***Submission form for phytosanitary treatments***

*(Reviewed by TPPT March 2016)*

Name of Country/RPPO:\_\_\_\_\_United States of America\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

[Click here](https://www.ippc.int/core-activities/ippc-standard-setting-procedure-manual) to find the IPPC Procedure Manual for Standard Setting on the IPP ([www.ippc.int](http://www.ippc.int)), where you can download this form.

**Submission number (Secretariat Use Only):**

Complete the following form, preferably in electronic format, and submit by e-mail to the IPPC Secretariat (ippc@fao.org). The call will remain open, but if you wish your submission to be considered by the TPPT in their next meeting, please send it before the 5 June 2017.

Please use one form per phytosanitary treatment. An electronic version of this form is available on the International Phytosanitary Portal (IPP) at <https://www.ippc.int/en/publications/1089/>. Incomplete submissions will be returned. Please save the completed submission form with the following file name: COUNTRY or RPPO NAME –Title of treatment.doc, prior to submitting to the IPPC Secretariat via e-mail. The words “Call for Phytosanitary Treatments” should be placed in the subject line of the email message.

Copies of all relevant supporting information and publications should be supplied with the treatment submission, preferably in PDF format, for ease of subsequent distribution.

Submitters are encouraged to make all supporting documentation available publicly. If you allow the public release of your submission and supporting documents, please check the following box

(Text in brackets given for explanatory purposes)

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| **Name of treatment** | Irradiation treatment for all stages *Aspidiotis destructor*  |

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| **Submitted by:** United States Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine |
| [x]  I agree to the public release of the submission and supporting documents. |
| **Contact:** (Contact information of an individual able to clarify issues relating to this submission, including sources of efficacy data)Name: Peter Follett Position and organization: Research Entomologist, USDA ARS, Hilo, Hawaii USA  Phone: +1 808 959 4303 Fax:+1 808 959 5470 E-mail: peter.follett@usda.gov |

**Treatment description**

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| Active ingredient | Ionizing radiation |
| Treatment type | Irradiation |
| Target pest | *Aspidiotus destructor* (coconut scale) - all stages |
| Target regulated articles | Bananas and many other tropical fruits |
| Treatment schedule | 150 Gy (minimum absorbed dose) |
| Other relevant information | A radiation dose of 150 Gy is approved by the USDA for this pest. Bananas and other tropical fruits have been successfully exported from Hawaii to the U.S. mainland since 2000 using irradiation treatment at 150 Gy to control tephritid fruit flies. When surface pests are found during pre-treatment inspection, the required dose is increased to 400 Gy, which motivated this study into lowering the dose for a key surface pest. |
| References | Follett, P. A. 2006. Irradiation as a phytosanitary treatment for *Aspidiotis* *destructor* (Homoptera: Diaspididae). Journal of Economic Entomology 99 (1): 1138-1142. Barkai-Golan, R. and P. A. Follett. 2017. *Irradiation for Quality Improvement, Microbial Safety and Phytosanitation of Fresh Produce*. Academic Press, Elsevier: Amsterdam.  |

The following form must be completed in accordance with [ISPM 28 *Phytosanitary treatments for regulated pests*](https://www.ippc.int/en/publications/591/), the IPPC Strategic Framework and the *Procedure and criteria for identifying topics for inclusion in the IPPC standard setting work programme*.

The following form refers to the relevant sections of ISPM 28 and are numbered accordingly.

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| **3.2 Efficacy data in support of the submission of a phytosanitary treatment** |
| The source of all efficacy data (published or unpublished) should be provided in the submission. Supporting data should be presented clearly and systematically. |
| **3.2.1 Efficacy data under laboratory/controlled conditions (Treatments may be considered without efficacy data under laboratory/controlled conditions if sufficient efficacy data is available from the operational application of the treatment (section 3.2.2) and if no data under laboratory/controlled conditions exists this section may be left blank.)** |
| Pest information |
| Identity of the pest to the appropriate level, life stage, and if a laboratory or field strain was used |
| A field strain of *Aspidiotus destructor* (coconut scale) was used in all tests. Second stage nymphs, adults and adults with eggs were irradiated at various doses from 60-200 Gy  |
| Conditions under which the pests are cultured, reared or grown |
| Reared in the laboratory on Japanese pumpkin, *Cucurbita* *moschata* var. *chirimen*, in plastic containers. |
| Biological traits of the pest relevant to the treatment |
| All life stages may be present on host commodities. Coconut scale is a sedentary surface pest and all scales on the surface of the fruit are females. Coconut scale has four life stages: egg, crawler, (1st stage nymph), 2nd stage nymph, adult. Eggs are hidden under the adult female scale. Only the crawler stage that hatches from the egg is mobile. |
| Method of natural or artificial infestation |
| Natural infestation – crawler stage coconut scales were transferred to rearing host |
| Determination of most resistant species/life stage (in the regulated article where appropriate) |
| Dose response tests indicated the adult female scale with eggs was the most radiotolerant life stage (Follett 2006) |
| Regulated article information |
| Type of regulated article and intended use |
| Bananas, other tropical fruits  |
| Botanical name for plant or plant product (where applicable) |
| *Musa* sp. (banana) |
| Conditions of the plant or plant product |
| Bananas are harvested in the mature green stage. |
| Experimental parameters |
| Level of confidence of laboratory tests provided by the method of statistical analysis and the data supporting that calculation |
| The desired response was failure of F1 adults to reproduce. In large-scale tests, 32,716 adults with eggs were irradiated at a target dose of 150 Gy (range 144-150 Gy) produced no F1 generation adults with eggs (Follett 2006). Couey and Chew (1986) calculate treatment efficacy at 99.99% (at the 95% confidence level) by treatment of 29,956 insects with no survivors, or in this case FI reproductive adults. Therefore, irradiation of coconut scale with a minimum absorbed dose of 150 Gy exceeded the 99.99% level of quarantine treatment efficacy. All scales were counted and followed for the duration of the experiment. Non-irradiated control scales successfully developed and produced large numbers of F1 adults with viable eggs. Survival to the adult stage from non-irradiated second-stage nymphs was 81.6%, and 70.9% laid eggs (Follett 2006). Data in Follett (2006) were used to gain approval of the 150 Gy treatment, which is published in the USDA Treatment Manual. |
| Experimental facilities and equipment |
| The commercial x-ray irradiation facility, CW Hawaii Pride LLC, was used to treat samples of coconut scale on pumpkins. Irradiation of our samples had a dose uniformity ratio of <1.2 as reported in Follett (2006). |
| Experimental design |
| Factorial design: for dose response test all life stages were treated at 60, 100, 150, and 200 Gy. Development of all scales was tracked post irradiation, recording the number of adults, adults with eggs, and F1 adults with eggs. For large-scale tests, adult females with and without eggs were irradiated at 150 Gy and followed for development to the F1 adult stage to determine reproductive potential. Details can be found in Follett (2006). |
| Experimental conditions |
| Insects were reared at 21 oC (range ~21-23 oC) and a photoperiod of 14:10 h light:dark. Pumpkins remained high quality hosts in the lab for 2 months or more depending on the density of scales, enough time for coconut scale to complete 2 generations. |
| Monitoring of critical parameters |
| The NIST-certified dosimeter system used by Hawaii Pride LLC was used to dose map and measure the absorbed dose in experimental samples. |
| Methodology to measure the effectiveness of the treatment |
| Failure to reproduce as F1 adults was the desired response. Live and dead scales can be distinguished by color, and adult female scales can be flipped over to inspect for eggs and successful reproduction (Follett 2006). |
| Determination of efficacy over a range of critical parameters, where appropriate |
| X-ray and gamma radiation have excellent penetration capabilities over a wide range of commodity sizes and packaging configurations. Papayas are not packaged commercially using modified atmospheres.  |
| Methodology to measure phytotoxicity, when appropriate |
| Bananas and other tropical fruits are generally very tolerant of irradiation and have been exported commercially using irradiation for 20+ years. |
| Dosimetry system, calibration and accuracy of measurements,  |
| A NIST-certified dosimeter system was used to measure the absorbed dose. The dose uniformity ration was <1.2. The measured doses for the 150 Gy treatment during large-scale testing was 144-150 Gy (Follett 2006) |
| **3.2.2 Efficacy data using operational conditions (historical data, may in some cases substitute for the requested information below)** |
| Pest information |
| Identity of the pest to the appropriate level, life stage, and if a laboratory or field strain was used |
| See above. all experimental irradiations were performed at a commercial irradiation facility. Tropical fruits have been irradiated at 150 Gy commercially for more than 20 years without incident. 150 Gy is a usda-approved treatment for coconut scale. |
| Conditions under which the pests are cultured, reared or grown |
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| Biological traits of the pest relevant to the treatment |
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| Method of natural or artificial infestation |
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| Determination of most resistant species/life stage (in the regulated article where appropriate) |
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| Regulated article information |
| Type of regulated article and intended use |
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| Botanical name for plant or plant product (where applicable) |
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| Conditions of the plant or plant product |
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| Experimental parameters |
| Level of confidence of laboratory tests provided by the method of statistical analysis and the data supporting that calculation |
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| Experimental facilities and equipment |
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| Experimental design |
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| Experimental conditions |
|  |
| Monitoring of critical parameters |
|  |
| Methodology to measure the effectiveness of the treatment |
|  |
| Determination of efficacy over a range of critical parameters, where appropriate |
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| Methodology to measure phytotoxicity, when appropriate |
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| Dosimetry system, calibration and accuracy of measurements |
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| Factors that affect the efficacy of the treatment |
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| Special procedures that affect the success of the treatment, if applicable |
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| **3.3 Feasibility and applicability (Information should be provided where appropriate on the following items)** |
| Procedure for carrying out the phytosanitary treatment |
| Treatment in a certified irradiation facility. Hawaii has two certified irradiation facilities, Hawaii Pride and Pa’ina Hawaii, used primarily for phytosanitary irradiation. |
| Cost of typical treatment facility and operational running costs if appropriate |
| Phytosanitary irradiation is cost competitive with alternatives such as vapour heat. Two commercial facilities in Hawaii have been operating profitable since 2000 (Hawaii Pride) and 2013 (Pa’ina Hawaii). |
| Commercial relevance, including affordability |
| Irradiation is used commercially as a phytosanitary treatment tropical fruits for domestic movement in the United States. In most cases, alternative treatments do not exist in Hawaii. |
| Extent to which other NPPOs have approved the treatment as a phytosanitary measure |
| Many NPPOs have approved irradiation as a phytosanitary measure. The USDA has approved 150 Gy for quarantine control of coconut scale on all commodities. |
| Availability of expertise needed to apply the phytosanitary treatment |
| The expertise needed is available at existing commercial irradiation facilities. |
| Versatility of the phytosanitary treatment |
| Irradiation is a superior phytosanitary treatment in terms of commodity quality and speed of treatment and can be applied to the commodity in boxes or other final packaging. |
| The degree to which the phytosanitary treatment complements other phytosanitary measures |
| Irradiation complements pre-harvest pest control measures to reduce pest risk. |
| Summary of available information of potential undesirable side-effects |
| Tropical fruits are generally very tolerant of irradiation at the doses used to control quarantine pests. |
| Applicability of treatment with respect to specific regulated article/pest combinations |
| An irradiation treatment of 150 Gy is USDA-approved for export of tropical fruits from Hawaii to the U.S. mainland to control tephritid fruit flies; 400 Gy is used if surface pests other than coconut scale are discovered during pre-treatment inspection. |
| Technical viability |
| Phytosanitary irradiation is currently being used on a commercial scale in a growing number of countries. |
| Phytotoxicity and other effects on the quality of regulated articles, when appropriate |
| Tropical fruits are very tolerant of irradiation. |
| Consideration of the risk of the target organism having or developing resistance to the treatment |
| There is no documented resistance development in insects to ionizing radiation.  |

**Send submissions to:**

**E-mail:** ippc@fao.org **Mail:** IPPC Secretariat (AGPP)

**(preferred)** Food and Agriculture Organization of the UN

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