchhiker on goods and vehicles or on a longer time span by natural range expansions.
Summarise Establishment	likely	medium	The egg can survive sub-zero temperatures during winters. The adult may prefer warmer temperatures than found in Norway today, but the temperatures are likely to be within its tolerance in a 50 year perspective. It is a generalist predator and can be expected to acquire food in Norway.
Summarise Spread	Moderately likely	medium	*Mantis religiosa* is currently spreading in Europe and in North America and can in a 50 year perspective establish viable populations in warm areas of Norway.
Summarise Impact	moderate	high	They have a great appetite and eat anything they can catch. However, high uncertainty because many impacts on natural ecosystems are difficult to predict.
Conclusion of the risk assessment	moderate	high	There is potential for establishment in warm areas. If established, *M. religiosa* may develop viable populations and spread, and possibly impact biodiversity and ecosystems.

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Cannings, R.A. (2007) Recent range expansion of the Praying Mantis, *Mantis religiosa* Linnaeus (Mantodea: Mantidae), in British Columbia. Journal of the Entomological Society of British Columbia, 104:73-80.

Rathet, I.H., and L.E. Hurd. 1983. Ecological relationships of three co-occurring mantids, *Tenodera sinensis* (Saussure), *T. angustipennis* (Saussure), and *Mantis religiosa* (Linnaeus). American Midland Naturalist 110: 240-248.

EU NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME
Name of organism: *Miomantis caffra* Saussure 1871 **Author:** Gaute Velle **Risk Assessment Area:** Norway **Synonyms:** None known **Common names:** Springbok mantis, the South African praying mantis

SECTION B – Detailed assessment

PROBABILITY OF ENTRY			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
1.20. How many known pathways are relevant to the potential entry of this organism?	very few (2)	low	*M. caffra is* from South Africa. Spread to New Zealand and Portugal by unknown mechanisms.
1.2. List relevant pathways through which the organism could enter. Where possible give detail about the specific origins and end points of the pathways.	commercial zoo trade private import	medium	*M. caffra* is held as pet.
Pathway name:	Commercial zoo trade and private import		
1.3. Is entry along this pathway intentional (e.g. the organism is imported for trade) or accidental (the organism is a contaminant of imported goods)?	intentional	low	

1.4. How likely is it that large numbers of the organism will travel along this pathway from the point(s) of origin over the course of one year? Point(s) of origin include natural settings or captivity. Large numbers refers to many specimens or multiple points of origin.	unlikely	high	The species is common in its native area and is held as a pet. Uncertain how many specimens are imported to Norway.
1.5. How likely is the organism to be able to transfer from the pathway to a suitable habitat or host in Norwegian nature?	unlikely	high	Number of escapees from captivity is low, but exact numbers are not known.
1.6. Estimate the overall likelihood of entry into Norwegian nature based on this pathway?	unlikely	high	Need to escape from captivity in areas of Norway with the warmest summers.
1.7. Estimate the overall likelihood of entry into Norwegian nature based on all pathways.	unlikely	medium	*M. caffra* species is common in its native area and is in trade. Escape from captivity must occur in areas of Norway with the warmest summers in order to survive outside.
PROBABILITY OF ESTABLISHMENT			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
1.8. How likely is it that the organism will be able to establish in Norway based on the similarity between climatic conditions in Norway and the organism's current distribution?	unlikely	medium	*M. caffra* is a south African species which was first found in New Zealand in 1978 and is now gradually extending its distribution in the North Island. Experiments and modelling suggest it can tolerate temperatures similar to Norway in a 50 year perspective
1.9. How likely is it that the organism will be able to establish in Norway based on the similarity between other abiotic conditions in Norway and the organism's current distribution?	Moderately likely	medium	Native range is New Zealand where it favour rank grass and weedy areas as well as shrubs and to hide beneath foliage
1.10. How likely is it that the organism will become established in protected conditions (in which the environment is artificially maintained, such as	likely	low	It is already kept as a pet in protected conditions.

wildlife parks, glasshouses, aquaculture facilities, terraria, zoological gardens) in Norway?			
1.11. How widespread are habitats or species necessary for the survival, development and multiplication of the organism in Norway?	Warmest areas of southern Norway	medium	
1.12. How likely is it that establishment will occur despite management practices (including eradication campaigns), competition from existing species or predators, parasites or pathogens in Norway?	likely	low	*M. caffra* has spread to New Zealand, and has recently been discovered in Portugal. It is spreading within New Zealand, despite management practices.
1.13. How likely are the biological characteristics (including adaptability and capacity of spread) of the organism to facilitate its establishment?	likely	low	*M. caffra* has a high capacity of spread.
1.14. How likely is it that the organism could establish despite low genetic diversity in the founder population?	likely	high	Data on genetic plasticity of species is lacking. In general, insects can establish with a small founder population.
1.15. Based on the history of invasion by this organism elsewhere in the world, how likely is to establish in Norway?	likely	low	The species is spreading within New Zealand and within Portugal.
1.16. Estimate the overall likelihood of establishment in Norway (mention any key issues in the comment box).	moderately likely	medium	The species may just be able to survive in some very limited areas of Norway in a 50 year perspective. It is a generalist predator and can be expected to acquire food in Norway

PROBABILITY OF SPREAD

QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
2.1. How likely is it that this organism will spread widely in Norway by *natural means*? (Please list and comment on the mechanisms for natural spread.)	very unlikely	low	
2.2. How likely is it that this organism will spread widely in Norway by *human assistance*? (Please list	moderately likely	medium	The species is common in its native area and is in trade. Need to escape from captivity in order to enter.

and comment on the mechanisms for human-assisted spread.)			
2.3. How likely is it that spread of the organism within Norway can be completely contained?	unlikely	low	*M. caffra* has spread rapidly in New Zealand, despite management practices.
2.4. Based on the answers to questions on the potential for establishment and spread in Norway, define the area endangered by the organism.		medium	Continental southern Norway with warm summers
2.5. Estimate the overall potential for future spread for this organism in Norway (using the comment box to indicate any key issues).	moderately likely	low	The species is currently spreading in New Zealand and Portugal, despite management practices in New Zealand. This suggests a large capacity of spread. However, areas where it potentially can survive in Norway are few and scattered.
PROBABILITY OF ENVIRONMENTAL IMPACT			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
2.6. How much environmental harm is caused by the organism within its existing geographic range, excluding Norway?	minimal	medium	In New Zealand, *M. caffra* is now displacing the native mantid *O. novaezealandiae,* which formerly was the more common
2.7. How much impact would there be, if genetic traits of the organism were to be transmitted to other species, modifying their genetic makeup and making their environmental effects more serious?	minimal	medium	
2.8. How much impact does the organism have, as food, as a host, or as a symbiont or a vector for other damaging organisms (e.g. diseases)?	minimal	high	Not known
2.9. How much impact do other factors have, factors which are not covered by previous questions (specify in the comment box)	na	high	Not known
2.10. How important are the expected impacts of the organism despite any natural control by other	moderate	high	

organisms, such as predators, parasites or pathogens that may already be present in Norway?			
2.11. Indicate any parts of Norway where environmental impacts are particularly likely to occur (provide as much detail as possible).	no known areas	medium	
ADDITIONAL QUESTIONS - CLIMATE CHANGE			
3.1. What aspects of climate change (in a 50 year perspective), if any, are most likely to affect the risk assessment for this organism?	increased temperatures	low	Species need warm summers. Uncertainty related to scenario RCP 8.5
3.2. What aspects of the risk assessment are most likely to change as a result of climate change? • Establishment • Spread • Impact on biodiversity • Impact on ecosystem functions	establishment spread Impact on biodiversity	medium	Increased temperatures beyond scenario RCP 8.5 will increase the probability of establishment. The length of the life cycle will decrease at increasing temperatures.
RISK SUMMARIES			
Miomantis caffra Saussure 1871	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
Summarise Entry	unlikely	medium	*M. caffra* species is common in its native area and is in trade. Escape from captivity must occur in areas of Norway with the warmest summers in order to survive outside.
Summarise Establishment	moderately likely	medium	The species may just be able to survive in some very limited areas of Norway in a 50 year perspective. It is a generalist predator and can be expected to acquire food in Norway
Summarise Spread	moderately likely	low	The species has a high capacity of spread. Climate might be a limiting factor for spread in Norway.
Summarise Impact	minimal	high	Although not considered a pest species, it is displacing the New Zealand native species (*O.*

			novaezealandiae) in urban environments of northern New Zealand. However, it is difficult to predict impacts on biodiversity and natural ecosystems in Norway.
Conclusion of the risk assessment	low	medium	There is perhaps a potential for establishment in the warmest areas. The impact is unknown.

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EU NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME
Name of organism: *Oligonicella scudderi* Saussure, 1870 **Author:** Gaute Velle **Risk Assessment Area:** Norway **Synonyms:** *O. missouriensis, O. bolliana, O. uhleri, Oligonyx uhleri, Oligonyx scudderi, Oligonyx bolliana* **Common names:** Scudder's mantis, slender prairie mantid

SECTION B – Detailed assessment			
PROBABILITY OF ENTRY			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
1.21. How many known pathways are relevant to the potential entry of this organism?	very few to none	low	*O. scudderi* is from Central USA (north to Nebraska). Will likely not reach Norway by natural means.
1.2. List relevant pathways through which the organism could enter. Where possible give detail about the specific origins and end points of the pathways.	commercial zoo trade private import	low	*O. scudderi* is held as pet by mantis enthusiasts.
Pathway name:	Commercial zoo trade and private import		
1.3. Is entry along this pathway intentional (e.g. the organism is imported for trade) or accidental (the organism is a contaminant of imported goods)?	intentional	low	
1.4. How likely is it that large numbers of the organism will travel along this pathway from the	unlikely	medium	Uncertain how many specimens are imported to Norway.

point(s) of origin over the course of one year? Point(s) of origin include natural settings or captivity. Large numbers refers to many specimens or multiple points of origin. Subnote: In your comment discuss how likely the organism is to get onto the pathway in the first place.			
1.5. How likely is the organism to be able to transfer from the pathway to a suitable habitat or host in Norwegian nature?	unlikely	medium	Number of escapees from captivity is low, but exact numbers are not known.
1.6. Estimate the overall likelihood of entry into Norwegian nature based on this pathway?	unlikely	medium	Need to escape from captivity in areas of Norway with the warmest summers.
1.7. Estimate the overall likelihood of entry into Norwegian nature based on all pathways (comment on the key issues that lead to this conclusion).	unlikely	high	*O. scudderi* is common in its native area. Uncertain how many specimens are imported to Norway, but likely to be few. Because of their small size it can be hard to find suitable food for specimen in captivity.

PROBABILITY OF ESTABLISHMENT			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
1.8. How likely is it that the organism will be able to establish in Norway based on the similarity between climatic conditions in Norway and the organism's current distribution?	unlikely	medium	The annual mean temperature in Norway will be above the temperature of areas where the species is present today. The egg can survive sub-zero temperatures during winters. However, the adult may prefer warmer and dryer temperatures during summers than that found in Norway.
1.9. How likely is it that the organism will be able to establish in Norway based on the similarity between other abiotic conditions in Norway and the organism's current distribution?	unlikely	high	Ground-dwelling species, also found in tussock. Native range is Central USA north to Nebraska, south southwards to Texas and Mexico.

1.10. How likely is it that the organism will become established in protected conditions (in which the environment is artificially maintained, such as wildlife parks, glasshouses, aquaculture facilities, terraria, zoological gardens) in Norway?	likely	low	*O. scudderi* is already kept as a pet in protected conditions.
1.11. How widespread are habitats or species necessary for the survival, development and multiplication of the organism in Norway?	isolated in southern Norway	low	
1.12. How likely is it that establishment will occur despite management practices (including eradication campaigns), competition from existing species or predators, parasites or pathogens in Norway?	likely	high	In general, it may be hard to control insect population sizes in geographical areas where the species is present and the fundamental niche of the species can be fulfilled.
1.13. How likely are the biological characteristics (including adaptability and capacity of spread) of the organism to facilitate its establishment?	unlikely	high	
1.14. How likely is it that the organism could establish despite low genetic diversity in the founder population?	likely	high	Data on genetic plasticity of species is lacking. In general, insects can establish with a small founder population.
1.15. Based on the history of invasion by this organism elsewhere in the world, how likely is to establish in Norway? (If possible, specify the instances in the comments box.)	na	na	
1.16. Estimate the overall likelihood of establishment in Norway (mention any key issues in the comment box).	unlikely	medium	The egg can survive sub-zero temperatures during winters. Summer temperatures in Norway are too cold now and likely too cold in 50 years. It is a generalist predator and can be expected to acquire food in Norway.
PROBABILITY OF SPREAD			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**

2.1. How likely is it that this organism will spread widely in Norway by *natural means*? (Please list and comment on the mechanisms for natural spread.)	very unlikely	medium	
2.2. How likely is it that this organism will spread widely in Norway by *human assistance*? (Please list and comment on the mechanisms for human-assisted spread.)	unlikely	high	*O. scudderi* is kept as pet. Uncertain how many specimens are transported to- and within Norway.
2.3. How likely is it that spread of the organism within Norway can be completely contained?	likely	medium	
2.4. Based on the answers to questions on the potential for establishment and spread in Norway, define the area endangered by the organism.		medium	Continental southern Norway with warm summers.
2.5. Estimate the overall potential for future spread for this organism in Norway (using the comment box to indicate any key issues).	unlikely	medium	Adult females have undeveloped wing pads that may suggest a low capacity of spread. However, spreading capacity is mostly unknown.
PROBABILITY OF ENVIRONMENTAL IMPACT			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
2.6. How much environmental harm is caused by the organism within its existing geographic range, excluding Norway?	minimal	high	
2.7. How much impact would there be, if genetic traits of the organism were to be transmitted to other species, modifying their genetic makeup and making their environmental effects more serious?	minimal	medium	
2.8. How much impact does the organism have, as food, as a host, or as a symbiont or a vector for other damaging organisms (e.g. diseases)?	na		Not known
2.9. How much impact do other factors have, factors which are not covered by previous questions (specify in the comment box)	na		Not known

2.10. How important are the expected impacts of the organism despite any natural control by other organisms, such as predators, parasites or pathogens that may already be present in Norway?	minimal	high	
2.11. Indicate any parts of Norway where environmental impacts are particularly likely to occur (provide as much detail as possible).	no known areas	medium	
ADDITIONAL QUESTIONS - CLIMATE CHANGE			
3.1. What aspects of climate change (in a 50 year perspective), if any, are most likely to affect the risk assessment for this organism?	increased temperatures	medium	Species need warm summers. Uncertainty related to scenario RCP 8.5.
3.2. What aspects of the risk assessment are most likely to change as a result of climate change? • Establishment • Spread • Impact on biodiversity • Impact on ecosystem functions	establishment spread	medium	Increased temperatures beyond scenario RCP 8.5 will increase the probability of establishment.
RISK SUMMARIES			
Oligonicella scudderi	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
Summarise Entry	unlikely	high	*O. scudderi* is common in its native area. Uncertain how many specimens are imported to Norway, but likely to be few. Because of their small size it can be hard to find suitable food for specimen in captivity.
Summarise Establishment	unlikely	medium	The egg can survive sub-zero temperatures during winters. Summer temperatures in Norway are too cold now and likely too cold in 50 years. It is a generalist predator and can be expected to acquire food in Norway.

Summarise Spread	unlikely	medium	Adult females have undeveloped wing pads that may suggest a low capacity of spread. However, spreading capacity is mostly unknown.
Summarise Impact	minimal	high	No known impact. However, information is lacking.
Conclusion of the risk assessment	low	medium	The likelihood of successful establishment is very low given that the summers in Norway are too cold now and likely too cold in a 50 year perspective. The impact is unknown.

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EU NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME
Name of organism: *Orthodera novaezealandiae* Colenso, 1882 **Author:** Gaute Velle **Risk Assessment Area:** Norway **Synonyms:** *Mantis novaezealandiae, Tenodera intermedia*, might be the same species as *Orthodera ministralis* of Australia **Common name:** The New Zealand mantid

SECTION B – Detailed assessment

PROBABILITY OF ENTRY

Important instructions:

- Entry is the introduction of an organism into Norway. Not to be confused with spread, the movement of an organism within Norway.
- For organisms which are already present in Norway, only complete the entry section for current active pathways of entry or if relevant potential future pathways. The entry section need not be completed for organisms which have entered in the past and have no current pathways of entry.

QUESTION	RESPONSE	UNCERTAINTY	COMMENT
1.22. How many known pathways are relevant to the potential entry of this organism?	very few (2)	low	*O. novaezealandiae* occurs only in New Zealand, and is found throughout the country.
1.2. List relevant pathways through which the organism could enter. Where possible give detail about the specific origins and end points of the pathways.	commercial zoo trade private import	medium	Species is held as pet. The extent of trade and import seems to be limited, but this is unknown.

Pathway name:	Commercial zoo trade and private import		
1.3. Is entry along this pathway intentional (e.g. the organism is imported for trade) or accidental (the organism is a contaminant of imported goods)?	intentional	low	
1.4. How likely is it that large numbers of the organism will travel along this pathway from the point(s) of origin over the course of one year? Point(s) of origin include natural settings or captivity. Large numbers refers to many specimens or multiple points of origin.	unlikely	medium	The species is common in its native area. The extent of trade and import is unknown, but likely limited.
1.5. How likely is the organism to be able to transfer from the pathway to a suitable habitat or host in Norwegian nature?	moderately likely	high	Number of escapees from captivity is not known. However, the nymphs are especially fast and can leap relatively far, suggesting that escapes may occur.
1.6. Estimate the overall likelihood of entry into Norwegian nature based on this pathway?	moderately likely	medium	
End of pathway assessment, repeat as necessary.			
1.7. Estimate the overall likelihood of entry into Norwegian nature based on all pathways (comment on the key issues that lead to this conclusion).	moderately likely	medium	*O. novaezealandiae* is endemic to New Zealand, where it is common. It is in trade. Special care must be taken to prevent this small, quick-moving species from escaping. Nymphs are especially fast and can leap far.

PROBABILITY OF ESTABLISHMENT

QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
1.8. How likely is it that the organism will be able to establish in Norway based on the similarity between climatic conditions in Norway and the organism's current distribution?	likely	low	Native range is New Zealand. The climatic conditions in southern Norway are simiar to that of southern South Island on New Zealand where the species is present today.
1.9. How likely is it that the organism will be able to establish in Norway based on the similarity between	likely	medium	Native range is New Zealand where it prefers shrub land and open country. It is a generalist

other abiotic conditions in Norway and the organism's current distribution?			predator and can be expected to aqcuire prey in Norway.
1.10. How likely is it that the organism will become established in protected conditions (in which the environment is artificially maintained, such as wildlife parks, glasshouses, aquaculture facilities, terraria, zoological gardens) in Norway?	likely	low	*O. novaezealandiae is* already kept as a pet in protected conditions.
1.11. How widespread are habitats or species necessary for the survival, development and multiplication of the organism in Norway?	widespread in southern Norway	low	
1.12. How likely is it that establishment will occur despite management practices (including eradication campaigns), competition from existing species or predators, parasites or pathogens in Norway?	moderately likely	high	*O. novaezealandiae* is being displaced by *M. caffra* in New Zealand. In general, it may be hard to control insect population sizes in geographical areas where the species is present and the fundamental niche of the species can be fulfilled.
1.13. How likely are the biological characteristics (including adaptability and capacity of spread) of the organism to facilitate its establishment?	moderately likely	high	
1.14. How likely is it that the organism could establish despite low genetic diversity in the founder population?	likely	high	Data on genetic plasticity of species is lacking. In general, insects can establish with a small founder population.
1.15. Based on the history of invasion by this organism elsewhere in the world, how likely is to establish in Norway?	na	na	
1.16. Estimate the overall likelihood of establishment in Norway (mention any key issues in the comment box).	likely	low	The environmental conditions in southern Norway are similar to that of areas where the species is present. It is a generalist predator and can be expected to find prey.
PROBABILITY OF SPREAD			
Important notes:			

- Spread is defined as the expansion of the geographical distribution of an alien species within an area.

QUESTION	RESPONSE	UNCERTAINTY	COMMENT
2.1. How likely is it that this organism will spread widely in Norway by *natural means*? (Please list and comment on the mechanisms for natural spread.)	very unlikely	low	
2.2. How likely is it that this organism will spread widely in Norway by *human assistance*? (Please list and comment on the mechanisms for human-assisted spread.)	unlikely	medium	The species is common in its native area and is in trade. Uncertain how many specimens are transported to- and within Norway.
2.3. How likely is it that spread of the organism within Norway can be completely contained?	unlikely	medium	
2.4. Based on the answers to questions on the potential for establishment and spread in Norway, define the area endangered by the organism.		medium	Continental southern Norway with warm summers.
2.5. Estimate the overall potential for future spread for this organism in Norway (using the comment box to indicate any key issues).	likely	high	Capacity of spread is unknown.

PROBABILITY OF ENVIRONMENTAL IMPACT

Important instructions:

- When assessing potential future environmental impacts, climate change should not be taken into account. This is done in later questions at the end of the assessment.
- Each set of questions starts with the impact elsewhere in the world, then considers impacts in Norway separating known impacts to date (i.e. past and current impacts) from potential future impacts. Key words are in bold for emphasis.

QUESTION	RESPONSE	UNCERTAINTY	COMMENTS
2.6. How much environmental harm is caused by the organism within its existing geographic range, excluding Norway?	minimal	low	
2.7. How much impact would there be, if genetic traits of the organism were to be transmitted to other species, modifying their genetic makeup and making their environmental effects more serious?	minimal	medium	

2.8. How much impact does the organism have, as food, as a host, or as a symbiont or a vector for other damaging organisms (e.g. diseases)?	na	na	Not known
2.9. How much impact do other factors have, factors which are not covered by previous questions (specify in the comment box)	na	na	Not known
2.10. How important are the expected impacts of the organism despite any natural control by other organisms, such as predators, parasites or pathogens that may already be present in Norway?	minimal	high	
2.11. Indicate any parts of Norway where environmental impacts are particularly likely to occur (provide as much detail as possible).	no known areas	medium	
ADDITIONAL QUESTIONS - CLIMATE CHANGE			
3.1. What aspects of climate change (in a 50 year perspective), if any, are most likely to affect the risk assessment for this organism?	increased temperatures	medium	Species need warm summers. Uncertainty related to scenario RCP 8.5
3.2. What aspects of the risk assessment are most likely to change as a result of climate change? • Establishment • Spread • Impact on biodiversity • Impact on ecosystem functions	Establishment Spread Impact on biodiversity	medium	Increased temperatures beyond scenario RCP 8.5 will increase the probability of establishment. The length of the life cycle will decrease at increasing temperatures
RISK SUMMARIES			
Orthodera novaezealandiae	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
Summarise Entry	moderately likely	medium	*O. novaezealandiae* is endemic to New Zealand, where it is common. It is in trade. Special care must be taken to prevent this small, quick-moving species from escaping. Nymphs are especially fast and can leap far.

Summarise Establishment	likely	low	The environmental conditions in southern Norway are similar to that of areas where the species is present. It is a generalist predator and can be expected to find prey.
Summarise Spread	likely	medium	Capacity of spread is unknown.
Summarise Impact	minimal	high	No known impact. However, it is difficult to predict impacts on natural ecosystems.
Conclusion of the risk assessment	medium	high	There is a potential for establishment. The impact on Norwegian biodiversity is unknown.

REFERENCES:

Cannings, R.A. (2007) Recent range expansion of the Praying Mantis, Mantis religiosa Linnaeus (Mantodea: Mantidae), in British Columbia. Journal of the Entomological Society of British Columbia, 104:73-80.

Murray Peter Fea 2011. Msc Theseis: The University of Auckland, 2011. Reproductive Ecology and Impact of the Invasive Praying Mantis Miomantis caffra. 100 pp.

Ramsay, G.W. (1990). Mantodea (Insecta), with a review of aspects of functional morphology and biology. Fauna of New Zealand 19, Landcare Research, New Zealand.

EU NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME

Name of organism: *Tenodera sinensis* Saussure, 1871

Author: Gaute Velle

Risk Assessment Area: Norway

Synonyms: *Ameles borealis, Tenodera aridifolia, Mantis mandarinea, Paratenodera sinensis*

Common name: Chinese mantis

SECTION B – Detailed assessment

PROBABILITY OF ENTRY

Important instructions:

- Entry is the introduction of an organism into Norway. Not to be confused with spread, the movement of an organism within Norway.
- For organisms which are already present in Norway, only complete the entry section for current active pathways of entry or if relevant potential future pathways. The entry section need not be completed for organisms which have entered in the past and have no current pathways of entry.

QUESTION	RESPONSE	UNCERTAINTY	COMMENT
1.23. How many known pathways are relevant to the potential entry of this organism?	very few	low	Species from Asia. Accidentally introduced into North Carolina in 1896 and has spread in many states in USA. Will likely not reach Norway by natural means.
1.2. List relevant pathways through which the organism could enter. Where possible give detail about the specific origins and end points of the pathways.	commercial zoo trade private import	low	*T. sinensis* is a common pet for mantis enthusiasts.

Pathway name:	Commercial zoo trade and private import		
1.3. Is entry along this pathway intentional (e.g. the organism is imported for trade) or accidental (the organism is a contaminant of imported goods)?	intentional	low	
1.4. How likely is it that large numbers of the organism will travel along this pathway from the point(s) of origin over the course of one year? Point(s) of origin include natural settings or captivity. Large numbers refers to many specimens or multiple points of origin.	unlikely	high	The species is common in its native area and is kept as pet. Uncertain how many specimens are imported to Norway.
1.5. How likely is the organism to be able to transfer from the pathway to a suitable habitat or host in Norwegian nature?	unlikely	medium	Number of escapees from captivity is not known, but the species is large suggesting few escapes.
1.6. Estimate the overall likelihood of entry into Norwegian nature based on this pathway?	unlikely	medium	Only areas in Norway with the warmest summers include potential habitats.
End of pathway assessment, repeat as necessary.			
1.7. Estimate the overall likelihood of entry into Norwegian nature based on all pathways	likely	medium	*T. sinensis* is very common. Originally it only occurred in Asia, but because of international commerce it has been introduced in North America. There this species is thriving and can be found in almost the whole continent. It is a common pet for mantis enthusiasts, and oothecae can easily be purchased. They are notable for quickly adapting to the presence of humans.

PROBABILITY OF ESTABLISHMENT

QUESTION	RESPONSE	UNCERTAINTY	COMMENT
1.8. How likely is it that the organism will be able to establish in Norway based on the similarity between climatic conditions in Norway and the organism's current distribution?	unlikely	medium	Winter temperatures in Norway are above the temperatures of areas where the species is present today. The egg can survive sub-zero temperatures during winters. However, the

			adult may prefer warmer temperatures during summers than found in Norway.
1.9. How likely is it that the organism will be able to establish in Norway based on the similarity between other abiotic conditions in Norway and the organism's current distribution?	unlikely	high	
1.10. How likely is it that the organism will become established in protected conditions (in which the environment is artificially maintained, such as wildlife parks, glasshouses, aquaculture facilities, terraria, zoological gardens) in Norway?	likely	medium	*T. sinensis* is already kept as a pet in protected conditions.
1.11. How widespread are habitats or species necessary for the survival, development and multiplication of the organism in Norway?	isolated in southern Norway	medium	Areas with warm summers. However, summer temperatures in Norway may presently be too cold. It can eat pollen as an alternative source of food.
1.12. How likely is it that establishment will occur despite management practices (including eradication campaigns), competition from existing species or predators, parasites or pathogens in Norway?	likely	medium	The species is currently spreading in USA. In general, it may be hard to control insect population sizes in geographical areas where the species is present and the fundamental niche of the species can be fulfilled.
1.13. How likely are the biological characteristics (including adaptability and capacity of spread) of the organism to facilitate its establishment?	unlikely	high	*T. sinensis* was accidentally introduced to USA in the 1890s and is now widespread in the USA.
1.14. How likely is it that the organism could establish despite low genetic diversity in the founder population?	likely	high	Data on genetic plasticity of species is lacking. In general, insects can establish with a small founder population.
1.15. Based on the history of invasion by this organism elsewhere in the world, how likely is to establish in Norway? (If possible, specify the instances in the comments box.)	likely	low	

1.16. Estimate the overall likelihood of establishment in Norway (mention any key issues in the comment box).	unlikely	high	The egg of *T. sinensis* can survive sub-zero temperatures during winters. Experience from the BC coast of Canada suggests that development requires more accumulated degree-days than are available in Norway today. It is uncertain whether the temperatures may be within its tolerance in a 50 year perspective. It is a general predator and can eat pollen as an alternative source of food, suggesting it can find food in Norway. After one mating the female mantis will produce fertilized eggs for the rest of her life.

PROBABILITY OF SPREAD

Important notes:

- Spread is defined as the expansion of the geographical distribution of an alien species within an area.

QUESTION	RESPONSE	UNCERTAINTY	COMMENT
2.1. How likely is it that this organism will spread widely in Norway by *natural means*? (Please list and comment on the mechanisms for natural spread.)	very unlikely	medium	
2.2. How likely is it that this organism will spread widely in Norway by *human assistance*? (Please list and comment on the mechanisms for human-assisted spread.)	likely	medium	The species is commonly held as pet
2.3. How likely is it that spread of the organism within Norway can be completely contained?	Moderately likely	medium	The species has quickly spread in the USA
2.4. Based on the answers to questions on the potential for establishment and spread in Norway, define the area endangered by the organism.		medium	Continental southern Norway with warm summers
2.5. Estimate the overall potential for future spread for this organism in Norway (using the comment box to indicate any key issues).	unlikely	high	Is currently spreading in USA, but capacity of spread is not known since the spread is assisted by humans.

PROBABILITY OF ENVIRONMENTAL IMPACT			
Important instructions: • When assessing potential future environmental impacts, climate change should not be taken into account. This is done in later questions at the end of the assessment. • Each set of questions starts with the impact elsewhere in the world, then considers impacts in Norway separating known impacts to date (i.e. past and current impacts) from potential future impacts. Key words are in bold for emphasis.			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
2.6. How much environmental harm is caused by the organism within its existing geographic range, excluding Norway?	moderate	high	They have a great appetite and are used as biological control agents. However, as generalist predators, they eat anything they can catch. Thus, their usefulness as biological control agents of pest insects is questionable since they eat beneficial species as well as pest insects.
2.7. How much impact would there be, if genetic traits of the organism were to be transmitted to other species, modifying their genetic makeup and making their environmental effects more serious?	minimal	medium	
2.8. How much impact does the organism have, as food, as a host, or as a symbiont or a vector for other damaging organisms (e.g. diseases)?	minimal	high	Not known
2.9. How much impact do other factors have, factors which are not covered by previous questions (specify in the comment box)	na	low	Not known
2.10. How important are the expected impacts of the organism despite any natural control by other organisms, such as predators, parasites or pathogens that may already be present in Norway?	moderate	high	It is difficult to predict impacts on natural ecosystems.
2.11. Indicate any parts of Norway where environmental impacts are particularly likely to occur (provide as much detail as possible).	no known areas	medium	Areas with warm summers

ADDITIONAL QUESTIONS - CLIMATE CHANGE			
3.1. What aspects of climate change (in a 50 year perspective), if any, are most likely to affect the risk assessment for this organism?	increased temperatures	medium	Species need warm summers. Uncertainty related to scenario RCP 8.5
3.2. What aspects of the risk assessment are most likely to change as a result of climate change? • Establishment • Spread • Impact on biodiversity • Impact on ecosystem functions	Establishment Spread Impact on biodiversity	medium	Increased temperatures beyond scenario RCP 8.5 will increase the probability of establishment.
RISK SUMMARIES			
Tenodera sinensis (Saussure, 1871)	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
Summarise Entry	likely	medium	*T. sinensis* is very common. Originally it only occurred in Asia, but because of international commerce it has been introduced in North America. There this species is thriving and can be found in almost the whole continent. It is a common pet for mantis enthusiasts, and oothecae can easily be purchased. They are notable for quickly adapting to the presence of humans.
Summarise Establishment	unlikely	high	The egg of *T. sinensis* can survive sub-zero temperatures during winters. Experience from the BC coast of Canada suggests that development requires more accumulated degree-days than are available in Norway today. It is uncertain whether the temperatures may be within its tolerance in a 50 year perspective. It is a general predator and can eat pollen as an alternative source of food, suggesting it can find food in Norway. After one

			mating the female mantis will produce fertilized eggs for the rest of her life.
Summarise Spread	unlikely	high	The species is currently spreading in USA, but capacity of spread is not known since the spread is assisted by humans.
Summarise Impact	moderate	high	*T. sinensis* has a great appetite and eat anything they can catch, including small vertebrates. It is thought to outcompete many of the native mantids in the USA, which are in decline. However, the uncertainty is high because many impacts on natural ecosystems are difficult to predict.
Conclusion of the risk assessment	low	medium	Temperatures in Norway are likely too cold.

REFERENCES:

Rathet, I.H., and L.E. Hurd. 1983. Ecological relationships of three co-occurring mantids, *Tenodera sinensis* (Saussure), *T. angustipennis* (Saussure), and *Mantis religiosa* (Linnaeus). American Midland Naturalist 110(2): 240-248.

Blatchley, Willis Stanley (1920). Orthoptera of northeastern America: with especial reference to the faunas of Indiana and Florida. The Nature Publishing Company. pp. 122–123

Beckman N, Hurd LE (2003) Pollen feeding and fitness in praying mantids: The vegetarian side of a tritrophic predator. Environmental Entomology 32: 881-885.

Cranshaw, W. 2004. Garden Insects of North America : The Ultimate Guide to Backyard Bugs (Princeton Field Guides). Princeton University Press.

Cannings, R.A. (2007) Recent range expansion of the Praying Mantis, *Mantis religiosa* Linnaeus (Mantodea: Mantidae), in British Columbia. Journal of the Entomological Society of British Columbia, 104:73-80.

Otte, D., Spearman, L. and Stiewe, M.B.D. Mantodea Species File Online. Version 5.0/5.0, Feb 2016 [Retrieved Jan-April 2016]. <http://Mantodea.SpeciesFile.org>

EU NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME
Name of organism: *Yersiniops solitarius* (Scudder, 1896) **Author:** Gaute Velle **Risk Assessment Area:** Norway **Synonyms:** *Yersiniops solitaria, Yersinia solitaria, Litaneutria minor* **Common names:** Horned ground mantis

SECTION B – Detailed assessment			
PROBABILITY OF ENTRY			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
1.24. How many known pathways are relevant to the potential entry of this organism?	very few to none	low	*Y. solitarius* is found in Central USA (north to Colorado, Rocky Mountain Morrison). Will likely not reach Norway by natural means.
1.2. List relevant pathways through which the organism could enter. Where possible give detail about the specific origins and end points of the pathways.	commercial zoo trade private import	high	Degree of trade at the present is unknown.
Pathway name:	Commercial zoo trade and private import		

1.3. Is entry along this pathway intentional (e.g. the organism is imported for trade) or accidental (the organism is a contaminant of imported goods)?	intentional	low	
1.4. How likely is it that large numbers of the organism will travel along this pathway from the point(s) of origin over the course of one year? Point(s) of origin include natural settings or captivity. Large numbers refers to many specimens or multiple points of origin.	unlikely	medium	*Y. solitarius* is little mentioned among pet enthusiasts, suggesting it is not in trade and not imported to Norway. However, the marked of insect trade is dynamic.
1.5. How likely is the organism to be able to transfer from the pathway to a suitable habitat or host in Norwegian nature?	unlikely	medium	Number of escapees from captivity is low, but exact numbers are not known.
1.6. Estimate the overall likelihood of entry into Norwegian nature based on this pathway?	unlikely	medium	Need to escape from captivity in areas of Norway with the warm and dry summers.
1.7. Estimate the overall likelihood of entry into Norwegian nature based on all pathways (comment on the key issues that lead to this conclusion).	unlikely	high	*Y. solitarius* does not seem to be common in its native area. No information has been found that suggests that the species is in trade.

PROBABILITY OF ESTABLISHMENT

QUESTION	RESPONSE	UNCERTAINTY	COMMENT
1.8. How likely is it that the organism will be able to establish in Norway based on the similarity between climatic conditions in Norway and the organism's current distribution?	unlikely	medium	The annual mean temperature in Norway will be above the temperature of areas where the species is present today. The egg can survive sub-zero temperatures during winters. However, the adult may prefer warmer and dryer temperatures during summers than that found in Norway.
1.9. How likely is it that the organism will be able to establish in Norway based on the similarity between other abiotic conditions in Norway and the organism's current distribution?	unlikely	high	Full environmental requirement of *Y. solitarius* in the wild is not known. Native range is Central USA from New Mexico to Colorado.

1.10. How likely is it that the organism will become established in protected conditions (in which the environment is artificially maintained, such as wildlife parks, glasshouses, aquaculture facilities, terraria, zoological gardens) in Norway?	likely	medium	
1.11. How widespread are habitats or species necessary for the survival, development and multiplication of the organism in Norway?	isolated in southern Norway	low	Full ecological requirements of species not known. Temperatures in Norway may be too cold during summers.
1.12. How likely is it that establishment will occur despite management practices (including eradication campaigns), competition from existing species or predators, parasites or pathogens in Norway?	likely	high	In general, it may be hard to control insect population sizes in geographical areas where the species is present and the fundamental niche of the species can be fulfilled.
1.13. How likely are the biological characteristics (including adaptability and capacity of spread) of the organism to facilitate its establishment?	unlikely	high	
1.14. How likely is it that the organism could establish despite low genetic diversity in the founder population?	likely	high	Data on genetic plasticity of species is lacking. In general, insects can establish with a small founder population.
1.15. Based on the history of invasion by this organism elsewhere in the world, how likely is to establish in Norway? (If possible, specify the instances in the comments box.)	na	na	
1.16. Estimate the overall likelihood of establishment in Norway (mention any key issues in the comment box).	unlikely	medium	Ecological requirement of *Y. solitarius* is poorly known. The egg can survive sub-zero temperatures during winters. Summer temperatures in Norway are too cold now and likely too cold in 50 years. It is a generalist predator and can be expected to find food.
PROBABILITY OF SPREAD			
Important notes: • Spread is defined as the expansion of the geographical distribution of an alien species within an area.			

QUESTION	RESPONSE	UNCERTAINTY	COMMENT
2.1. How likely is it that this organism will spread widely in Norway by *natural means*? (Please list and comment on the mechanisms for natural spread.)	very unlikely	medium	
2.2. How likely is it that this organism will spread widely in Norway by *human assistance*? (Please list and comment on the mechanisms for human-assisted spread.)	unlikely	medium	Information is lacking whether this species is in trade or not.
2.3. How likely is it that spread of the organism within Norway can be completely contained?	likely	medium	
2.4. Based on the answers to questions on the potential for establishment and spread in Norway, define the area endangered by the organism.		medium	Continental southern Norway with warm summers
2.5. Estimate the overall potential for future spread for this organism in Norway (using the comment box to indicate any key issues).	unlikely	high	Capacity of spread is unknown. Mantids are often considered to have a limited capacity of spread.

PROBABILITY OF ENVIRONMENTAL IMPACT

Important instructions:

- When assessing potential future environmental impacts, climate change should not be taken into account. This is done in later questions at the end of the assessment.
- Each set of questions starts with the impact elsewhere in the world, then considers impacts in Norway separating known impacts to date (i.e. past and current impacts) from potential future impacts. Key words are in bold for emphasis.

QUESTION	RESPONSE	UNCERTAINTY	COMMENTS
2.6. How much environmental harm is caused by the organism within its existing geographic range, excluding Norway?	minimal	high	
2.7. How much impact would there be, if genetic traits of the organism were to be transmitted to other species, modifying their genetic makeup and making their environmental effects more serious?	minimal	medium	

2.8. How much impact does the organism have, as food, as a host, or as a symbiont or a vector for other damaging organisms (e.g. diseases)?	na		Not known
2.9. How much impact do other factors have, factors which are not covered by previous questions (specify in the comment box)	na		Not known
2.10. How important are the expected impacts of the organism despite any natural control by other organisms, such as predators, parasites or pathogens that may already be present in Norway?	minimal	high	
2.11. Indicate any parts of Norway where environmental impacts are particularly likely to occur (provide as much detail as possible).	no known areas	medium	
ADDITIONAL QUESTIONS - CLIMATE CHANGE			
3.1. What aspects of climate change (in a 50 year perspective), if any, are most likely to affect the risk assessment for this organism?	increased temperatures	medium	Species need warm summers. Uncertainty related to scenario RCP 8.5
3.2. What aspects of the risk assessment are most likely to change as a result of climate change? • Establishment • Spread • Impact on biodiversity • Impact on ecosystem functions	establishment spread	medium	Increased temperatures beyond scenario RCP 8.5 will increase the probability of establishment.
RISK SUMMARIES			
Yersiniops solitarius	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
Summarise Entry	unlikely	high	*Y. solitarius* does not seem to be common in its native area. No information has been found that suggests that the species is in trade.
Summarise Establishment	unlikely	medium	Ecological requirement of *Y. solitarius* is poorly known. The egg can survive sub-zero temperatures during winters. Summer

			temperatures in Norway are too cold now and likely too cold in 50 years. It is a generalist predator and can be expected to find food.
Summarise Spread	unlikely	high	Capacity of spread is unknown. Mantids are often considered to have a limited capacity of spread.
Summarise Impact	minimal	high	No known impact. However, information is lacking.
Conclusion of the risk assessment	low	high	There is a potential for establishment in limited areas, however the likelihood of entry is very low. The impact is unknown.

REFERENCES:

Otte, D., Spearman, L. and Stiewe, M.B.D. Mantodea Species File Online. Version 5.0/5.0, Feb 2016 [Retrieved Jan-April 2016]. <http://Mantodea.SpeciesFile.org>

James AGR, Hebard M (1909) An Orthopterological Reconnoissance of the Southwestern United States. Part II: New Mexico and Western Texas. Proceedings of the Academy of Natural Sciences of Philadelphia 61: 111-175.

Reinhard Ehrmann (2002) *Mantodea Gottesanbeterinnen de Welt.* Natur und Tier – Verlag, Münster. 519 pages

EU NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME

Name of organism: *Aphonopelma chalcodes* Chamberlin, 1940 (but note that this species cannot be separated morphologically from several others in its species group)

Author: Lawrence R. Kirkendall

Risk Assessment Area: Norway

Synonyms: *Rhechostica chalcodes* Raven 1985, *A. apacheum* Chamberlin 1940, *A. minchi* Smith 1995, *A. schmidti* Smith 1995, *A. stahnkei* Smith 1995

Common names: Tucson Blonde, Desert Blonde, Arizona Blonde, Mexican Blonde, Western Desert Tarantula

SECTION B – Detailed assessment			
PROBABILITY OF ENTRY			
Important instructions: • Entry is the introduction of an organism into Norway. Not to be confused with spread, the movement of an organism within Norway. • For organisms which are already present in Norway, only complete the entry section for current active pathways of entry or if relevant potential future pathways. The entry section need not be completed for organisms which have entered in the past and have no current pathways of entry.			
QUESTION	**RESPONSE [chose one entry, delete all others]**	**UNCERTAINTY [chose one entry, delete all others]**	**COMMENT**
1.25. How many known pathways are relevant to the potential entry of this organism?	very few	low	Widely sold (but this species cannot be separated from several others, by morphology alone)
1.2. List relevant pathways through which the organism could enter. Where possible give detail about the specific origins and end points of the pathways.	Private or commercial trade		Can't know start or endpoints
Pathway name:	Trade (private or commercial)		
1.3. Is entry along this pathway intentional (e.g. the organism is imported for trade) or accidental (the organism is a contaminant of imported goods)?	intentional	low	Commercial and private trade

1.4. How likely is it that large numbers of the organism will travel along this pathway from the point(s) of origin over the course of one year? Subnote: In your comment discuss how likely the organism is to get onto the pathway in the first place.	unlikely	low	Very commonly sold species, but unlikely that "large" numbers will enter Norway
1.5. How likely is the organism to be able to transfer from the pathway to a suitable habitat or host in Norwegian nature?	very unlikely	low	accidental or deliberate release of valuable adults is very unlikely; adults and subadults are too large to escape accidentally; spiderlings could escape but would have low survivorship
1.6. Estimate the overall likelihood of entry into Norwegian nature based on this pathway?	very unlikely	low	
End of pathway assessment, repeat as necessary.			
1.7. Estimate the overall likelihood of entry into Norwegian nature based on all pathways (comment on the key issues that lead to this conclusion).	very unlikely	low	

PROBABILITY OF ESTABLISHMENT			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
1.8. How likely is it that the organism will be able to establish in Norway based on the similarity between climatic conditions in Norway and the organism's current distribution?	Likely	medium	*Aphonopelma chalcodes* is primarily found in Arizona and southwards, where it occurs from sealevel to at least 3000 m.a.s.l.
1.9. How likely is it that the organism will be able to establish in Norway based on the similarity between other abiotic conditions in Norway and the organism's current distribution?	Unlikely	medium	little otherwise of their ecological requirements; few in captivity at present; low prey availability in Norway; quite different soils in southwest USA than Norway
1.10. How likely is it that the organism will become established in protected conditions (in which the environment is artificially maintained, such as wildlife parks, glasshouses, aquaculture facilities, terraria, zoological gardens) in Norway? Subnote: gardens are not considered protected conditions	Very unlikely	low	Might be better environmental conditions, but some might be too warm or too humid? Is hard to imagine how several individuals could get into such a situation and start a population; none or few currently in captivity; low prey availability in Norway
1.11. How widespread are habitats or species necessary for the survival, development and multiplication of the organism in Norway?	Isolated in southern Norway and western Norway?	very high	What habitats and climates might be suitable are unknown, really (needs to have right soil conditions for burrowing, enough prey, and survivable climate)
1.12. How likely is it that establishment will occur despite management practices (including eradication	very unlikely	low	For reasons restricting establishment, above

campaigns), competition from existing species or predators, parasites or pathogens in Norway?			
1.13. How likely are the biological characteristics (including adaptability and capacity of spread) of the organism to facilitate its establishment?	very unlikely	low	Slow dispersers, few males likely to be available (not parthenogenetic)
1.14. How likely is it that the organism could establish despite low genetic diversity in the founder population?	unlikely	medium	Low genetic diversity likely to create inbreeding depression, but nothing known about population genetics for this genus
1.15. Based on the history of invasion by this organism elsewhere in the world, how likely is to establish in Europe? (If possible, specify the instances in the comments box.)	very unlikely	low	No instances known of successful invasion anywhere in the world for this genus or similar genera
1.16. Estimate the overall likelihood of establishment in Norway (mention any key issues in the comment box).	very unlikely	low	

PROBABILITY OF SPREAD			
Important notes: • Spread is defined as the expansion of the geographical distribution of an alien species within an area.			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
2.1. How likely is it that this organism will spread widely in Norway by *natural means*? (Please list and comment on the mechanisms for natural spread.)	very unlikely	low	Slow dispersers, few males likely to be available if any (not parthenogenetic)
2.2. How likely is it that this organism will spread widely in Norway by *human assistance*? (Please list and comment on the mechanisms for human-assisted spread.)	likely	medium	Individuals of this popular species are probably already kept as pets in Norway. Uncertain how many specimens are transported to- and within Norway, not likely it is many. Note that the species is hard to find and collect in nature, limiting the number of amateurs likely to have them.
2.3. How likely is it that spread of the organism within Norway can be completely contained?	very likely	low	
2.4. Based on the answers to questions on the potential for establishment and spread in Norway, define the area endangered by the organism.	none	low	
2.5. Estimate the overall potential for future spread for this organism in Norway (using the comment box to indicate any key issues).	very unlikely	low	Establishment unlikely, spread very unlikely

PROBABILITY OF ENVIRONMENTAL IMPACT			
Important instructions: • **When assessing potential future environmental impacts, climate change should not be taken into account. This is done in later questions at the end of the assessment.** • **Each set of questions starts with the impact elsewhere in the world, then considers impacts in Norway separating known impacts to date (i.e. past and current impacts) from potential future impacts. Key words are in bold for emphasis.**			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
2.6. How much environmental harm is caused by the organism within its existing geographic range, excluding Norway?	minimal	low	**None known**
2.7. How much impact would there be, if genetic traits of the organism were to be transmitted to other species, modifying their genetic makeup and making their environmental effects more serious?	minimal	low	Not possible in Norway (no related spiders)
2.8. How much impact does the organism have, as food, as a host, or as a symbiont or a vector for other damaging organisms (e.g. diseases)?	minimal	low	Tarantulas are not known to vector pathogens or pests to other organisms. (no related spiders in Norway)
2.9. How much impact do other factors have, factors which are not covered by previous questions (specify in the comment box)	NA	low	

2.10. How important are the expected impacts of the organism despite any natural control by other organisms, such as predators, parasites or pathogens that may already be present in Norway?	minimal	low	
2.11. Indicate any parts of Norway where environmental impacts are particularly likely to occur (provide as much detail as possible).	NA	low	

ADDITIONAL QUESTIONS - CLIMATE CHANGE			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
3.1. What aspects of climate change (in a 50 year perspective), if any, are most likely to affect the risk assessment for this organism?	Milder winters, longer growth seasons; more precipitation	medium	Ecosystem impacts of climate change are complex and somewhat unpredictable; tarantula populations would be favoured by climate effects which increased potential prey and which increased winter survival. Wetter climate in future might be unfavourable for this particular species.
3.2. What aspects of the risk assessment are most likely to change as a result of climate change? • Establishment • Spread • Impact on biodiversity • Impact on ecosystem functions	spread	low	Spread still very unlikely, though

RISK SUMMARIES			
	RESPONSE	**UNCERTAINTY**	**COMMENT**
Summarise Entry	unlikely	low	Species is popular among hobbyists. Escape or release very unlikely, entry into Norwegian nature in which they could survive is unlikely.
Summarise Establishment	very unlikely	low	If kept in captivity: very unlikely one or a few tarantulas would escape or be released at the same time in the same place, unlikely that a male would be one of the few escaping or being released, very unlikely that such escape/release would be in a time and place where they could survive.
Summarise Spread	very slowly	low	Probably no spread
Summarise Impact	minimal	low	None known
Conclusion of the risk assessment	low	low	

REFERENCES:

Hamilton, C. A., B. E. Hendrixson, and J. E. Bond. 2016. Taxonomic revision of the tarantula genus *Aphonopelma* Pocock, 1901 (Araneae, Mygalomorphae, Theraphosidae) within the United States. Zookeys:1-340.

EU NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME

Name of organism: *Aphonopelma iodius* (Chamberlin & Ivie, 1939)

(but note that this very common species cannot be separated morphologically from several others in its species group)

Author: Lawrence R. Kirkendall

Risk Assessment Area: Norway

Synonyms: Much taxonomic confusion, synonyms too numerous to list, see Hamilton et al. 2016

Common names: Fresno County Brown, Salt Lake Blonde, Washington Rust, and other local names

SECTION B – Detailed assessment

PROBABILITY OF ENTRY			
Important instructions: • Entry is the introduction of an organism into Norway. Not to be confused with spread, the movement of an organism within Norway. • For organisms which are already present in Norway, only complete the entry section for current active pathways of entry or if relevant potential future pathways. The entry section need not be completed for organisms which have entered in the past and have no current pathways of entry.			
QUESTION	**RESPONSE [chose one entry, delete all others]**	**UNCERTAINTY [chose one entry, delete all others]**	**COMMENT**
1.26. How many known pathways are relevant to the potential entry of this organism?	very few	low	sold (but this species cannot be separated from several others, by morphology alone), presumably traded privately
1.2. List relevant pathways through which the organism could enter. Where possible give detail about the specific origins and end points of the pathways.	Private or commercial trade		Can't know start or endpoints
Pathway name:	Trade (private or commercial)		
1.3. Is entry along this pathway intentional (e.g. the organism is imported for trade) or accidental (the organism is a contaminant of imported goods)?	intentional	low	Commercial and private trade

1.4. How likely is it that large numbers of the organism will travel along this pathway from the point(s) of origin over the course of one year? Subnote: In your comment discuss how likely the organism is to get onto the pathway in the first place.	unlikely	low	Commonly sold species, but unlikely that "large" numbers will enter Norway
1.5. How likely is the organism to be able to transfer from the pathway to a suitable habitat or host in Norwegian nature?	very unlikely	low	accidental or deliberate release of valuable adults is very unlikely; adults and subadults are too large to escape accidentally; spiderlings could escape but would have low survivorship
1.6. Estimate the overall likelihood of entry into Norwegian nature based on this pathway?	very unlikely	low	
End of pathway assessment, repeat as necessary.			
1.7. Estimate the overall likelihood of entry into Norwegian nature based on all pathways (comment on the key issues that lead to this conclusion).	very unlikely	low	

PROBABILITY OF ESTABLISHMENT			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
1.8. How likely is it that the organism will be able to establish in Norway based on the similarity between climatic conditions in Norway and the organism's current distribution?	Likely	medium	*Aphonopelma iodius* occurs widely in the southwestern US, up to at least 2000 m.a.s.l. Winters are cold in upper elevations, but relatively dry in many places.
1.9. How likely is it that the organism will be able to establish in Norway based on the similarity between other abiotic conditions in Norway and the organism's current distribution?	Unlikely	medium	little otherwise of their ecological requirements; few in captivity at present; low prey availability in Norway; quite different soils in southwest USA than Norway
1.10. How likely is it that the organism will become established in protected conditions (in which the environment is artificially maintained, such as wildlife parks, glasshouses, aquaculture facilities, terraria, zoological gardens) in Norway? Subnote: gardens are not considered protected conditions	Very unlikely	low	Might be better environmental conditions, but some might be too humid? Is hard to imagine how several individuals could get into such a situation and start a population; none or few currently in captivity; low prey availability in Norway
1.11. How widespread are habitats or species necessary for the survival, development and multiplication of the organism in Norway?	Isolated in southern Norway and western Norway?	very high	What habitats and climates might be suitable are unknown, really (needs to have right soil conditions for burrowing, enough prey, and survivable climate)
1.12. How likely is it that establishment will occur despite management practices (including eradication	very unlikely	low	For reasons restricting establishment, above

campaigns), competition from existing species or predators, parasites or pathogens in Norway?			
1.13. How likely are the biological characteristics (including adaptability and capacity of spread) of the organism to facilitate its establishment?	very unlikely	low	Slow dispersers, few males likely to be available (not parthenogenetic)
1.14. How likely is it that the organism could establish despite low genetic diversity in the founder population?	unlikely	medium	Low genetic diversity likely to create inbreeding depression, but nothing known about population genetics for this genus
1.15. Based on the history of invasion by this organism elsewhere in the world, how likely is to establish in Europe? (If possible, specify the instances in the comments box.)	very unlikely	low	No instances known of successful invasion anywhere in the world for this genus or similar genera
1.16. Estimate the overall likelihood of establishment in Norway (mention any key issues in the comment box).	very unlikely	low	

PROBABILITY OF SPREAD			
Important notes: • Spread is defined as the expansion of the geographical distribution of an alien species within an area.			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
2.1. How likely is it that this organism will spread widely in Norway by *natural means*? (Please list and comment on the mechanisms for natural spread.)	very unlikely	low	Slow dispersers, few males likely to be available if any (not parthenogenetic)
2.2. How likely is it that this organism will spread widely in Norway by *human assistance*? (Please list and comment on the mechanisms for human-assisted spread.)	likely	medium	IUncertain how many specimens are transported to- and within Norway, not likely it is many. Note that the species is hard to find and collect in nature, limiting the number of amateurs likely to have them.
2.3. How likely is it that spread of the organism within Norway can be completely contained?	very likely	low	
2.4. Based on the answers to questions on the potential for establishment and spread in Norway, define the area endangered by the organism.	none	low	
2.5. Estimate the overall potential for future spread for this organism in Norway (using the comment box to indicate any key issues).	very unlikely	low	Establishment unlikely, spread very unlikely

PROBABILITY OF ENVIRONMENTAL IMPACT			
Important instructions: • **When assessing potential future environmental impacts, climate change should not be taken into account. This is done in later questions at the end of the assessment.** • **Each set of questions starts with the impact elsewhere in the world, then considers impacts in Norway separating known impacts to date (i.e. past and current impacts) from potential future impacts. Key words are in bold for emphasis.**			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
2.6. How much environmental harm is caused by the organism within its existing geographic range, excluding Norway?	minimal	low	**None known**
2.7. How much impact would there be, if genetic traits of the organism were to be transmitted to other species, modifying their genetic makeup and making their environmental effects more serious?	minimal	low	Not possible in Norway (no related spiders)
2.8. How much impact does the organism have, as food, as a host, or as a symbiont or a vector for other damaging organisms (e.g. diseases)?	minimal	low	Tarantulas are not known to vector pathogens or pests to other organisms. (no related spiders in Norway)
2.9. How much impact do other factors have, factors which are not covered by previous questions (specify in the comment box)	NA	low	

2.10. How important are the expected impacts of the organism despite any natural control by other organisms, such as predators, parasites or pathogens that may already be present in Norway?	minimal	low	
2.11. Indicate any parts of Norway where environmental impacts are particularly likely to occur (provide as much detail as possible).	NA	low	

ADDITIONAL QUESTIONS - CLIMATE CHANGE			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
3.1. What aspects of climate change (in a 50 year perspective), if any, are most likely to affect the risk assessment for this organism?	Milder winters, longer growth seasons; more precipitation	medium	Ecosystem impacts of climate change are complex and somewhat unpredictable; tarantula populations would be favoured by climate effects which increased potential prey and which increased winter survival. Wetter climate in future might be unfavourable for this particular species.
3.2. What aspects of the risk assessment are most likely to change as a result of climate change? • Establishment • Spread • Impact on biodiversity • Impact on ecosystem functions	spread	low	Spread still very unlikely, though

RISK SUMMARIES			
	RESPONSE	**UNCERTAINTY**	**COMMENT**
Summarise Entry	unlikely	low	Species is popular among hobbyists. Escape or release very unlikely, entry into Norwegian nature in which they could survive is unlikely.
Summarise Establishment	very unlikely	low	If kept in captivity: very unlikely one or a few tarantulas would escape or be released at the same time in the same place, unlikely that a male would be one of the few escaping or being released, very unlikely that such escape/release would be in a time and place where they could survive.
Summarise Spread	very slowly	low	Probably no spread
Summarise Impact	minimal	low	None known
Conclusion of the risk assessment	low	low	

REFERENCES:

Hamilton, C. A., B. E. Hendrixson, and J. E. Bond. 2016. Taxonomic revision of the tarantula genus *Aphonopelma* Pocock, 1901 (Araneae, Mygalomorphae, Theraphosidae) within the United States. Zookeys:1-340.

EU NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME

Name of organism: *Aphonopelma mareki* Hamilton, Hendrixson & Bond, 2016

Author: Lawrence R. Kirkendall

Risk Assessment Area: Norway

Synonyms: (new species)

Common names: none given in article

SECTION B – Detailed assessment

PROBABILITY OF ENTRY

Important instructions:

- Entry is the introduction of an organism into Norway. Not to be confused with spread, the movement of an organism within Norway.
- For organisms which are already present in Norway, only complete the entry section for current active pathways of entry or if relevant potential future pathways. The entry section need not be completed for organisms which have entered in the past and have no current pathways of entry.

QUESTION	RESPONSE [chose one entry, delete all others]	UNCERTAINTY [chose one entry, delete all others]	COMMENT
1.27. How many known pathways are relevant to the potential entry of this organism?	very few	low	At least *A. marxi* is sold, under the name *A. behlei*
1.2. List relevant pathways through which the organism could enter. Where possible give detail about the specific origins and end points of the pathways.	Private or commercial trade in the future		Can't know start or endpoints
Pathway name:	Trade (private or commercial)		
1.3. Is entry along this pathway intentional (e.g. the organism is imported for trade) or accidental (the organism is a contaminant of imported goods)?	intentional	low	Commercial and presumably private trade

1.4. How likely is it that large numbers of the organism will travel along this pathway from the point(s) of origin over the course of one year? Subnote: In your comment discuss how likely the organism is to get onto the pathway in the first place.	unlikely	low	Unlikely, given the large number of tarantula species for sale (these are fairly plain and not especially popular); also, the species is hard to find and collect in nature, limiting the number of amateurs likely to have them.
1.5. How likely is the organism to be able to transfer from the pathway to a suitable habitat or host in Norwegian nature?	very unlikely	low	accidental or deliberate release of valuable adults is very unlikely; adults and subadults are too large to escape accidentally; spiderlings could escape but would have low survivorship
1.6. Estimate the overall likelihood of entry into Norwegian nature based on this pathway?	very unlikely	low	
End of pathway assessment, repeat as necessary.			
1.7. Estimate the overall likelihood of entry into Norwegian nature based on all pathways (comment on the key issues that lead to this conclusion).	very unlikely	low	

PROBABILITY OF ESTABLISHMENT			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
1.8. How likely is it that the organism will be able to establish in Norway based on the similarity between climatic conditions in Norway and the organism's current distribution?	Likely	medium	*Aphonopelma mareki* can be found inhabiting the Arizona/New Mexico Mountains and Sonoran Basin. Mountain populations experience quite cold temperatures but relatively little precipitation.
1.9. How likely is it that the organism will be able to establish in Norway based on the similarity between other abiotic conditions in Norway and the organism's current distribution?	Unlikely	medium	little otherwise of their ecological requirements; few in captivity at present; low prey availability in Norway; quite different soils in southwest USA than Norway
1.10. How likely is it that the organism will become established in protected conditions (in which the environment is artificially maintained, such as wildlife parks, glasshouses, aquaculture facilities, terraria, zoological gardens) in Norway? Subnote: gardens are not considered protected conditions	Very unlikely	low	Might be better environmental conditions, but some might be too humid? Is hard to imagine how several individuals could get into such a situation and start a population; none or few currently in captivity; low prey availability in Norway
1.11. How widespread are habitats or species necessary for the survival, development and multiplication of the organism in Norway?	Isolated in southern Norway and western Norway?	very high	What habitats and climates might be suitable are unknown, really (needs to have right soil conditions for burrowing, enough prey, and survivable climate)
1.12. How likely is it that establishment will occur despite management practices (including eradication	very unlikely	low	For reasons restricting establishment, above

campaigns), competition from existing species or predators, parasites or pathogens in Norway?			
1.13. How likely are the biological characteristics (including adaptability and capacity of spread) of the organism to facilitate its establishment?	very unlikely	low	Slow dispersers, few males likely to be available (not parthenogenetic)
1.14. How likely is it that the organism could establish despite low genetic diversity in the founder population?	unlikely	medium	Low genetic diversity likely to create inbreeding depression, but nothing known about population genetics for this genus
1.15. Based on the history of invasion by this organism elsewhere in the world, how likely is to establish in Europe? (If possible, specify the instances in the comments box.)	very unlikely	low	No instances known of successful invasion anywhere in the world for this genus or similar genera
1.16. Estimate the overall likelihood of establishment in Norway (mention any key issues in the comment box).	very unlikely	low	

PROBABILITY OF SPREAD			
Important notes: • Spread is defined as the expansion of the geographical distribution of an alien species within an area.			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
2.1. How likely is it that this organism will spread widely in Norway by *natural means*? (Please list and comment on the mechanisms for natural spread.)	very unlikely	low	Slow dispersers, few males likely to be available if any (not parthenogenetic)
2.2. How likely is it that this organism will spread widely in Norway by *human assistance*? (Please list and comment on the mechanisms for human-assisted spread.)	very unlikely	low	The species might someday be kept as pets in Norway. Uncertain how many specimens would then be transported to- and within Norway, not likely it is many.
2.3. How likely is it that spread of the organism within Norway can be completely contained?	very likely	low	
2.4. Based on the answers to questions on the potential for establishment and spread in Norway, define the area endangered by the organism.	none	low	
2.5. Estimate the overall potential for future spread for this organism in Norway (using the comment box to indicate any key issues).	very unlikely	low	Establishment unlikely, spread very unlikely

PROBABILITY OF ENVIRONMENTAL IMPACT			
Important instructions: • **When assessing potential future environmental impacts, climate change should not be taken into account. This is done in later questions at the end of the assessment.** • **Each set of questions starts with the impact elsewhere in the world, then considers impacts in Norway separating known impacts to date (i.e. past and current impacts) from potential future impacts. Key words are in bold for emphasis.**			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
2.6. How much environmental harm is caused by the organism within its existing geographic range, excluding Norway?	minimal	low	**None known**
2.7. How much impact would there be, if genetic traits of the organism were to be transmitted to other species, modifying their genetic makeup and making their environmental effects more serious?	minimal	low	Not possible in Norway (no related spiders)
2.8. How much impact does the organism have, as food, as a host, or as a symbiont or a vector for other damaging organisms (e.g. diseases)?	minimal	low	Tarantulas are not known to vector pathogens or pests to other organisms. (no related spiders in Norway)
2.9. How much impact do other factors have, factors which are not covered by previous questions (specify in the comment box)	NA	low	

2.10. How important are the expected impacts of the organism despite any natural control by other organisms, such as predators, parasites or pathogens that may already be present in Norway?	minimal	low	
2.11. Indicate any parts of Norway where environmental impacts are particularly likely to occur (provide as much detail as possible).	NA	low	

ADDITIONAL QUESTIONS - CLIMATE CHANGE			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
3.1. What aspects of climate change (in a 50 year perspective), if any, are most likely to affect the risk assessment for this organism?	Milder winters, longer growth seasons; more precipitation	medium	Ecosystem impacts of climate change are complex and somewhat unpredictable; tarantula populations would be favoured by climate effects which increased potential prey and which increased winter survival. Wetter climate in future might be unfavourable for this particular species.
3.2. What aspects of the risk assessment are most likely to change as a result of climate change? • Establishment • Spread • Impact on biodiversity • Impact on ecosystem functions	spread	low	Spread still very unlikely, though

RISK SUMMARIES			
	RESPONSE	**UNCERTAINTY**	**COMMENT**
Summarise Entry	very unlikely	low	If and when traded: escape or release very unlikely, entry into Norwegian nature in which they could survive very unlikely
Summarise Establishment	very unlikely	low	If kept in captivity: very unlikely one or a few tarantulas would escape or be released at the same time in the same place, unlikely that a male would be one of the few escaping or being released, very unlikely that such escape/release would be in a time and place where they could survive
Summarise Spread	very slowly	low	Probably no spread
Summarise Impact	minimal	low	None known
Conclusion of the risk assessment	low	low	

REFERENCES: Hamilton, C. A., B. E. Hendrixson, and J. E. Bond. 2016. Taxonomic revision of the tarantula genus *Aphonopelma* Pocock, 1901 (Araneae, Mygalomorphae, Theraphosidae) within the United States. Zookeys:1-340.

EU NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME

Name of organism: *Aphonopelma marxi* species group *sensu* Hamilton et al. 2016:

Aphonopelma marxi (Simon, 1891)

A. catalina Hamilton, Hendrixson & Bond, 2016

A. chiricahua Hamilton, Hendrixson & Bond, 2016

A. madera Hamilton, Hendrixson & Bond, 2016

A. peloncillo Hamilton, Hendrixson & Bond, 2016

A. vorhiesi Hamilton, Hendrixson & Bond, 2016

Author: Lawrence R. Kirkendall

Risk Assessment Area: Norway

Synonyms: has been considerable taxonomic confusion, too many synonyms of *A. marxi* to list: see Hamilton et al. 2016. A commonly used name in the commercial trade is *A. behlei*.

Common names: some local names, none widespread (e.g. Grand Canyon Black for *A. marxi*)

SECTION B – Detailed assessment			
PROBABILITY OF ENTRY			
Important instructions: • Entry is the introduction of an organism into Norway. Not to be confused with spread, the movement of an organism within Norway. • For organisms which are already present in Norway, only complete the entry section for current active pathways of entry or if relevant potential future pathways. The entry section need not be completed for organisms which have entered in the past and have no current pathways of entry.			
QUESTION	**RESPONSE [chose one entry, delete all others]**	**UNCERTAINTY [chose one entry, delete all others]**	**COMMENT**
1.28. How many known pathways are relevant to the potential entry of this organism?	very few	low	At least *A. marxi* is sold, under the name *A. behlei*
1.2. List relevant pathways through which the organism could enter. Where possible give detail about the specific origins and end points of the pathways.	Private or commercial trade in the future		Can't know start or endpoints
Pathway name:	Trade (private or commercial)		
1.3. Is entry along this pathway intentional (e.g. the organism is imported for trade) or accidental (the organism is a contaminant of imported goods)?	intentional	low	Commercial and presumably private trade

1.4. How likely is it that large numbers of the organism will travel along this pathway from the point(s) of origin over the course of one year? Subnote: In your comment discuss how likely the organism is to get onto the pathway in the first place.	unlikely	low	Unlikely, given the large number of tarantula species for sale (these are fairly plain, not especially popular); also, species in this group are hard to find and collect in nature, limiting the number of amateurs likely to have them.
1.5. How likely is the organism to be able to transfer from the pathway to a suitable habitat or host in Norwegian nature?	very unlikely	low	accidental or deliberate release of valuable adults is very unlikely; adults and subadults are too large to escape accidentally; spiderlings could escape but would have low survivorship
1.6. Estimate the overall likelihood of entry into Norwegian nature based on this pathway?	very unlikely	low	
End of pathway assessment, repeat as necessary.			
1.7. Estimate the overall likelihood of entry into Norwegian nature based on all pathways (comment on the key issues that lead to this conclusion).	very unlikely	low	

PROBABILITY OF ESTABLISHMENT			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
1.8. How likely is it that the organism will be able to establish in Norway based on the similarity between climatic conditions in Norway and the organism's current distribution?	Likely	medium	This group is primarily distributed in the high-elevation 'sky islands' areas of Arizona and New Mexico (occur up to 3000 m.a.s.l.). They experience quite cold temperatures but relatively little precipitation.
1.9. How likely is it that the organism will be able to establish in Norway based on the similarity between other abiotic conditions in Norway and the organism's current distribution?	Unlikely	medium	little otherwise of their ecological requirements; few in captivity at present; low prey availability in Norway; quite different soils in southwest USA than Norway
1.10. How likely is it that the organism will become established in protected conditions (in which the environment is artificially maintained, such as wildlife parks, glasshouses, aquaculture facilities, terraria, zoological gardens) in Norway? Subnote: gardens are not considered protected conditions	Very unlikely	low	Might be better environmental conditions, but some might be too humid? Is hard to imagine how several individuals could get into such a situation and start a population; none or few currently in captivity; low prey availability in Norway
1.11. How widespread are habitats or species necessary for the survival, development and multiplication of the organism in Norway?	Isolated in southern Norway and western Norway?	very high	What habitats and climates might be suitable are unknown, really (needs to have right soil conditions for burrowing, enough prey, and survivable climate)
1.12. How likely is it that establishment will occur despite management practices (including eradication	very unlikely	low	For reasons restricting establishment, above

campaigns), competition from existing species or predators, parasites or pathogens in Norway?			
1.13. How likely are the biological characteristics (including adaptability and capacity of spread) of the organism to facilitate its establishment?	very unlikely	low	Slow dispersers, few males likely to be available (not parthenogenetic)
1.14. How likely is it that the organism could establish despite low genetic diversity in the founder population?	unlikely	medium	Low genetic diversity likely to create inbreeding depression, but nothing known about population genetics for this genus
1.15. Based on the history of invasion by this organism elsewhere in the world, how likely is to establish in Europe? (If possible, specify the instances in the comments box.)	very unlikely	low	No instances known of successful invasion anywhere in the world for this genus or similar genera
1.16. Estimate the overall likelihood of establishment in Norway (mention any key issues in the comment box).	very unlikely	low	

PROBABILITY OF SPREAD			
Important notes: • Spread is defined as the expansion of the geographical distribution of an alien species within an area.			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
2.1. How likely is it that this organism will spread widely in Norway by *natural means*? (Please list and comment on the mechanisms for natural spread.)	very unlikely	low	Slow dispersers, few males likely to be available if any (not parthenogenetic)
2.2. How likely is it that this organism will spread widely in Norway by *human assistance*? (Please list and comment on the mechanisms for human-assisted spread.)	very unlikely	low	The species might someday be kept as pets in Norway. Uncertain how many specimens would then be transported to- and within Norway, not likely it is many.
2.3. How likely is it that spread of the organism within Norway can be completely contained?	very likely	low	
2.4. Based on the answers to questions on the potential for establishment and spread in Norway, define the area endangered by the organism.	none	low	
2.5. Estimate the overall potential for future spread for this organism in Norway (using the comment box to indicate any key issues).	very unlikely	low	Establishment unlikely, spread very unlikely

PROBABILITY OF ENVIRONMENTAL IMPACT			
Important instructions: • **When assessing potential future environmental impacts, climate change should not be taken into account. This is done in later questions at the end of the assessment.** • **Each set of questions starts with the impact elsewhere in the world, then considers impacts in Norway separating known impacts to date (i.e. past and current impacts) from potential future impacts. Key words are in bold for emphasis.**			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
2.6. How much environmental harm is caused by the organism within its existing geographic range, excluding Norway?	minimal	low	**None known**
2.7. How much impact would there be, if genetic traits of the organism were to be transmitted to other species, modifying their genetic makeup and making their environmental effects more serious?	minimal	low	Not possible in Norway (no related spiders)
2.8. How much impact does the organism have, as food, as a host, or as a symbiont or a vector for other damaging organisms (e.g. diseases)?	minimal	low	Tarantulas are not known to vector pathogens or pests to other organisms. (no related spiders in Norway)
2.9. How much impact do other factors have, factors which are not covered by previous questions (specify in the comment box)	NA	low	

2.10. How important are the expected impacts of the organism despite any natural control by other organisms, such as predators, parasites or pathogens that may already be present in Norway?	minimal	low	
2.11. Indicate any parts of Norway where environmental impacts are particularly likely to occur (provide as much detail as possible).	NA	low	

ADDITIONAL QUESTIONS - CLIMATE CHANGE			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
3.1. What aspects of climate change (in a 50 year perspective), if any, are most likely to affect the risk assessment for this organism?	Milder winters, longer growth seasons; more precipitation	medium	Ecosystem impacts of climate change are complex and somewhat unpredictable; tarantula populations would be favoured by climate effects which increased potential prey and which increased winter survival. Wetter climate in future might be unfavourable for this particular group of species.
3.2. What aspects of the risk assessment are most likely to change as a result of climate change? • Establishment • Spread • Impact on biodiversity • Impact on ecosystem functions	spread	low	Spread still very unlikely, though

RISK SUMMARIES			
	RESPONSE	**UNCERTAINTY**	**COMMENT**
Summarise Entry	very unlikely	low	If and when traded: escape or release very unlikely, entry into Norwegian nature in which they could survive very unlikely
Summarise Establishment	very unlikely	low	If kept in captivity: very unlikely one or a few tarantulas would escape or be released at the same time in the same place, unlikely that a male would be one of the few escaping or being released, very unlikely that such escape/release would be in a time and place where they could survive
Summarise Spread	very slowly	low	Probably no spread
Summarise Impact	minimal	low	None known
Conclusion of the risk assessment	low	low	

REFERENCES:

Hamilton, C. A., B. E. Hendrixson, and J. E. Bond. 2016. Taxonomic revision of the tarantula genus *Aphonopelma* Pocock, 1901 (Araneae, Mygalomorphae, Theraphosidae) within the United States. Zookeys:1-340.

EU NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME

Name of organism: *Bistriopelma lamasi* Kaderka, 2015 and *Bistriopelma matuskai* Kaderka, 2015

Author: Lawrence R. Kirkendall

Risk Assessment Area: Norway

Synonyms: none (recently described genus and species)

Common names: none (recently described genus and species)

SECTION B – Detailed assessment			
PROBABILITY OF ENTRY			
Important instructions: • Entry is the introduction of an organism into Norway. Not to be confused with spread, the movement of an organism within Norway. • For organisms which are already present in Norway, only complete the entry section for current active pathways of entry or if relevant potential future pathways. The entry section need not be completed for organisms which have entered in the past and have no current pathways of entry.			
QUESTION	**RESPONSE [chose one entry, delete all others]**	**UNCERTAINTY [chose one entry, delete all others]**	**COMMENT**
1.29. How many known pathways are relevant to the potential entry of this organism?	very few	low	None currently: known only from a few collections high up in the Andes
1.2. List relevant pathways through which the organism could enter. Where possible give detail about the specific origins and end points of the pathways.	Private or commercial trade in the future		Can't know start or endpoints
Pathway name:	Trade (private or commercial)		
1.3. Is entry along this pathway intentional (e.g. the organism is imported for trade) or accidental (the organism is a contaminant of imported goods)?	intentional	low	

1.4. How likely is it that large numbers of the organism will travel along this pathway from the point(s) of origin over the course of one year? Subnote: In your comment discuss how likely the organism is to get onto the pathway in the first place.	Very unlikely	low	Not at all available currently, difficult to find in native habitat, remote
1.5. How likely is the organism to be able to transfer from the pathway to a suitable habitat or host in Norwegian nature?	very unlikely	low	Pets such as these are not common and are expensive so accidental or deliberate release of adults is very unlikely; adults and subadults are too large to escape accidentally; spiderlings could escape but would have low survivorship
1.6. Estimate the overall likelihood of entry into Norwegian nature based on this pathway?	very unlikely	low	
End of pathway assessment, repeat as necessary.			
1.7. Estimate the overall likelihood of entry into Norwegian nature based on all pathways (comment on the key issues that lead to this conclusion).	very unlikely	low	

PROBABILITY OF ESTABLISHMENT			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
1.8. How likely is it that the organism will be able to establish in Norway based on the similarity between climatic conditions in Norway and the organism's current distribution?	Likely	low	Distribution Peruvian Andes, 4000 – 4300 m.a.s.l. Tropical latitude but high enough to get subzero temperatures in the winter.
1.9. How likely is it that the organism will be able to establish in Norway based on the similarity between other abiotic conditions in Norway and the organism's current distribution?	Very unlikely	low	but nothing otherwise of their ecological requirements; none in captivity at present; low prey availability in Norway
1.10. How likely is it that the organism will become established in protected conditions (in which the environment is artificially maintained, such as wildlife parks, glasshouses, aquaculture facilities, terraria, zoological gardens) in Norway? Subnote: gardens are not considered protected conditions	Very unlikely	low	Might be better environmental conditions, but some might be too warm? Is hard to imagine how several individuals could get into such a situation and start a population; none currently in captivity at all; low prey availability in Norway
1.11. How widespread are habitats or species necessary for the survival, development and multiplication of the organism in Norway?	Isolated in southern Norway or western Norway?	very high	What habitats might be suitable are unknown, really (needs to have right soil conditions for burrowing, enough prey, and survivable climate)
1.12. How likely is it that establishment will occur despite management practices (including eradication	very unlikely	low	For reasons restricting establishment, above

campaigns), competition from existing species or predators, parasites or pathogens in Norway?			
1.13. How likely are the biological characteristics (including adaptability and capacity of spread) of the organism to facilitate its establishment?	very unlikely	low	Slow dispersers, few males likely to be available (not parthenogenetic)
1.14. How likely is it that the organism could establish despite low genetic diversity in the founder population?	unlikely	medium	Low genetic diversity likely to create inbreeding depression, but nothing known about population genetics for this genus
1.15. Based on the history of invasion by this organism elsewhere in the world, how likely is to establish in Europe? (If possible, specify the instances in the comments box.)	very unlikely	low	No instances known of successful invasion anywhere in the world for this genus or similar genera
1.16. Estimate the overall likelihood of establishment in Norway (mention any key issues in the comment box).	very unlikely	low	

PROBABILITY OF SPREAD			
Important notes: • Spread is defined as the expansion of the geographical distribution of an alien species within an area.			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
2.1. How likely is it that this organism will spread widely in Norway by *natural means*? (Please list and comment on the mechanisms for natural spread.)	very unlikely	low	Slow dispersers, few males likely to be available if any (not parthenogenetic)
2.2. How likely is it that this organism will spread widely in Norway by *human assistance*? (Please list and comment on the mechanisms for human-assisted spread.)	very unlikely	low	The species might someday be kept as pet. Uncertain how many specimens would then be transported to- and within Norway, not likely it is many.
2.3. How likely is it that spread of the organism within Norway can be completely contained?	very likely	low	
2.4. Based on the answers to questions on the potential for establishment and spread in Norway, define the area endangered by the organism.	none	low	
2.5. Estimate the overall potential for future spread for this organism in Norway (using the comment box to indicate any key issues).	very unlikely	low	Establishment very unlikely, spread very unlikely

PROBABILITY OF ENVIRONMENTAL IMPACT			
Important instructions: • **When assessing potential future environmental impacts, climate change should not be taken into account. This is done in later questions at the end of the assessment.** • **Each set of questions starts with the impact elsewhere in the world, then considers impacts in Norway separating known impacts to date (i.e. past and current impacts) from potential future impacts. Key words are in bold for emphasis.**			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
2.6. How much environmental harm is caused by the organism within its existing geographic range, excluding Norway?	minimal	low	**None known**
2.7. How much impact would there be, if genetic traits of the organism were to be transmitted to other species, modifying their genetic makeup and making their environmental effects more serious?	minimal	low	Not possible in Norway (no related spiders)
2.8. How much impact does the organism have, as food, as a host, or as a symbiont or a vector for other damaging organisms (e.g. diseases)?	minimal	low	Tarantulas are not known to vector pathogens or pests to other organisms. (no related spiders in Norway)
2.9. How much impact do other factors have, factors which are not covered by previous questions (specify in the comment box)	NA	low	

2.10. How important are the expected impacts of the organism despite any natural control by other organisms, such as predators, parasites or pathogens that may already be present in Norway?	minimal	low	
2.11. Indicate any parts of Norway where environmental impacts are particularly likely to occur (provide as much detail as possible).	NA	low	

ADDITIONAL QUESTIONS - CLIMATE CHANGE			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
3.1. What aspects of climate change (in a 50 year perspective), if any, are most likely to affect the risk assessment for this organism?	Milder winters, longer growth seasons	medium	Ecosystem impacts of climate change are complex and somewhat unpredictable; tarantula populations would be favoured by climate effects which increased potential prey and which increased winter survival
3.2. What aspects of the risk assessment are most likely to change as a result of climate change? • Establishment • Spread • Impact on biodiversity • Impact on ecosystem functions	spread	low	Spread still very unlikely, though

RISK SUMMARIES			
	RESPONSE	**UNCERTAINTY**	**COMMENT**
Summarise Entry	very unlikely	low	If someday traded: escape or release very unlikely, entry into Norwegian nature in which they could survive very unlikely
Summarise Establishment	very unlikely	low	If someday kept in captivity: very unlikely one or a few tarantulas would escape or be released at the same time in the same place, unlikely that a male would be one of the few escaping or being released, very unlikely that such escape/release would be in a time and place where they could survive
Summarise Spread	very slowly	low	Probably no spread
Summarise Impact	minimal	low	None known
Conclusion of the risk assessment	low	low	

REFERENCES:

Kaderka R. 2015. *Bistriopelma*, a new genus with two new species from Peru (Araneae: Theraphosidae: Theraphosinae). Revista peruana de biología 22(3): 275 - 288 (December 2015). doi: http://dx.doi.org/10.15381/ rpb.v22i2.11432

EU NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME
Name of organism: *Euathlus* Ausserer, 1875: 6 described species, but undescribed species also occur in Chile **Author:** Lawrence R. Kirkendall **Risk Assessment Area:** Norway **Synonyms:** *Paraphysa* Simon, 1892 (in part, see Perefan and Perez-Miles 2014) **Common names:** Chilean flame, Chilean dwarf flame, or *Euathlus* species red (unclear which species); Chilean gold burst (*E. parvulus*); Chilean beautiful (*E. truculentus*)

SECTION B – Detailed assessment

PROBABILITY OF ENTRY

Important instructions:

- Entry is the introduction of an organism into Norway. Not to be confused with spread, the movement of an organism within Norway.
- For organisms which are already present in Norway, only complete the entry section for current active pathways of entry or if relevant potential future pathways. The entry section need not be completed for organisms which have entered in the past and have no current pathways of entry.

QUESTION	RESPONSE [chose one entry, delete all others]	UNCERTAINTY [chose one entry, delete all others]	COMMENT
1.30. How many known pathways are relevant to the potential entry of this organism?	very few	low	At least three species are commercially available and traded
1.2. List relevant pathways through which the organism could enter. Where possible give detail about the specific origins and end points of the pathways.	Private or commercial trade		Can't know start or endpoints
Pathway name:	Trade (private or commercial)		
1.3. Is entry along this pathway intentional (e.g. the organism is imported for trade) or accidental (the organism is a contaminant of imported goods)?	intentional	low	

1.4. How likely is it that large numbers of the organism will travel along this pathway from the point(s) of origin over the course of one year? Subnote: In your comment discuss how likely the organism is to get onto the pathway in the first place.	very unlikely	low	Consumers can choose among dozens of tarantula species, many which are more striking in size or color
1.5. How likely is the organism to be able to transfer from the pathway to a suitable habitat or host in Norwegian nature?	very unlikely	low	Pets such as these are not common and are expensive so accidental or deliberate release of adults is very unlikely; adults and subadults are too large to escape accidentally; spiderlings could escape but would have low survivorship
1.6. Estimate the overall likelihood of entry into Norwegian nature based on this pathway?	very unlikely	low	
End of pathway assessment, repeat as necessary.			
1.7. Estimate the overall likelihood of entry into Norwegian nature based on all pathways (comment on the key issues that lead to this conclusion).	very unlikely	low	

PROBABILITY OF ESTABLISHMENT			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
1.8. How likely is it that the organism will be able to establish in Norway based on the similarity between climatic conditions in Norway and the organism's current distribution?	likely	medium	Genus is distributed up to 3000 m.a.s.l. in the Andes, but not much known otherwise of their ecological requirements; most individuals in captivity are females
1.9. How likely is it that the organism will be able to establish in Norway based on the similarity between other abiotic conditions in Norway and the organism's current distribution?	unlikely	medium	Genus is distributed up to 3000 m.a.s.l. in the Andes, but not much known otherwise of their ecological requirements; most individuals in captivity are females; low prey availability in Norway
1.10. How likely is it that the organism will become established in protected conditions (in which the environment is artificially maintained, such as wildlife parks, glasshouses, aquaculture facilities, terraria, zoological gardens) in Norway? Subnote: gardens are not considered protected conditions	Very unlikely	low	Would be better environmental conditions, but hard to imagine how several individuals could get into such a situation and start a population; most individuals in captivity are females; low prey availability in Norway
1.11. How widespread are habitats or species necessary for the survival, development and multiplication of the organism in Norway?	?	very high	What habitats might be suitable are unknown, really (needs to have right soil conditions, enough prey, and survivable climate)
1.12. How likely is it that establishment will occur despite management practices (including eradication	very unlikely	low	For reasons above

campaigns), competition from existing species or predators, parasites or pathogens in Norway?			
1.13. How likely are the biological characteristics (including adaptability and capacity of spread) of the organism to facilitate its establishment?	very unlikely	low	Slow dispersers, few males likely to be available if any (not parthenogenetic)
1.14. How likely is it that the organism could establish despite low genetic diversity in the founder population?	unlikely	medium	Low genetic diversity likely to create inbreeding depression, but nothing known about population genetics for this genus
1.15. Based on the history of invasion by this organism elsewhere in the world, how likely is to establish in Europe? (If possible, specify the instances in the comments box.)	very unlikely	low	No instances known of successful invasion anywhere in the world for this genus
1.16. Estimate the overall likelihood of establishment in Norway (mention any key issues in the comment box).	very unlikely	low	

PROBABILITY OF SPREAD			
Important notes: • Spread is defined as the expansion of the geographical distribution of an alien species within an area.			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
2.1. How likely is it that this organism will spread widely in Norway by *natural means*? (Please list and comment on the mechanisms for natural spread.)	very unlikely	low	Slow dispersers, few males likely to be available if any (not parthenogenetic)
2.2. How likely is it that this organism will spread widely in Norway by *human assistance*? (Please list and comment on the mechanisms for human-assisted spread.)	very unlikely	low	The species is kept as pet. Uncertain how many specimens are transported to- and within Norway, not likely it is many.
2.3. How likely is it that spread of the organism within Norway can be completely contained?	very likely	low	
2.4. Based on the answers to questions on the potential for establishment and spread in Norway, define the area endangered by the organism.	none	low	
2.5. Estimate the overall potential for future spread for this organism in Norway (using the comment box to indicate any key issues).	very unlikely	low	Establishment very unlikely, spread very unlikely

PROBABILITY OF ENVIRONMENTAL IMPACT			
Important instructions: • **When assessing potential future environmental impacts, climate change should not be taken into account. This is done in later questions at the end of the assessment.** • **Each set of questions starts with the impact elsewhere in the world, then considers impacts in Norway separating known impacts to date (i.e. past and current impacts) from potential future impacts. Key words are in bold for emphasis.**			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
2.6. How much environmental harm is caused by the organism within its existing geographic range, excluding Norway?	minimal	low	**None known**
2.7. How much impact would there be, if genetic traits of the organism were to be transmitted to other species, modifying their genetic makeup and making their environmental effects more serious?	minimal	low	Not possible in Norway (no related spiders)
2.8. How much impact does the organism have, as food, as a host, or as a symbiont or a vector for other damaging organisms (e.g. diseases)?	minimal	low	Tarantulas are not known to vector pathogens or pests to other organisms. (no related spiders in Norway)
2.9. How much impact do other factors have, factors which are not covered by previous questions (specify in the comment box)	NA	low	

2.10. How important are the expected impacts of the organism despite any natural control by other organisms, such as predators, parasites or pathogens that may already be present in Norway?	minimal	low	
2.11. Indicate any parts of Norway where environmental impacts are particularly likely to occur (provide as much detail as possible).	NA	low	

ADDITIONAL QUESTIONS - CLIMATE CHANGE			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
3.1. What aspects of climate change (in a 50 year perspective), if any, are most likely to affect the risk assessment for this organism?	Milder winters, longer growth seasons	medium	Ecosystem impacts of climate change are complex and somewhat unpredictable; tarantula populations would be favoured by climate effects which increased potential prey and which increased winter survival
3.2. What aspects of the risk assessment are most likely to change as a result of climate change? • Establishment • Spread • Impact on biodiversity • Impact on ecosystem functions	spread	low	Spread still very unlikely, though

RISK SUMMARIES			
	RESPONSE	**UNCERTAINTY**	**COMMENT**
Summarise Entry	very unlikely	low	Escape or release very unlikely, entry into Norwegian nature in which they could survive very unlikely
Summarise Establishment	very unlikely	low	Very unlikely one or a few tarantulas would escape or be released at the same time in the same place, unlikely that a male would be one of the few escaping or being released, very unlikely that such escape/release would be in a time and place where they could survive
Summarise Spread	very slowly	low	Probably no spread
Summarise Impact	minimal	low	None known
Conclusion of the risk assessment	low	low	

REFERENCES:

Perafán, C. & Pérez-Miles, F. (2014). The Andean tarantulas *Euathlus* Ausserer, 1875, *Paraphysa* Simon, 1892 and *Phrixotrichus* Simon, 1889 (Araneae: Theraphosidae): phylogenetic analysis, genera redefinition and new species descriptions. *Journal of Natural History* **48**(39-40): 2389-2418. doi:10.1080/00222933.2014.902142

https://sites.google.com/site/chiletarantulas/mygalomorphas

EU NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME
Name of organism: *Hapalotremus albipes* Simon, 1903 **Author:** Lawrence R. Kirkendall **Risk Assessment Area:** Norway **Synonyms:** none **Common names:** none found

SECTION B – Detailed assessment			
PROBABILITY OF ENTRY			
Important instructions: • Entry is the introduction of an organism into Norway. Not to be confused with spread, the movement of an organism within Norway. • For organisms which are already present in Norway, only complete the entry section for current active pathways of entry or if relevant potential future pathways. The entry section need not be completed for organisms which have entered in the past and have no current pathways of entry.			
QUESTION	**RESPONSE [chose one entry, delete all others]**	**UNCERTAINTY [chose one entry, delete all others]**	**COMMENT**
1.31. How many known pathways are relevant to the potential entry of this organism?	very few	low	Apparently, not available commercially, but may be traded and reared privately (at least a few people have this species as pet)
1.2. List relevant pathways through which the organism could enter. Where possible give detail about the specific origins and end points of the pathways.	Private or commercial trade in the future		Can't know start or endpoints
Pathway name:	Trade (private or commercial)		
1.3. Is entry along this pathway intentional (e.g. the organism is imported for trade) or accidental (the organism is a contaminant of imported goods)?	intentional	low	

1.4. How likely is it that large numbers of the organism will travel along this pathway from the point(s) of origin over the course of one year? Subnote: In your comment discuss how likely the organism is to get onto the pathway in the first place.	Very unlikely	low	Not available currently so not likely to be widely available for some time
1.5. How likely is the organism to be able to transfer from the pathway to a suitable habitat or host in Norwegian nature?	very unlikely	low	Currently rare and will be uncommon for some time; accidental or deliberate release of valuable adults is very unlikely; adults and subadults are too large to escape accidentally; spiderlings could escape but would have low survivorship
1.6. Estimate the overall likelihood of entry into Norwegian nature based on this pathway?	very unlikely	low	
End of pathway assessment, repeat as necessary.			
1.7. Estimate the overall likelihood of entry into Norwegian nature based on all pathways (comment on the key issues that lead to this conclusion).	very unlikely	low	

PROBABILITY OF ESTABLISHMENT			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
1.8. How likely is it that the organism will be able to establish in Norway based on the similarity between climatic conditions in Norway and the organism's current distribution?	Likely	medium	Distribution Bolivian and Peruvian Andes, up to at least 4000 m.a.s.l.
1.9. How likely is it that the organism will be able to establish in Norway based on the similarity between other abiotic conditions in Norway and the organism's current distribution?	unlikely	medium	but nothing otherwise of their ecological requirements; few or none in captivity at present; low prey availability in Norway
1.10. How likely is it that the organism will become established in protected conditions (in which the environment is artificially maintained, such as wildlife parks, glasshouses, aquaculture facilities, terraria, zoological gardens) in Norway? Subnote: gardens are not considered protected conditions	Very unlikely	low	Might be better environmental conditions, but some might be too warm? Is hard to imagine how several individuals could get into such a situation and start a population; none or few currently in captivity; low prey availability in Norway
1.11. How widespread are habitats or species necessary for the survival, development and multiplication of the organism in Norway?	Isolated in southern Norway or western Norway?	very high	What habitats might be suitable are unknown, really (needs to have right soil conditions for burrowing, enough prey, and survivable climate)
1.12. How likely is it that establishment will occur despite management practices (including eradication	very unlikely	low	For reasons restricting establishment, above

campaigns), competition from existing species or predators, parasites or pathogens in Norway?			
1.13. How likely are the biological characteristics (including adaptability and capacity of spread) of the organism to facilitate its establishment?	very unlikely	low	Slow dispersers, few males likely to be available (not parthenogenetic)
1.14. How likely is it that the organism could establish despite low genetic diversity in the founder population?	unlikely	medium	Low genetic diversity likely to create inbreeding depression, but nothing known about population genetics for this genus
1.15. Based on the history of invasion by this organism elsewhere in the world, how likely is to establish in Europe? (If possible, specify the instances in the comments box.)	very unlikely	low	No instances known of successful invasion anywhere in the world for this genus or similar genera
1.16. Estimate the overall likelihood of establishment in Norway (mention any key issues in the comment box).	very unlikely	low	

PROBABILITY OF SPREAD			
Important notes: • Spread is defined as the expansion of the geographical distribution of an alien species within an area.			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
2.1. How likely is it that this organism will spread widely in Norway by *natural means*? (Please list and comment on the mechanisms for natural spread.)	very unlikely	low	Slow dispersers, few males likely to be available if any (not parthenogenetic)
2.2. How likely is it that this organism will spread widely in Norway by *human assistance*? (Please list and comment on the mechanisms for human-assisted spread.)	very unlikely	low	The species might someday be kept as pet in Norway. Uncertain how many specimens would then be transported to- and within Norway, not likely it is many.
2.3. How likely is it that spread of the organism within Norway can be completely contained?	very likely	low	
2.4. Based on the answers to questions on the potential for establishment and spread in Norway, define the area endangered by the organism.	none	low	
2.5. Estimate the overall potential for future spread for this organism in Norway (using the comment box to indicate any key issues).	very unlikely	low	Establishment very unlikely, spread very unlikely

PROBABILITY OF ENVIRONMENTAL IMPACT			
Important instructions: • **When assessing potential future environmental impacts, climate change should not be taken into account. This is done in later questions at the end of the assessment.** • **Each set of questions starts with the impact elsewhere in the world, then considers impacts in Norway separating known impacts to date (i.e. past and current impacts) from potential future impacts. Key words are in bold for emphasis.**			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
2.6. How much environmental harm is caused by the organism within its existing geographic range, excluding Norway?	minimal	low	**None known**
2.7. How much impact would there be, if genetic traits of the organism were to be transmitted to other species, modifying their genetic makeup and making their environmental effects more serious?	minimal	low	Not possible in Norway (no related spiders)
2.8. How much impact does the organism have, as food, as a host, or as a symbiont or a vector for other damaging organisms (e.g. diseases)?	minimal	low	Tarantulas are not known to vector pathogens or pests to other organisms. (no related spiders in Norway)
2.9. How much impact do other factors have, factors which are not covered by previous questions (specify in the comment box)	NA	low	

2.10. How important are the expected impacts of the organism despite any natural control by other organisms, such as predators, parasites or pathogens that may already be present in Norway?	minimal	low	
2.11. Indicate any parts of Norway where environmental impacts are particularly likely to occur (provide as much detail as possible).	NA	low	

ADDITIONAL QUESTIONS - CLIMATE CHANGE			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
3.1. What aspects of climate change (in a 50 year perspective), if any, are most likely to affect the risk assessment for this organism?	Milder winters, longer growth seasons	medium	Ecosystem impacts of climate change are complex and somewhat unpredictable; tarantula populations would be favoured by climate effects which increased potential prey and which increased winter survival
3.2. What aspects of the risk assessment are most likely to change as a result of climate change? • Establishment • Spread • Impact on biodiversity • Impact on ecosystem functions	spread	low	Spread still very unlikely, though

RISK SUMMARIES			
	RESPONSE	**UNCERTAINTY**	**COMMENT**
Summarise Entry	very unlikely	low	If and when traded: escape or release very unlikely, entry into Norwegian nature in which they could survive very unlikely
Summarise Establishment	very unlikely	low	If someday kept in captivity: very unlikely one or a few tarantulas would escape or be released at the same time in the same place, unlikely that a male would be one of the few escaping or being released, very unlikely that such escape/release would be in a time and place where they could survive
Summarise Spread	very slowly	low	Probably no spread
Summarise Impact	minimal	low	None known
Conclusion of the risk assessment	low	low	

REFERENCES:

Cavallo, P. E. & Ferretti, N. E. (2015). The first *Hapalotremus* Simon, 1903 (Araneae: Theraphosidae) from Argentina: description and natural history of *Hapalotremus martinorum* sp. nov.. *Journal of Natural History* **49**(15-16): 873-887. doi:10.1080/00222933.2014.953226

Krajick K. 2006. Living the high life: the mountaintop environment of the Andes harbors a Noah's ark of previously undocumented species. Nat Hist. 115:44–50.

EU NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME

Name of organism: *Phrixotrichus scrofa* (Molina, 1788)

Author: Lawrence R. Kirkendall

Risk Assessment Area: Norway

Synonyms: *Aranea scrofa* Molina 1788, *Mygale chilensis* Molina 1810, *Mygale rosea* C.L. Koch 1842, *Mygale chilensis* Nicolet 1849, *Phrixotrichus roseus* Simon 1889 (misidentified), *Phrixotrichus chilensis* Simon 1896, *Phrixotrichus auratus* Pocock 1903, *Paraphysa scrofa* Pérez-Miles et al. 1996

Common names: Chilean copper, Chile pink burst

SECTION B – Detailed assessment

PROBABILITY OF ENTRY

Important instructions:

- Entry is the introduction of an organism into Norway. Not to be confused with spread, the movement of an organism within Norway.
- For organisms which are already present in Norway, only complete the entry section for current active pathways of entry or if relevant potential future pathways. The entry section need not be completed for organisms which have entered in the past and have no current pathways of entry.

QUESTION	**RESPONSE [chose one entry, delete all others]**	**UNCERTAINTY [chose one entry, delete all others]**	**COMMENT**
1.32. How many known pathways are relevant to the potential entry of this organism?	very few	low	Available commercially (inexpensive), presumably traded and reared privately
1.2. List relevant pathways through which the organism could enter. Where possible give detail about the specific origins and end points of the pathways.	Private or commercial trade		Can't know start or endpoints
Pathway name:	Trade (private or commercial)		
1.3. Is entry along this pathway intentional (e.g. the organism is imported for trade) or accidental (the organism is a contaminant of imported goods)?	intentional	low	

1.4. How likely is it that large numbers of the organism will travel along this pathway from the point(s) of origin over the course of one year? Subnote: In your comment discuss how likely the organism is to get onto the pathway in the first place.	unlikely	low	Consumers can choose among dozens of tarantula species, unlikely many of this one species will enter Norway, but is commonly available commercially and not expensive
1.5. How likely is the organism to be able to transfer from the pathway to a suitable habitat or host in Norwegian nature?	very unlikely	low	Pets such as these are not common and are expensive so accidental or deliberate release of adults is very unlikely; adults and subadults are too large to escape accidentally; spiderlings could escape but would have low survivorship
1.6. Estimate the overall likelihood of entry into Norwegian nature based on this pathway?	very unlikely	low	
End of pathway assessment, repeat as necessary.			
1.7. Estimate the overall likelihood of entry into Norwegian nature based on all pathways (comment on the key issues that lead to this conclusion).	very unlikely	low	

PROBABILITY OF ESTABLISHMENT			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
1.8. How likely is it that the organism will be able to establish in Norway based on the similarity between climatic conditions in Norway and the organism's current distribution?	Likely	Medium	Distribution central Chile, coast to Andean foothills; temperate Argentina. Occurs in cold, wet climates which do have occasional winter snow, the upper elevation like Bergen climate today.
1.9. How likely is it that the organism will be able to establish in Norway based on the similarity between other abiotic conditions in Norway and the organism's current distribution?	Unlikely	Medium	but not much known otherwise of their ecological requirements; most individuals in captivity are females (making establishment difficult); low prey availability in Norway
1.10. How likely is it that the organism will become established in protected conditions (in which the environment is artificially maintained, such as wildlife parks, glasshouses, aquaculture facilities, terraria, zoological gardens) in Norway? Subnote: gardens are not considered protected conditions	Very unlikely	low	Would be better environmental conditions, but hard to imagine how several individuals could get into such a situation and start a population; most individuals in captivity are females; low prey availability in Norway
1.11. How widespread are habitats or species necessary for the survival, development and multiplication of the organism in Norway?	?	very high	What habitats might be suitable are unknown, really (needs to have right soil conditions for burrowing, enough prey, and survivable climate)
1.12. How likely is it that establishment will occur despite management practices (including eradication	very unlikely	low	For reasons above

campaigns), competition from existing species or predators, parasites or pathogens in Norway?			
1.13. How likely are the biological characteristics (including adaptability and capacity of spread) of the organism to facilitate its establishment?	very unlikely	low	Slow dispersers, few males likely to be available if any (not parthenogenetic)
1.14. How likely is it that the organism could establish despite low genetic diversity in the founder population?	unlikely	medium	Low genetic diversity likely to create inbreeding depression, but nothing known about population genetics for this genus
1.15. Based on the history of invasion by this organism elsewhere in the world, how likely is to establish in Europe? (If possible, specify the instances in the comments box.)	very unlikely	low	No instances known of successful invasion anywhere in the world for this genus or similar genera
1.16. Estimate the overall likelihood of establishment in Norway (mention any key issues in the comment box).	very unlikely	low	

PROBABILITY OF SPREAD			
Important notes: • Spread is defined as the expansion of the geographical distribution of an alien species within an area.			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
2.1. How likely is it that this organism will spread widely in Norway by *natural means*? (Please list and comment on the mechanisms for natural spread.)	very unlikely	low	Slow dispersers, few males likely to be available if any (not parthenogenetic)
2.2. How likely is it that this organism will spread widely in Norway by *human assistance*? (Please list and comment on the mechanisms for human-assisted spread.)	very unlikely	low	The species is kept as pet. Uncertain how many specimens are transported to- and within Norway, not likely it is many.
2.3. How likely is it that spread of the organism within Norway can be completely contained?	very likely	low	
2.4. Based on the answers to questions on the potential for establishment and spread in Norway, define the area endangered by the organism.	none	low	
2.5. Estimate the overall potential for future spread for this organism in Norway (using the comment box to indicate any key issues).	very unlikely	low	Establishment very unlikely, spread very unlikely

PROBABILITY OF ENVIRONMENTAL IMPACT			
Important instructions: • **When assessing potential future environmental impacts, climate change should not be taken into account. This is done in later questions at the end of the assessment.** • **Each set of questions starts with the impact elsewhere in the world, then considers impacts in Norway separating known impacts to date (i.e. past and current impacts) from potential future impacts. Key words are in bold for emphasis.**			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
2.6. How much environmental harm is caused by the organism within its existing geographic range, excluding Norway?	minimal	low	**None known**
2.7. How much impact would there be, if genetic traits of the organism were to be transmitted to other species, modifying their genetic makeup and making their environmental effects more serious?	minimal	low	Not possible in Norway (no related spiders)
2.8. How much impact does the organism have, as food, as a host, or as a symbiont or a vector for other damaging organisms (e.g. diseases)?	minimal	low	Tarantulas are not known to vector pathogens or pests to other organisms. (no related spiders in Norway)
2.9. How much impact do other factors have, factors which are not covered by previous questions (specify in the comment box)	NA	low	

2.10. How important are the expected impacts of the organism despite any natural control by other organisms, such as predators, parasites or pathogens that may already be present in Norway?	minimal	low	
2.11. Indicate any parts of Norway where environmental impacts are particularly likely to occur (provide as much detail as possible).	NA	low	

ADDITIONAL QUESTIONS - CLIMATE CHANGE			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
3.1. What aspects of climate change (in a 50 year perspective), if any, are most likely to affect the risk assessment for this organism?	Milder winters, longer growth seasons	medium	Ecosystem impacts of climate change are complex and somewhat unpredictable; tarantula populations would be favoured by climate effects which increased potential prey and which increased winter survival
3.2. What aspects of the risk assessment are most likely to change as a result of climate change? • Establishment • Spread • Impact on biodiversity • Impact on ecosystem functions	spread	low	Spread still very unlikely, though

RISK SUMMARIES			
	RESPONSE	**UNCERTAINTY**	**COMMENT**
Summarise Entry	very unlikely	low	Escape or release very unlikely, entry into Norwegian nature in which they could survive very unlikely
Summarise Establishment	very unlikely	low	Very unlikely one or a few tarantulas would escape or be released at the same time in the same place, unlikely that a male would be one of the few escaping or being released, very unlikely that such escape/release would be in a time and place where they could survive
Summarise Spread	very slowly	low	Probably no spread
Summarise Impact	minimal	low	None known
Conclusion of the risk assessment	low	low	

REFERENCES:

Perafán, C. & Pérez-Miles, F. (2014). The Andean tarantulas *Euathlus* Ausserer, 1875, *Paraphysa* Simon, 1892 and *Phrixotrichus* Simon, 1889 (Araneae: Theraphosidae): phylogenetic analysis, genera redefinition and new species descriptions. *Journal of Natural History* **48**(39-40): 2389-2418. doi:10.1080/00222933.2014.902142

https://sites.google.com/site/chiletarantulas/mygalomorphas

EU NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME
Name of organism: *Phrixotrichus vulpinus* (Karsch, 1880) **Author:** Lawrence R. Kirkendall **Risk Assessment Area:** Norway **Synonyms:** *Orthothrichus vulpinus* Karsch, 1880, *Ashantia latithorax* Strand, 1908, *Euathlus vulpinus* Schmidt, 1996, *Euathlus latithorax* Gallon, 2005, *Euathlus vulpinus* Perafán & Pérez-Miles, 2010 **Common names:** none in English? “Arana pollito” in Spanish (a name applied to several species)

SECTION B – Detailed assessment

PROBABILITY OF ENTRY			
Important instructions: • Entry is the introduction of an organism into Norway. Not to be confused with spread, the movement of an organism within Norway. • For organisms which are already present in Norway, only complete the entry section for current active pathways of entry or if relevant potential future pathways. The entry section need not be completed for organisms which have entered in the past and have no current pathways of entry.			
QUESTION	**RESPONSE [chose one entry, delete all others]**	**UNCERTAINTY [chose one entry, delete all others]**	**COMMENT**
1.33. How many known pathways are relevant to the potential entry of this organism?	very few	low	Available commercially, presumably traded and reared privately
1.2. List relevant pathways through which the organism could enter. Where possible give detail about the specific origins and end points of the pathways.	Private or commercial trade		Can't know start or endpoints
Pathway name:	Trade (private or commercial)		
1.3. Is entry along this pathway intentional (e.g. the organism is imported for trade) or accidental (the organism is a contaminant of imported goods)?	intentional	low	

1.4. How likely is it that large numbers of the organism will travel along this pathway from the point(s) of origin over the course of one year? Subnote: In your comment discuss how likely the organism is to get onto the pathway in the first place.	very unlikely	low	Consumers can choose among dozens of tarantula species, unlikely many of this one species will enter Norway
1.5. How likely is the organism to be able to transfer from the pathway to a suitable habitat or host in Norwegian nature?	very unlikely	low	Pets such as these are not common and are expensive so accidental or deliberate release of adults is very unlikely; adults and subadults are too large to escape accidentally; spiderlings could escape but would have low survivorship
1.6. Estimate the overall likelihood of entry into Norwegian nature based on this pathway?	very unlikely	low	
End of pathway assessment, repeat as necessary.			
1.7. Estimate the overall likelihood of entry into Norwegian nature based on all pathways (comment on the key issues that lead to this conclusion).	very unlikely	low	

PROBABILITY OF ESTABLISHMENT			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
1.8. How likely is it that the organism will be able to establish in Norway based on the similarity between climatic conditions in Norway and the organism's current distribution?	Likely	Medium	Distribution central and southern Chile, coast to Andean foothills; Neuquén and Pucará provinces, Argentina. Most southernmost tarantula in Chile. Occurs in cold, wet climates which do have winter snow, much like Bergen climate today.
1.9. How likely is it that the organism will be able to establish in Norway based on the similarity between other abiotic conditions in Norway and the organism's current distribution?	Unlikely	Medium	but not much known otherwise of their ecological requirements; most individuals in captivity are females (making establishment difficult); low prey availability in Norway
1.10. How likely is it that the organism will become established in protected conditions (in which the environment is artificially maintained, such as wildlife parks, glasshouses, aquaculture facilities, terraria, zoological gardens) in Norway? Subnote: gardens are not considered protected conditions	Very unlikely	low	Would be better environmental conditions, but hard to imagine how several individuals could get into such a situation and start a population; most individuals in captivity are females; low prey availability in Norway
1.11. How widespread are habitats or species necessary for the survival, development and multiplication of the organism in Norway?	?	very high	What habitats might be suitable are unknown, really (needs to have right soil conditions for burrowing, enough prey, and survivable climate)

1.12. How likely is it that establishment will occur despite management practices (including eradication campaigns), competition from existing species or predators, parasites or pathogens in Norway?	very unlikely	low	For reasons above
1.13. How likely are the biological characteristics (including adaptability and capacity of spread) of the organism to facilitate its establishment?	very unlikely	low	Slow dispersers, few males likely to be available if any (not parthenogenetic)
1.14. How likely is it that the organism could establish despite low genetic diversity in the founder population?	unlikely	medium	Low genetic diversity likely to create inbreeding depression, but nothing known about population genetics for this genus or similar genera
1.15. Based on the history of invasion by this organism elsewhere in the world, how likely is to establish in Europe? (If possible, specify the instances in the comments box.)	very unlikely	low	No instances known of successful invasion anywhere in the world for this genus
1.16. Estimate the overall likelihood of establishment in Norway (mention any key issues in the comment box).	very unlikely	low	

PROBABILITY OF SPREAD			
Important notes: • Spread is defined as the expansion of the geographical distribution of an alien species within an area.			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
2.1. How likely is it that this organism will spread widely in Norway by *natural means*? (Please list and comment on the mechanisms for natural spread.)	very unlikely	low	Slow dispersers, few males likely to be available if any (not parthenogenetic)
2.2. How likely is it that this organism will spread widely in Norway by *human assistance*? (Please list and comment on the mechanisms for human-assisted spread.)	very unlikely	low	The species is kept as pet. Uncertain how many specimens are transported to- and within Norway, not likely it is many.
2.3. How likely is it that spread of the organism within Norway can be completely contained?	very likely	low	
2.4. Based on the answers to questions on the potential for establishment and spread in Norway, define the area endangered by the organism.	none	low	
2.5. Estimate the overall potential for future spread for this organism in Norway (using the comment box to indicate any key issues).	very unlikely	low	Establishment very unlikely, spread very unlikely

PROBABILITY OF ENVIRONMENTAL IMPACT			
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QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
2.6. How much environmental harm is caused by the organism within its existing geographic range, excluding Norway?	minimal	low	**None known**
2.7. How much impact would there be, if genetic traits of the organism were to be transmitted to other species, modifying their genetic makeup and making their environmental effects more serious?	minimal	low	Not possible in Norway (no related spiders)
2.8. How much impact does the organism have, as food, as a host, or as a symbiont or a vector for other damaging organisms (e.g. diseases)?	minimal	low	Tarantulas are not known to vector pathogens or pests to other organisms. (no related spiders in Norway)
2.9. How much impact do other factors have, factors which are not covered by previous questions (specify in the comment box)	NA	low	

2.10. How important are the expected impacts of the organism despite any natural control by other organisms, such as predators, parasites or pathogens that may already be present in Norway?	minimal	low	
2.11. Indicate any parts of Norway where environmental impacts are particularly likely to occur (provide as much detail as possible).	NA	low	

ADDITIONAL QUESTIONS - CLIMATE CHANGE			
QUESTION	**RESPONSE**	**UNCERTAINTY**	**COMMENTS**
3.1. What aspects of climate change (in a 50 year perspective), if any, are most likely to affect the risk assessment for this organism?	Milder winters, longer growth seasons	medium	Ecosystem impacts of climate change are complex and somewhat unpredictable; tarantula populations would be favoured by climate effects which increased potential prey and which increased winter survival
3.2. What aspects of the risk assessment are most likely to change as a result of climate change? • Establishment • Spread • Impact on biodiversity • Impact on ecosystem functions	spread	low	Spread still very unlikely, though

RISK SUMMARIES			
	RESPONSE	**UNCERTAINTY**	**COMMENT**
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Summarise Spread	very slowly	low	Probably no spread
Summarise Impact	minimal	low	None known
Conclusion of the risk assessment	low	low	

REFERENCES:

Ferretti, N. (2015). A new species of *Phrixotrichus* (Araneae, Theraphosidae) from southwestern Argentina and new distributional data for *P. vulpinus*. *Iheringia, Série Zoologia* **105**(2): 252-256. doi:10.1590/1678-476620151052252256

Perafán, C. & Pérez-Miles, F. (2014). The Andean tarantulas *Euathlus* Ausserer, 1875, *Paraphysa* Simon, 1892 and *Phrixotrichus* Simon, 1889 (Araneae: Theraphosidae): phylogenetic analysis, genera redefinition and new species descriptions. *Journal of Natural History* **48**(39-40): 2389-2418. doi:10.1080/00222933.2014.902142

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