Terms of Reference for a report assessing the impact of importing the gall fly *Cecidochares connexa* for the biological control of *Chromolaena odorata*

The terms of reference set out below outlines the reporting requirements for assessing the potential impact on the environment of amending the 'List of Specimens Suitable for Live Import' for the purposes of the *Environment Protection and Biodiversity Conservation Act 1999*, to include the gall fly *Cecidochares connexa* (Macquart) (Diptera: Tephritidae) for the potential biological control of chromolaena, *Chromolaena odorata* (L.) King & Robinson (Asteraceae).

1. Summary of the proposed activity, including the proposed source of the agent, the number of individuals to be imported and the way in which the specimen(s) will be kept and transported within Australia and disposed of.

Chromolaena odorata is a Class 1 weed in Queensland and the target of a national cost-share eradication program. In a recent review of the program, it was recommended that biocontrol be implemented to assist in the control and containment of the weed. The gall fly *Cecidochares connexa*, has been tested in four countries against a total of 79 plant species, representing 18 families, including 22 species in the family Asteraceae and five of these in the tribe Eupatorieae. *C. connexa* is highly host specific, not attacking any other species and is a very effective agent, controlling or aiding the control of chromolaena in PNG, Indonesia, Guam, Micronesia and Timor Leste. The gall fly will be imported from PNG as mature larvae or pupae in mature galls in double sealed containers into the quarantine unit at the Ecosciences Precinct, Brisbane. Host specificity tests will be conducted against plant species in the subfamily Eupatoriae to determine if the plants can support gall formation and gall fly populations. If the gall fly proves to be host specific, an application to seek its field release in Australia will be submitted to AQIS and the Department of Sustainability, Environment, Water, Population and Communities. All associated materials, including the *C. connexa* colony should the agent be found unsuitable for release, will be autoclaved prior to removal for the quarantine facility.

2. Information on the target species, including taxonomy, related Australian native and introduced species, native range, current distribution, pest status and documentation of approval for biological control.

Taxonomy

Target species:	*Chromolaena odorata* (L.) King & Robinson
Tribe:	Eupatoriae
Family:	Asteraceae

Related Australian native & introduced species

There are 20 species in the Eupatoriae in Australia, of which two, *Adenostemma lavenia* and *A. macrophyllum*, are native. Two species *Ageratina adenophora* and *Ageratina riparia* are also targets for biocontrol and four species *Chromolaena odorata, C. squalida, Gymnocoronis spilanthoides* and *Mikania micrantha* are targets for eradication. The remaining species are all exotic and none is of economic importance.

Native range
Chromolaena odorata is endemic to much of tropical America where it is found in southern USA, Mexico, Central and South America and the Caribbean.

Current distribution
Two forms of chromolaena are thought to exist. The Asia-West African form is found, in many Asian countries, most countries in sub-Saharan Africa, Papua New Guinea, Micronesia and northern Queensland. The other form is found only in South Africa.

Pest status
Chromolaena odorata was first found in Queensland in 1994 and was later declared a Class 1 weed under the *Land Protection Act 2002*. It is currently the target of a national cost-eradication program. At a recent review of the program, it was recommended that biocontrol be considered should the program switch to containment.

Approval for biological control
Chromolaena odorata was approved as a target species for biological control in August 2010, with Queensland Department of Employment, Economic Development and Innovation as the proposing organisation.

3. Information on the taxonomy of the biological control agent.

Scientific name:	*Cecidochares connexa* (Macquart)
Family:	Tephritidae
Order:	Diptera
Class:	Insecta

4. Information on the biology and ecology of the species including the native range, current distribution, related species and an estimate of the likely efficacy of the species.

Biology
Adults ingest only water and live for between 5 and 11 days. Mating occurs on chromolaena and females deposit eggs in the axils of stems or tips. The eggs hatch in 4-7 days and the larvae burrow into the stem or tip. Feeding by larvae results in the formation of galls, first visible after about 15 days. Larvae feed for 30-50 days and construct a window in the side of the gall, prior to pupation, to facilitate adult emergence. The entire life cycle from egg to adult ranges from 47 to 75 days, with an average of 60 days.

Native range
Cecidochares connexa is native to Central and South America.

Current distribution
Cecidochares connexa has been introduced and has established in Cote d'Ivorie, Federated States of Micronesia, Guam, Indonesia, Northern Mariana Islands, Palau, Papua New Guinea, Philippines and Timor Leste. It has also been introduced into Thailand but it is not known whether it has established there.

Related species
The family Tephritidae contains over 5,000 species in 500 genera. The genus *Cecidochares* contains 13 species, all of which are native to tropical America. Eight species of tephritids have been introduced into Australia as biocontrol agents namely; *Procecidochares utilis* to control *Ageratina adenophora* (crofton weed), *Procecidochares alani* to control *Ageratina riparia* (mistflower), *Urophora solstitialis* to control *Carduus nutans* (nodding thistle), *Mesoclanis polana* to control *Chrysanthemoides monilifera* (bitou bush), *Urophora stylata* to control *Cirsium vulgare* (spear thistle), *Tephritis postica* to control *Onopordum acanthium* (scotch thistle), *Euaresta aequalis* to control *Xanthium strumarium* (noogoora burr) (all Asteraceae) and *Eutreta xanthochaeta* to control *Lantana camara* (lantana) (Verbenaceae).

Estimate of likely efficacy
Cecidochares connexa causes galls to form on stems of *C. odorata*, killing branches or stems. In high numbers (above 20), plants can die. In PNG, *C. connexa* has controlled *C. odorata* in most of the provinces where the weed occurs. Only about 100 individuals are needed to achieve establishment and the gall fly disperses easily, over 100 km in about 5 years. The gall fly is also aiding control in all other countries in which it has been introduced. Similar results should be observed if the agent is released in Australia.

5. Describe the current status of the species in its native range.
Cecidochares connexa has been reported on *Chromolaena* and *Eupatorium* species in its native range. However, in host specificity trials on 79 plant species, representing 18 families, including 22 species in the family Asteraceae and five of these in the tribe Eupatorieae, *C. connexa* did not form galls on any species other than *C. odorata*. Field observations in the countries in which it has been released have found no evidence of it attacking other species.

6. Describe the current status of the species in Australia.
Cecidochares connexa is currently not present in Australia.

7. Provide information on where, when and how initial releases will be made.

If *Cecidochares connexa* is proven to be host specific, an application seeking its field release will be submitted to AQIS and Department of Sustainability, Environment, Water, Population and Communities. If approved, the agent will be released in Queensland where chromolaena occurs, as well as Cocos and Christmas islands, both territories of Australia.

8. Report on the results of host-specificity testing of the biological control agent, including the approved host specificity test list, an explanation of any variation from this list, testing methods, risk evaluation to non-target species and any evidence of laboratory artefacts.

Biosecurity Australia no longer approves host specificity testing lists so species selected for testing will be based on previous testing in other countries. A total of 79 plant species, representing 18 families, including 22 species in the family Asteraceae

and five of these in the tribe Eupatorieae have been tested in four countries; none has been attacked by *C. connexa.* Consequently, only species in the Eupatoriae will be tested. If gall formation occurs on any species, then additional species in the Asteraceae will be tested to more rigorously evaluate any risk.

Host specificity testing in Australia will be conducted in the quarantine facility at the Ecosciences Precinct in Brisbane. As adults do not feed and larvae do not transfer or wander, host testing will consist of adult oviposition no-choice trials, with plants kept for subsequent larval development and possible gall formation. If gall development occurs on any of the non-target plants, then these species will be tested in choice-tests to understand the 'ecological host' range.

9. Provide an analysis of the overall potential impacts on the Australian environment of importing and releasing the species, including a statement on the likelihood that the species could become an environmental pest.

Chromolaena odorata is a Class 1 weed in Queensland and the target of a national cost-share eradication program. While the program has not been able to eradicate it yet, the weed has been contained in northern Queensland. However, *C. odorata* has the potential to spread down the Queensland coast to Fraser Island and across to Western Australia. Biological control, using host-specific natural enemies is viewed as another method in trying to control and contain *C. odorata*. *Cecidochares connexa* has offered great control in several overseas countries and it is hoped that similar results will occur here if the agent is approved for release.

If any environmentally or economically important plant species are considered to be at risk following laboratory evaluation, the culture will be destroyed and an Application for Release will not be made.