Department for Environment Food & Rural Affairs

Dear Sir/Madam,

Proposed release of a non-native biological control agent for the control of *Dryocosmus kuriphilus* (oriental chestnut gall wasp)

I am writing to invite your view on whether the non-native biological control agent, *Torymus sinensis* (parasitoid wasp), should be released in England to suppress populations of *D. kuriphilus*, a harmful gall wasp of sweet chestnut trees.

Dryocosmus kuriphilus is native to China and has since spread into Japan, the Republic of Korea, Nepal, USA, and many countries in Europe. It was first discovered in the UK in June 2015 in Kent, and as of March 2020, has been detected in over 140 locations in rural and urban areas in South-East England. Galls produced by the wasp impede shoot and flower development, which negatively impacts on the quality of coppiced timber. The galls also reduce tree vigour by reducing leaf area, photosynthesis and tree biomass.

Biological control is considered to be the only effective way of managing *D. kuriphilus* in the wider environment. Native parasitoids have generally provided low levels of parasitisation (< 5%), while *Torymus sinensis*, a parasitoid wasp native to China, has been very successful in reducing numbers of *D. kuriphilus* in Japan, the USA and Italy, and has been released in many other European countries.

Defra therefore commissioned Fera Science Ltd through the Future Proofing Plant Health package to investigate the possibility of using *T. sinensis* as a biological control agent in England.

Under article 14 of the Wildlife and Countryside Act 1981, animals that are not ordinarily resident in, and are not a regular visitor to, Great Britain in a wild state are prohibited from being released into the wild in England. However, under article 16 of the Wildlife and Countryside Act 1981, these animals can be released into the wild in England under a licence authorised by Defra.

Before authorisation can be given, an assessment of the biological control's safety must be made, and Fera Science Ltd has produced a risk assessment for *T. sinensis*. In this assessment, the risks of *T. sinensis* having an impact on native gall wasps are discussed, alongside the potential benefits that it could have for sweet chestnut trees. The risk assessment has been reviewed by Defra, and externally by other bodies. A summary of these reviews is included along with this letter in Annex I.

We now welcome your views and comments on whether *T. sinensis* should be released into England to control *D. kuriphilus*. We are directly contacting the organisations in Annex II, but this list is not exhaustive, so if there is an organisation that is not included on the list that you think would like to contribute then please make them aware of this letter and the risk assessment.

If you would like to respond, use the following details:

Matthew Everatt
Plant Health Risk and Policy team
Department for environment, food and rural affairs
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Telephone: 02080262509

Or e-mail: non-nativebiocontrol.licensing@defra.gov.uk

Responses should be received by 16th November 2020.

Information provided in response to this consultation, including personal information, may be made available to the public on request, in accordance with the requirements of the Freedom of Information Act 2000 (FOIA) and the Environmental Information Regulations 2004 (EIRs).

If you do not wish your response, including your name, contact details and any other personal information, to be publicly available, please say so clearly in writing when you send your response to the consultation. Please note that if your computer automatically includes a confidentiality disclaimer, this will not count as a confidentiality request. Please explain why you need to keep details confidential. We will take your reasons into account if someone asks for this information under freedom of information legislation. However, we cannot promise that we will always be able to keep those details confidential.

Yours sincerely,

Richard McIntosh

Annex I

Summary of reviews and Fera Science Ltd responses

1. Defra review

Defra fed back comments to Fera Science Ltd early in the application process, and these comments have been incorporated into the current risk assessment.

Defra considers *T. sinensis* to be an effective parasitoid that has the potential to establish and suppress populations of *D. kuriphilus* in the UK. Although there is the possibility for the parasitoid to parasitise, and hybridise with, native species, the risk is low and is unlikely to be significant. Defra is therefore supportive of release.

2. External consultation

Reviewer 1

Summary

Reviewer 1 was asked to consider the risk of releasing *T. sinensis* into England, and to balance this against any potential benefits of reducing *D. kuriphilus*. Based on this, the following paper sets out the main points considered by Reviewer 1 in arriving at a recommendation on whether a licence to release *T. sinensis* should be given. On balance, Reviewer 1 was content, from the experience of how successful this biological control agent is in a large number of other countries, in conjunction with the information presented in the risk assessment, and that its advice was to recommend that a licence to release should be given.

Introduction

Alien, or non-native species are recognised as the largest threat to biological diversity after that of habitat destruction. The oriental chestnut gall wasp *D. kuriphilus* is the most damaging insect pest of chestnut species (*Castanea* spp.) worldwide. This invasive alien species is currently established in Southern England, and it is a significant pest of sweet chestnut wherein it forms galls. The sweet chestnut tree itself is an introduced species in the UK with significant amenity value; in forming galls the wasp *D. kuriphilus* can cause significant reduction in both this, and in its value for sale. In studies during 2019, for example, the gall wasp appeared to significantly impact the growth of coppiced sweet chestnut tress by reducing the area of foliage as a result of smaller and fewer leaves. Although *D. kuriphilus* was an accidental introduction to the UK as recently as 2014, as it spreads across South-East England the economic impact due to this is likely to become of greater significance in the future. The only effective management of this pest is by way of a classical biological control agent (BCA), *Torymus sinensis* (a parasitoid wasp), which is not native to Great Britain.

Under the Wildlife and Countryside Act 1981, it is an offence to release an animal into the wild, which is not ordinarily resident in, and is not a regular visitor to, Great Britain.

However, these animals can be released into the wild if they have a non-native biological control licence, which has been approved by Defra.

There are currently three classical non-native biological control agents that have been approved for release into the UK: the predatory beetle, *Rhizophagus grandis*, which is used to control the bark beetle, *Dendroctonus micans*, the psyllid, *Aphalara itadori*, which is used to control the invasive Japanese knotweed, *Fallopia japonica*, and the mite, *Aculus crassulae*, which is used to control Australian swamp stonecrop, *Crassula helmsii*. *T. sinensis* would represent the fourth classical biological control agent release into England if it is approved.

In compiling this application, Fera Science Ltd have completed a risk assessment for *T. sinensis*, identifying and addressing the risks associated with the intentional release of the wasp into England. Reviewer 1 considered this application from the point of view of three principal areas A-C:

A. Efficacy and benefits.

The release of *T. sinensis* has occurred in Croatia, France, Hungary, Japan, Portugal, Slovenia, Spain, Turkey and the USA, without ill-effects. It is an extremely successful biocontrol agent for its target (the cynipid *D. kuriphilus).* The wasp has proven highly successful in northern Italy, where *D. kuriphilus* infestation rates have been reduced to almost zero, nine years after release. Equally in Southern Italy the BCA affected a drastic reduction in *D. kuriphilus* numbers within only five years.

The principle benefits gained from the suppression of *D. kuriphilus* populations are twofold. Firstly, by lowering the risk of galls reducing foliage area and affecting branch architecture, which is detrimental to the quality of coppice grown for fencing. Secondly, a reduction in the numbers of galls, thereby improving the appearance of sweet chestnut trees; the latter being introduced to the UK due to it having significant amenity value.

Reviewer 1 considered that this application therefore highlights one problem for which there appears to be a cost effective solution. That is when placing the chestnut gall former *D. kuriphilus* in the context of a number of expanding threats to UK broad leaved trees, which include ash dieback, chronic oak dieback, horse chestnut leaf miner, dutch elm disease among others. Acre also noted there is in this case an additional protection against spread of the regulated disease sweet chestnut blight and its causal agent the plant pathogen (*Cryphonectria parasitica*). This is because the aim of the biocontrol agent is to reduce the incidence of galls and the subsequent holes left by emerging adult *D.kuriphilus*, and it is these holes which can act as entry points for *C. parasitica*.

The application included a Cost Benefit Analysis indicating that the release programme provides value for money as the benefits of a recovery in the yield and non-market benefits of sweet chestnut trees outweighs the programme’s outlays by a ratio of 0.59.

B. Uncertainties:

i) Host specificity.

Reviewer 1 noted that, contrary to initial reports, *T. sinensis* is not completely specialised on its target host. Host range studies were not fully completed prior to release in Italy because the target pest was so damaging to the timber industry; post release studies in that country showed it parasitising other gall forming wasps on oak, but the incidence of this was found to be very low (only 0.01% of adults reared from 14,512 non-target galls). Subsequent to the release in Italy, more complete host range studies were conducted and FERA's risk assessment takes these into account. There is only one threatened gall forming wasp in the UK and it is not thought that it would be in any danger from release of *T. sinensis*. Reviewer 1 further noted that said attack rates on non-targets were very low (<1% parasitism) in the context of >50% parasitoid attack of these gall formers in natural communities. The latter levels of host parasitism have been recorded in more than one European study.

Reviewer 1 further considered that this rate of non-host parasitism may be a high estimate as the data collection took place when the target host population was crashing and there may have been an excess of parasitoids to targets.

The application reports that host range appears to be expanding; that the reasons for this expansion are not fully understood, and that potentially this impact could be exacerbated in the UK as *D. kuriphilus* are less abundant when compared to Italy. To act as a counter to this, the application makes reference to studies, including one in France, wherein *T. sinensis* underwent an extended diapause (a form of embryonic dormancy) covering two years rather than merely overwintering in response to the drastic reduction in *D. kuriphilus* numbers. Reviewer 1 noted that FERA considered this an adaptive mechanism in their risk assessment, where they described it as a 'bet-hedging' strategy; suggesting the expansion of host range to make up for a collapse in the *D. kuriphilus* population is not so important as that of waiting for its main host's numbers to recover. This appears to lead to cyclic waves in the respective population of pest and parasite; the latter following the former and so controlling it.

ii) Hybridisation

Reviewer 1 noted that *T. sinensis* has been observed mating with *T. beneficus* (a native parasitoid) post release in Japan, and this mating has resulted in the displacement of the late spring strain of *T. beneficus*. The early spring strain of *T. beneficus* has also been displaced, but this was likely due to competition from *T. sinensis* rather than hybridisation. Displacement of native species in the UK is unlikely to happen because there are no native species that rely on *D. kuriphilus* as their main host. Experiments in Italy have confirmed high levels of mating specificity and no evidence for potential hybridisation with parasitoid wasps of native European origin; therefore interbreeding with native *Torymus* species is unlikely. Furthermore there have been no other records of hybridisation by *T. sinensis* in Europe, and no evidence that it will do so in the UK, despite experimental attempts at such crosses being made. In addition, Reviewer 1 also considered what the ill

effects of any such hybridisation might be and was satisfied that these were unlikely to be severe.

iii) Other considerations

Reviewer 1 agreed with the FERA risk assessment in that it could see no other identifiable threats to the UK environment from the release of this species, and that no negative environmental impacts have been noted in prior releases.

C. Effect of UK climatic conditions on the establishment potential of *T. sinensis*

Reviewer 1 noted that the risk assessment used Climatic modelling to indicate that the wasp should be able to establish in South-East England where *D. kuriphilus* occurs. Factors that may interfere with establishment include the relatively low density of sweet chestnut trees; a low density of *D. kuriphilus* galls, the mortality of *T. sinensis* in galls overwintering on the ground; the effect of climate on synchronization between the gall formation and *T. sinensis* adult emergence, and effects of hyper-parasitism.

Reviewer 1 agreed with the application that any expansion of host range by *T. sinensis* is likely to be negatively affected by the different climatic conditions; this is reinforced by studies carried out in France. However, FERA have set out in their application plans for extensive post-release monitoring in order to assess both this and the other areas of uncertainty above, so as to better inform subsequent biocontrol agent releases.

Conclusions/Recommendation

Reviewer 1, in reviewing this application, highlighted the uncertainty as to how widely *T.sinensis* could spread in the UK; potential alternative native species targets, and the effect of climate differences with respect to Italy where these aspects have been well-studied. However, Reviewer 1 noted that FERA's risk assessment had addressed these points and taken them into account in its proposed post –release monitoring, in order to inform more fully subsequent biological control agent releases. Therefore, on balance, Reviewer was content with the information presented in the risk assessment and its advice was to recommend that a licence to release should be given.

Reviewer 2

Are the information sources up to date?

The "Universal Chalcidoidea Database" (UCD: http://www.nhm.ac.uk/our-science/data/chalcidoids/) is an authoritative and up to date source of taxonomic, biological and other information for all species of Chalcidoidea. I have located six references to *T. sinensis* in the UCD that are not in the proposal. I do not think that the exclusion of these references affects in any way the decision whether or not to import *T. sinensis* into the UK. For the sake of completeness of the bibliography, and in case they may eventually be of use to anyone involved in this process, those references are listed here.

Izawa, H.; Osakabe, M.; Moriya, S. 1992, Isozyme discrimination between an imported parasitoid wasp, *Torymus sinensis* Kamijo and its sibling species, *T. beneficus* Yasumatsu et Kamijo (Hymenoptera: Torymidae) attacking *Dryocosmus kuriphilus* Yasumatsu (Hymenoptera: Cynipidae). Japanese Journal of Applied Entomology and Zoology 36(1):58-60.

Izawa, H.; Osakabe, M.; Moriya, S. 1995, Relation between banding patterns of malic enzyme by electrophoresis and a morphological characters in exotic and native *Torymus* species. Applied Entomology and Zoology 30(1):37-41.

Otake, A. 1987, Comparison of some morphological charcters among two strains of *Torymus beneficus* Yasumatsu et Kamijo and *Torymus sinensis* Kamijo (Hymenoptera, Torymidae). Applied Entomology and Zoology 22(4):600-609.

Piao, C.S.; Moriya, S. 1992, Ovarian and egg development of *Torymus sinensis* Kamijo and ovarian development of two strains of *Torymus beneficus* Yasumatsu et Kamijo. Bulletin of the Fruit Tree Research Station 1992(22):79-89.

Quacchia, A.; Ferracini, C.; Alma, A. 2010, Origin, spread and measures adopted to control the chestnut gall wasp in Europe. Atti Accademia Nazionale Italiana di Entomologia 58:91.

Zhao, Y.X.; Huang, D.W.; Xiao, H. 2009, A taxonomic study of genus *Torymus* Dalman (Hymenoptera, Torymidae). Acta Zootaxonomica Sinica 34(2):370-371

Has the information been comprehensively searched?

Largely, although the following additional missing references might be useful:

Gyoutoku, Y.; Isoda, T. 1993, Oviposition behaviour of two parasitoids of *Dryocosmus kuriphilus* Yasumatsu (Hymenoptera: Cynipidae), *Torymus (Syntomaspis) sinensis* Kamijo and *Torymus (Syntomaspis) beneficus* Yasumatsu et Kamijo (Hymenoptera: Torymidae), in a chestnut orchard. Proceedings of the Association for Plant Protection of Kyushu 39:127-130

Gyoutoku, Y.; Uemura, M.; Isoda, T.; Sakai, S.; Matsuo, T.; Iwasaki, M. 1991, Ecology and biological control of the chestnut gall wasp, *Dryocosmus kuriphilus* Yasumatsu (Hymenoptera: Cynipidae). 4. Recovery and period of emergence of *Torymus (Synyomaspis) sinensis* Kamijo in colonization at Matubase. Proceedings of the Association for Plant Protection of Kyushu 37:191-193

Huang, J.F.; Luo, Y.Q.; Liao, D.X. 1988, Studies on the natural enemies of chestnut gall wasp in China. Scientia Silvae Sinicae (Linye Kexue) 24(2):162-169

Has the information been correctly interpreted?

The actual and potential host ranges of *T. sinensis* have been meticulously prepared in the proposal. I can see nothing that suggests inaccuracy or missing information.

Has the information been properly referenced?

See above.

Is the risk assessment fit for purpose?

This risk assessment appears to be very well-researched and convincing. Although I would prefer to see more evidence of more extensive host-range testing, I can also see that this could present a number of problems in terms of host availability, rearing conditions etc. Where the information is available, the authors appear to be erring on the side of probable host suitability, but point out, correctly, that even where successful development on a non-

target host is possible, or even likely, the probable percentage parasitism is likely to be miniscule.

I agree with the authors that hybridisation between *T. sinensis* and any native/established *Torymus* species is very unlikely.

Is the risk assessment sufficiently detailed to support conclusions?

With the above observations, yes.

Reviewer 3

The risk assessment does not include information on the impact of *T. sinensis* on local faunas except for Italy. The authors say "There have been no significant negative environmental impacts recorded in any countries where *T. sinensis* has been deliberately introduced." Does this mean no studies, or studies showing no impact? If the latter, these papers should be cited and discussed. Considering the range of countries involved in its introduction, I'd expect more data and assessments.

I'm not convinced by the 'low' level of uncertainty given to the question "what is the level of damage likely to be caused by the organism on its major native hosts". The incidence of native species parasitism in Italy is low, but by the authors' own account, "The [wasp's] host range appears to be expanding and is not fully understood" and "The population levels of *D. kuriphilus* are much lower in the UK and there may be increased pressure on *T. sinensis* to attack native oak galling wasps."

T. sinensis is likely to become established and extend its distribution (including Scotland) by possibly attacking the native gall fauna and hybridising. These risks may be low, but they should be measured up against the importance of controlling *D. kuriphilus* in the UK. I can't comment on that, but it's a question worth addressing.

Reviewer 4

It is understood that this is a consultation to release a non-native parasitoid wasp (*Torymus sinensis*) in order to control the non-native Oriental chestnut gall wasp *Dryocosmus kuriphilus* which impacts on non-native sweet chestnut trees (*Castanea sativa*). Sweet chestnut trees are mainly located in the south west of England and there are few in Wales, they have limited economic value, they provide some amenity value and also in comparison to native trees they provide limited ecological benefits.

There is some uncertainty over how *Torymus sinensis* will react once introduced and there has been some evidence of it affecting native oak galling wasps and hybridising with native *Torymus* species. So far *D. kuriphilus* is not affecting sweet chestnut trees to the same extent as in other European countries this may be because of the relatively early stage of the invasion however there may be other factors at play including native parasites and issues in relation to survival relating to the climate etc.

We have some concerns about the risk of the potential impact on native species of releasing this in the UK, particularly given the limited commercial benefit of sweet chestnut.

The following points were noted from the assessment:

1. Reliance on research undertaken in Japan and Italy.

The assessment demonstrates that *T. sinensis* has been an effective biocontrol where it has been released in other areas of the world. A lot of the research focuses on releases in Japan and Italy and is unfortunate that there have not been more studies carried out in France where it has also been released. This makes it more difficult to understand if *T. sinensis* will react in a similar way given the difference in climate and native species.

2. Lack of acknowledgement that the introduced range of *T. sinensis* in the UK may be larger than just areas where sweet chestnut is present if they utilise galls located on species of oak.

While *T. sinensis* appears to favour *D. kuriphilus* galls it has been found to parasitise oak galling wasps and there is some concern that given the limited number of *D. kuriphilus* galls there may be pressure on this species to utilise galls created by native oak galling wasps.

It is understood from the only work done on this in Italy that 14,512 non-target galls were collected and 8708 adult chalcid parasitoids were reared and 116 of these were *T. sinensis* which means they have an occurrence in the reared parasitoids of 1.3%, which is fairly low.

The assessment acknowledges that *T. sinensis* is highly adaptable in terms of its environment and so could potentially spread to other areas of the UK where sweet chestnut and *D. kuriphilus* are present which may not have been identified as suitable in terms of the climate.

The assessment does not seem to explore the possibility that given that *T. sinensis* can utilise galls on oak species that the distribution of sweet chestnut tress may not be a limiting factor to its distribution in the UK.

3. Lack of evidence to in relation to the impact that it may have on native oak galling wasps

The assessment attempts to screen out a number of native oak galling wasps which *T. sinensis* is likely to affect however there are still some remaining species which could potentially be affected and the extent of this affect is unknown.

4. Lack of evidence in relation to hybridisations with native *Torymus* species

Torymus sinensis was found to hybridise with *T. beneficus* and both strains of the indigenous *T. beneficus* (Murakami, 1988) were shown to be displaced by *T. sinensis*

(Yara, 2014) in Japan. However it is determined in the assessment that the displacement of native parasitoid species is unlikely to happen in the UK because no native species rely on *D. kuriphilus* as their main host. However this does not seem to address the issues around the displacement of native parasitoids in oak galls. The report acknowledges that there is no detailed phylogenetic study of the relationships between all the *Torymus* species found in the UK and *T. sinensis* which could indicate which species are most likely to hybridise.

Experiments looking at mating behaviour identified that there was no behaviour demonstrated that indicated species recognition or attempted mating using *T. sinensis* males and native *Torymus* females (or vice versa) either in trials with individuals or with small groups. Having read the paper this came from it also stated that '*It is important to note that the native species which were tested are difficult to mate under controlled conditions, and other species, such as T. notatus and T. cyaneus, which are more closely related to T. sinensis, should also be tested. Apart from any morphological or phenological differences between T. sinensis and native Torymus species, the mating behaviour we found to be peculiar to T. sinensis could be an additional, behavioural barrier to cross breeding with native Torymus*.' Given this it is not explained if there are any native *Torymus* which are more closely aligned to *T. sinensis* in the UK and whether they have or need to be assessed.

Conclusion:

A balance needs to be struck between the risk that release may have on our native fauna given the evidence provided and the potential benefits of protecting sweet chestnut trees which are not native to the UK but which do provide some limited, financial, amenity and ecological benefit in England. Sweet chestnut trees have very limited economic, amenity and ecological value to the Welsh economy.

Sweet Chestnut is far more significant to some parts of the rural economy in France and other parts of Europe and so it is easier to justify the risk however it is not clear if the benefits will outweigh the risk in the UK.

Reviewer 5

Overview. I find this document to provide a balanced summary of available evidence relevant to the use of *Torymus sinensis* as a non-native biocontrol agent. The document correctly identifies areas of significant uncertainty surrounding the possible impact of *T. sinensis* on native species, and (I think correctly) concludes that negative effects are likely to be small or very small, given what we know about past gall wasp invasions of the UK. Given uncertainty in the consequences of any release, in my opinion, close monitoring of the UK gall wasp community after any release of *T. sinensis* is essential.

The following sections provide my comments on each section of the Risk Assessment document.

Executive summary

Page 4, **Eradication or containment of the pest and transient populations**: "It is possible that *T. sinensis* will naturally spread across Europe and be introduced into the UK in an unmanaged way." I consider this very likely, based on what has happened in Continental Europe.

Page 5, **Economic, Environmental and Social Impacts**: The document states that "*Torymus sinensis* may have some negative environmental impact by parasitizing native oak galling wasps and there is a small risk of hybridisation with native *Torymus* species. The incidence of *T. sinensis* parasitizing native oak-galling wasps in Italy has been found to be very low (only 0.01% of adult chalcids reared from 14,512 non-target galls were *T. sinensis*) and there are no reported environmental consequences. No evidence of hybridization has been observed in Europe."

I consider the evidence that *T. sinensis* will not shift to native gall wasps if released to be preliminary. The sampling of native galls to screen them for attack by *T. sinensis* was not systematic, and no experiments to test the acceptability of native gall wasps as hosts for *T. sinensis* have been carried out. Attack rates by native UK parasitoid species of introduced and invading oak gall wasps have been shown to increase over time on timescales of years to decades (see Schönrogge et al. 2006 for an overview), and there is thus a risk that *T. sinensis* attack of native hosts could similarly change, and possibly increase, over time.

Stage 1: Initiation.

1.05 Specify all host species. Indicate the ones which are present in the RA area.

Page 10, **Preferred host**. *Dryocosmus kuriphilus* is known from *Castanea sativa* in Europe. Elsewhere in the world it attacks other *Castanea* species (e.g. *C. mollissima* in China), and it is possible that UK populations of *D. kuriphilus* could also be found on ornamental or arboretum specimens of non-*sativa Castanea* species.

Page 11, **Non preferred hosts**, Table 1.

Overall comment: The information on *T. sinensis* attack of non-target hosts is patchy. The best way to assess this risk would be to (a) systematically rear non-target host galls from regions where *T. sinensis* is present, and (b) carry out host choice experiments. For (a), though >14,000 non-target host galls have been reared in Italy (Ferracini et. al., 2015 and 2017), the sampling is not equivalent across host gall types. As a result we are more confident that some non-target galls are not attacked than we are about others. For (b), some experiments exposing native, non-target galls to *T. sinensis* (Quacchia et al. 2014) used small sample sizes and gall developmental stages that were probably not appropriate for parasitoid attack. As a result, I am wary of the conclusion by Quacchia et al. that the gall types they screened are not potential hosts for *T. sinensis*. I have higher faith in similar experiments by Ferracini and colleagues (for whom rearing of parasitoids from galls sampled in the wild, and lab experiments of host choice give largely consistent answers).

On the basis of current data, we cannot rule out the possibility that *T. sinensis* will attack non-target native oak galls.

Previous work on invading or introduced oak gall wasps in the UK (particularly *Andricus aries, A. corruptrix, A. kollari, A. lignicola* and *A. quercuscalicis*) has shown that the number of parasitoids attacking an unfamiliar gall increases over time (Schönrogge et al. 2012). It is possible that *T. sinensis* could respond in a similar way, attacking a gradually widening spectrum of non-target hosts with time after release. No data exist to address this possibility. However, despite sharing many parasitoid species with native oak gall wasps, the establishment of 12 invading oak gall wasps has so far had no detectable negative impacts on native gall wasp species. Following this pattern, one would expect low impacts of parasitoids associated with Chestnut gall wasp on native species.

Currently recorded attack rates by *T. sinensis* on non-target hosts are very low, and, if unchanged, would have little impact on the distribution or abundance of non-target gall types, or on the dynamics of native parasitoids attacking the same galls.

Specific points on non-preferred hosts:

(i) In Table 1, *Andricus cydoniae* (the sexual generation of *Andricus conificus*) has not yet been confirmed present in the UK to my knowledge. Otherwise the information on the European galls known to be attacked by *T. sinensis* is correct as far as I know.

(ii) Table 3, on the possible value of other native UK oak gall wasps to *T. sinensis*, is a conservative 'best guess', based on ecological overlap of these galls with the galls of the preferred host. There is good agreement between potential non-target hosts identified in this way, and known non-target hosts, so the approach has some validity.

(iii) If useful, the host oak associations of the cynipid species in Table 1 could be further specified, given that cynipid gall generations are (almost) always either on white Section Quercus oaks (*Q. petraea, Q. pubescens, Q. robur*) or Section Cerris oaks (*Q. cerris*, *Q. ilex*, *Q. suber*), but not both.

The following galls in Table 1 are known only from section Quercus oaks:

Andricus curvator Hartig, 1840 – Curved leaf gall-causer, Collared-bud Gall Causer

Andricus inflator Hartig, 1840

Andricus kollari (Hartig, 1843) – Marble gall

Andricus lignicolus (Hartig, 1840) – Cola- nut gall

Andricus lucidus (Hartig, 1843) – Hedgehog gall

Biorhiza pallida (Olivier, 1791)

Cynips quercusfolii Linnaeus, 1758 – Cherry gall

Neuroterus anthracinus (Curtis, 1838) – Oyster gall

Neuroterus quercusbaccarum (Linnaeus, 1758) – Currant gall, Common spangle

The following gall is known only from section Cerris species

Andricus cydoniae Giraud, 1859

Stage 2: BCA Risk Assessment

Section A

2.02 Summarise the biology and ecology of the Biological Control Agent

Page 20: Hybridisation between *T. sinensis* and native *Torymus* species is possible, but I would consider it a low risk given what we know. If we assume that *T. sinensis* mates on or near the galls it emerges from, then it is probably unlikely to meet other UK *Torymus* species at anything other than low abundance. The most abundant UK native *Torymus* species emerging from *D. kuriphilus* is *Torymus flavipes*, which on that basis would be the strongest candidate for possible hybridisation with *T. sinensis*. To my knowledge, there is no evidence that this has occurred. However, the right sort of data (analysis of mitochondrial and nuclear sequence data for many individuals of native *Torymus* species, from multiple sites, in comparison with voucher sequences for *T. sinensis*) has not yet really been attempted. I suspect that the risk through hybridisation is genuinely low.

Conclusion of pest categorization

2.11 This BCA could present a risk to the RA area (Summarize the main elements leading to this conclusion)

Page 24, I agree with the conclusions given in this section.

Section B:

Assessment of the probability of establishment and spread and of potential consequences

Page 41: Post release monitoring. This is important and I would advocate strongly that such collections and rearings are carried out in a systematic and planned way, targeting as full a range of possible native hosts as possible.

Assessment of potential economic, environmental and social consequences

Pages 42-53. I find the summary of evidence and assessments of risk and uncertainty to be appropriate, given what is known.

Degree of uncertainty:

Page 54: **Key areas of uncertainty.** The extent to which *T. sinensis* may impact on native UK gall wasp species remains a major area of uncertainty in the risk assessment, and I see careful post-release monitoring as essential.

References:

Schönrogge K, Begg T, Williams R, Melika G, Randle Z & Stone GN (2012). Range expansion and enemy recruitment by eight alien gallwasp species in Britain. Insect Conservation & Diversity. 5, 298-311. doi: 10.1111/j.1752-4598.2011.00161.x

3. Fera Science Ltd responses to external consultation

Response to Reviewer 1

Reviewer 1 concluded that "*Torymus sinensis* is not considered as posing a risk to the UK environment, and no further information is required."

Response to Reviewer 2

Reviewer 2 raised two issues, one regarding references and the second regarding host-range testing.

Reviewer 2 suggested considering including a further 10 references (see Appendix 1). All the references have been considered and we concluded that they do not add any additional useful information to the risk assessment. Some of the publications based on work conducted in Asia in the 1980s and 1990s is of less relevance (and quality) than work published more recently in Europe.

Reviewer 2 stated that he would prefer to see further evidence of more extensive host-range testing. A significant amount of research has been carried out in Italy where they found that the incidence of *T. sinensis* parasitizing native oak-galling wasps in Italy to be very low (only 0.01% of adult chalcids reared from 14,512 non-target galls were *T. sinensis*) and there are no reported environmental consequences. We have included all the data available on the host-range and taken a precautionary approach, indicating all possible potential native hosts in the UK.

Reviewer 2 also stated that 'This risk assessment appears to be very well-researched and convincing.'

Response to reviewer 3

The following points of concern were raised:

'The RA does not include information on the impact of *T. sinensis* on local faunas except for Italy. The authors say "There have been no significant negative environmental impacts recorded in any countries where *T. sinensis* has been deliberately introduced." Does this mean no studies, or studies showing no impact? If the latter, these papers should be cited

and discussed. Considering the range of countries involved in its introduction, I'd expect more data and assessments. ‘

Non-target effects have only been studied in detail in Italy, where they were found to be very low (0.01% reared from 14,512 non-target galls). There is no more published data available.

I'm not convinced by the 'low' level of uncertainty given to the question "what is the level of damage likely to be caused by the organism on its major native hosts". The incidence of native species parasitism in Italy is low, but by the authors' own account, "The [wasp's] host range appears to be expanding and is not fully understood" and "The population levels of *D. kuriphilus* are much lower in the UK and there may be increased pressure on *T. sinensis* to attack native oak galling wasps."

I agree with the comments and have revised the level of uncertainty from low to medium in the Risk Assessment as follows:

6.09.0C What is the level of damage likely to be caused by the organism on its major native hosts in the RA area?

The incidence of parasitism of native species observed in Italy was very low. There is a medium degree of uncertainty regarding the non-target effects as the population of *D. kuriphilus* is lower in the UK than in Italy.

Minimal, minor, moderate, major, massive

Level of uncertainty:	**Low**	**Medium** X	**High**

However, it should be noted that the biology of *T. sinensis* is not especially adapted to the native fauna in the UK. *Torymus sinensis* is univoltine whereas the native oak gall wasps and native parasitoids are bivoltine.

The impact from the increase in native parasitoids is likely to be far more significant

T. sinensis is likely to become established and extend its distribution (including Scotland) by possibly attacking the native gall fauna and hybridising. These risks may be low, but they should be measured up against the importance of controlling *D. kuriphilus* in the UK. I can't comment on that, but it's a question worth addressing.

There is no evidence that *T. sinensis* can maintain a self-sustaining population breeding on oak gall wasps and this is very unlikely due to the low incidence of parasitism. The risk of *T. sinensis* establishing in Scotland is low due to the low density of sweet chestnuts and absence of *D. kuriphilus*.

Response to Reviewer 4

The main points of concern appear to be:

The assessment does not seem to explore the possibility that given *T. sinensis* can utilise galls on oak species that the distribution of sweet chestnut tress may not be a limiting factor to its distribution in the UK.

There is no evidence that *T. sinensis* can maintain a self-sustaining population breeding on oak gall wasps and this is very unlikely due to the low incidence of parasitism.

Response to Reviewer 5

Reviewer 5 provided the following overview: 'I find this document to provide a balanced summary of available evidence relevant to the use of *Torymus sinensis* as a non-native biocontrol agent. The document correctly identifies areas of significant uncertainty surrounding the possible impact of *T. sinensis* on native species, and (I think correctly) concludes that negative effects are likely to be small or very small, given what we know about past gall wasp invasions of the UK. In my opinion, close monitoring of the UK gall wasp community after any release of *T. sinensis* is essential.'

One of the main areas of uncertainty raised by reviewer 5 is the potential rate of attack of native species by *T. sinensis* over the medium to long term. Attack rates by native UK parasitoid species of introduced and invading oak gall wasps have been shown to increase over time on timescales of years to decades. It is possible therefore that attack rates of native gall wasp species by *T. sinensis* may increase over several years but the only evidence that we have for these non-target effects is based on research in Italy, where the incidence is extremely low (0.01% reared from 14,512 non-target galls, after 10+ years) and has had a negligible effect on the environment. No non-target effects have been found in any other European country.

Reviewer 5 has also emphasized the importance of post release monitoring stating 'I would advocate strongly that such collections and rearings are carried out in a systematic and planned way, targeting as full a range of possible native hosts as possible'.

The Risk Assessment has been revised as follows:

Table 1 has been revised according to reviewer 5's recommendations.

The summary paragraph on page 5 has been revised thus: '*Torymus sinensis* may have some negative environmental impact by parasitizing native oak-galling wasps and there is a possibility that this may increase over time.'

The following paragraph has been added on page 29:

Attack rates by native UK parasitoid species of introduced and invading oak gall wasps have been shown to increase over time on timescales of years to decades (Schönrogge

et. al. 2006), and there is thus a risk that *T. sinensis* attack of native hosts could similarly change, and possibly increase, over time.

The reference by Schönrogge *et. al.* (2012) has been added.

General response

None of the arguments and comments put forward by the external experts and devolved administrations fundamentally change the case for the release of *T. sinensis* in Britain for the biological control of *D. kuriphilus*. All the areas of uncertainty raised by the reviewers, especially potential non-target effects, have already been highlighted in the Risk Assessment.

It is important to note that the increase in number of native parasitoids (especially *Torymus flavipes*) developing on *D. kuriphilus* is likely to have more of a harmful impact on the native gall wasps than *T. sinensis* is likely to have.

Annex II

List of interested parties

- Action Oak
- Arboricultural Association
- Association for the Protection of Rural Scotland
- Association of Local Government Ecologists
- Botanical Society of Britain and Ireland
- Botanical Society of Scotland
- British Association of Landscape Industries
- British Association of Nature Conservationists
- British Ecological Society
- Buglife
- Butterfly Conservation
- CABI
- Campaign for National Parks
- Campaign to Protect Rural England
- Campaign to Protect Rural Wales
- Centre for Ecology and Hydrology (+ Aquatic Plant Management)
- CLA
- Confor
- Department of the Environment (Northern Ireland)
- English Heritage
- Environment Agency
- Environment, Food and Agriculture, Isle of Man
- Forest Stewardship Council
- Future Trees Trust
- Horticultural Trade Association
- Institute of Chartered Foresters
- International Plant Sentinel Network
- London Tree Office Association
- National Association for Areas of Outstanding Natural Beauty
- National Coppice Federation
- National Parks
- National Parks England
- National Trust
- National Trust for Wales
- Natural England
- Plantlife
- Rootstock
- Royal Botanic Gardens Edinburgh
- Royal Botanic Gardens Kew
- Royal Entomological Society

- Royal Forestry Society
- Royal Horticultural Society
- Royal Parks
- Royal Scottish Forestry Society
- Royal Society of Wildlife Trusts
- RSPB
- SASA - Science and Advice for Scottish Agriculture
- Scottish Timber Trade Association
- Small Woods Association
- Timber Trade Federation
- Tree Council
- UK Forest Products Association
- Wales Biodiversity Partnership
- Wildlife and Countryside Link
- Wildlife Trusts
- Woodland Heritage
- Woodland Trust
- Wood Protection Association