[PleaseReview document review. Review title: 2024 consultation: Draft annex to ISPM 28: Combination of irradiation and modified atmosphere treatment for Trogoderma granarium. Document title: 2023-032\_Draft\_PT\_MA\_Ir\_Trogoderma\_eng.docx]

***[1]***Draft ANNEX to ISPM 28: Combination of irradiation and modified atmosphere treatment for *Trogoderma granarium* (2023-032)

***[2]*Status box**

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| ***[3]****This is not an official part of the annex to the standard and it will be modified by the IPPC Secretariat after adoption.* |
| ***[4]*Date of this document** | ***[5]***2024-03-11 |
| ***[6]*Document category** | ***[7]***Draft annex to ISPM 28 |
| ***[8]*Current document stage** | ***[9]****To* first consultation |
| ***[10]*Major stages** | ***[11]***2023-08 Treatment submitted in response to 2017 call for treatments (ongoing).***[12]***2023-09 SC added *Combination of modified atmosphere and irradiation treatment for* Trogoderma granarium (2023-032) to the TPPT work programme, subsequently (in 2023-11) assigning it priority 1.***[13]***2023-10 TPPT revised the draft and recommended it to SC for first consultation. |
| ***[14]*Treatment Lead** | ***[15]***2023-08 Scott MYERS (US, Treatment Lead) |
| ***[16]*Notes** | ***[17]***2023-10 TPPT changed title of draft PT to “Combination of irradiation and modified atmosphere treatment for *Trogoderma granarium*” to reflect the order in which the treatment would be applied***[18]***2024-02 Edited |

***[19]***Scope of the treatment

***[20]***This treatment describes the irradiation at 200 Gy minimum absorbed dose, followed by modified atmosphere storage under hypoxic conditions of not more than 1% oxygen (O2), of stored products to result in the mortality of all life stages of *Trogoderma granarium* at the stated efficacy.[[1]](#footnote-1)

***[22]***Treatment description

***[23]*Name of treatment** Irradiation and modified atmosphere treatment for *Trogoderma granarium*

***[24]*Active ingredient** n/a

***[25]*Treatment type** Irradiation followed by modified atmosphere

***[26]*Target pest** *Trogoderma granarium* Everts, 1898 (Coleoptera: Dermestidae)

***[27]*Target regulated articles** All stored products that are hosts of *Trogoderma granarium*

***[28]***Treatment schedule

***[29]***A minimum absorbed dose of 200 Gy, followed by modified atmosphere storage at not more than 1% O2 for a minimum of 15 continuous days at or above 24 °C.

***[30]***There is 95% confidence that the treatment according to this schedule kills not less than 99.9973% of all life stages of *Trogoderma granarium*.

***[31]***This treatment should be applied in accordance with the requirements of ISPM 18 (*Requirements for the use of irradiation as a phytosanitary measure*) and ISPM 44 (*Requirements for the use of modified atmosphere treatments as phytosanitary measures*).

***[32]***Other relevant information

***[33]***The Technical Panel on Phytosanitary Treatments (TPPT) based its evaluation of this treatment on the research reported by Zhao *et al.* (2021). The TPPT also considered information on the effect of irradiation on *Trogoderma granarium* in Gao *et al.* (2004) and Mansour(2016).

***[34]***The efficacy of this schedule was calculated based on a total of 111 366 larvae of *Trogoderma granarium* treated with no survivors; the control survival was 97.49% in all confirmatory trials conducted.

***[35]***Extrapolation of treatment efficacy to all stored products was based on knowledge and experience that radiation dosimetry systems measure the actual radiation dose absorbed by the target pest independent of host commodity, and evidence from research studies on a variety of pests and commodities. These include studies on the following pests and hosts: *Anastrepha fraterculus* (*Eugenia pyriformis, Malus pumila* and *Mangifera indica*); *Anastrepha ludens* (*Citrus paradisi, Citrus sinensis, Mangifera indica* and artificial diet), *Anastrepha obliqua* (*Averrhoa carambola*, *C. sinensis* and *Psidium guajava*); *Anastrepha suspensa* (*Averrhoa carambola*, *C. paradisi* and *Mangifera indica*), *Bactrocera tryoni* (*C. sinensis*, *Solanum lycopersicum*, *Malus pumila*, *Mangifera indica*, *Persea* *americana* and *Prunus avium*), *Cydia pomonella* (*Malus pumila* and artificial diet), *Grapholita molesta* (*Malus pumila* and artificial diet), *Pseudococcus jackbeardsleyi* (*Cucurbita* sp. and *Solanum tuberosum*) and *Tribolium confusum* (*Triticum aestivum*, *Hordeum vulgare* and *Zea mays*) (Bustos *et al*., 2004; Gould and von Windeguth, 1991; Hallman, 2004a, 2004b, 2013; Hallman and Martinez, 2001; Hallman *et al.*, 2010; Jessup *et al.*, 1992; Mansour, 2003; Tunçbilek and Kansu, 1996; von Windeguth, 1986; von Windeguth and Ismail, 1987; Zhan *et al*., 2016). It is recognized, however, that treatment efficacy has not been tested for all potential hosts of the target pest. If evidence becomes available to show that the extrapolation of the treatment to cover all hosts of this pest is incorrect, the treatment will be reviewed.

***[36]***Potential implementation issues

***[37]***This section is not part of the standard. The Standards Committee in May 2016 requested the Secretariat to gather information on any potential implementation issues related to this draft. Please provide details and proposals on how to address these potential implementation issues.

***[38]***References

***[39]***The present annex may refer to ISPMs. ISPMs are available on the International Phytosanitary Portal (IPP) at [www.ippc.int/core-activities/standards-setting/ispms](http://www.ippc.int/core-activities/standards-setting/ispms).

***[40]*Bustos, M.E., Enkerlin, W., Reyes, J. & Toledo, J.** 2004. Irradiation of mangoes as a postharvest quarantine treatment for fruit flies (Diptera: Tephritidae). *Journal of Economic Entomology*, 97: 286–292. <https://doi.org/10.1093/jee/97.2.286>

***[41]*Gao, M., Wang, C. Li, S. & Zhang, S.** 2004. Irradiation as a phytosanitary treatment for *Trogoderma granarium* Everts and *Callosobruchus chinensis* L. in food and agricultural products. In: *Irradiation as a phytosanitary treatment of food and agricultural commodities – Proceedings of a final research coordination meeting organized by the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture*, pp. 75–85. Technical Document No. IAEA-TECDOC-1427. Vienna, International Atomic Energy Agency. 181 pp. <https://www.iaea.org/publications/7159/irradiation-as-a-phytosanitary-treatment-of-food-and-agricultural-commodities>

***[42]*Gould, W.P. & von Windeguth, D.L.** 1991. Gamma irradiation as a quarantine treatment for carambolas infested with Caribbean fruit flies. *Florida Entomologist*, 74: 297–300. <https://journals.flvc.org/flaent/article/view/58735>

***[43]*Hallman, G.J.** 2004a. Ionizing irradiation quarantine treatment against oriental fruit moth (Lepidoptera: Tortricidae) in ambient and hypoxic atmospheres. *Journal of Economic Entomology*, 97: 824–827. <https://doi.org/10.1093/jee/97.3.824>

***[44]*Hallman, G.J.** 2004b. Irradiation disinfestation of apple maggot (Diptera: Tephritidae) in hypoxic and low-temperature storage. *Journal of Economic Entomology*, 97: 1245–1248. <https://doi.org/10.1093/jee/97.4.1245>

***[45]*Hallman G.J.** 2013. Rationale for a generic phytosanitary irradiation dose of 70 Gy for the genus *Anastrepha* (Diptera: Tephritidae). *Florida Entomologist*, 96(3): 983–990. <https://journals.flvc.org/flaent/article/view/82599>

***[46]*Hallman, G.J., Levang-Brilz, N.M., Zettler, J.L. & Winborne, I.C.** 2010. Factors affecting ionizing radiation phytosanitary treatments, and implications for research and generic treatments. *Journal of Economic Entomology*, 103: 1950–1963. <https://doi.org/10.1603/EC10228>

***[47]*Hallman, G.J. & Martinez, L.R.** 2001. Ionizing irradiation quarantine treatment against Mexican fruit fly (Diptera: Tephritidae) in citrus fruits. *Postharvest Biology and Technology*, 23: 71–77. [https://doi.org/10.1016/S0925-5214(01)00090-4](https://doi.org/10.1016/S0925-5214%2801%2900090-4)

***[48]*Jessup, A.J., Rigney, C.J., Millar, A., Sloggett, R.F. & Quinn, N.M.** 1992. Gamma irradiation as a commodity treatment against the Queensland fruit fly in fresh fruit. In: *Use of irradiation as a quarantine treatment of food and agricultural commodities*. Proceedings of the Final Research Coordination Meeting on Use of Irradiation as a Quarantine Treatment of Food and Agricultural Commodities, Kuala Lumpur, 27–31 August 1990, pp. 13–42. Vienna, International Atomic Energy Agency. 182 pp. <https://www-pub.iaea.org/MTCD/Publications/PDF/Pub873.pdf>

***[49]*Mansour, M.** 2003.Gamma irradiation as a quarantine treatment for apples infested by codling moth (Lepidoptera: Tortricidae). *Journal of Applied Entomology*, 127: 137–141. <https://doi.org/10.1046/j.1439-0418.2003.00723.x>

***[50]*Mansour, M.** 2016. Irradiation as a phytosanitary treatment against *Trogoderma granarium* (Coleoptera: Dermestidae). *Florida Entomologist*, 99: 138–142. <https://journals.flvc.org/flaent/article/view/88688>

***[51]*Tunçbilek, A.Ş. & Kansu, I.A.** 1996. The influence of rearing medium on the irradiation sensitivity of eggs and larvae of the flour beetle, *Tribolium confusum* J. du Val. *Journal of Stored Products Research*, 32: 1–6. [https://doi.org/10.1016/0022-474X(95)00039-A](https://doi.org/10.1016/0022-474X%2895%2900039-A)

***[52]*von Windeguth, D.L.** 1986. Gamma irradiation as a quarantine treatment for Caribbean fruit fly infested mangos. *Proceedings of the Florida State Horticultural Society*, 99: 131–134. <https://journals.flvc.org/fshs/article/view/94783>

***[53]*von Windeguth, D.L. & Ismail, M.A.** 1987. Gamma irradiation as a quarantine treatment for Florida grapefruit infested with Caribbean fruit fly, *Anastrepha suspensa* (Loew). *Proceedings of the Florida State Horticultural Society*, 100: 5–7. <https://journals.flvc.org/fshs/article/view/94415>

***[54]*Zhan, G., Shao, Y., Yu, Q., Xu, L., Liu, B., Wang, Y. & Wang, Q.** 2016. Phytosanitary irradiation of Jack Beardsley mealybug (Hemiptera: Pseudococcidae) females on rambutan (Sapindales: Sapindaceae) fruits. *Florida Entomologist*, 99 (Special Issue 2): 114–120. <https://journals.flvc.org/flaent/article/view/88683>

***[55]*Zhao, Q.-Y., Li, T.-X., Song, Z.-J., Sun, T., Liu, B., Han, X., Li, Z.-H. & Zhan, G.-P.** 2021. Combination of modified atmosphere and irradiation for the phytosanitary disinfestation of *Trogoderma granarium* Everts (Coleoptera: Dermestidae). *Insects*, 12: 442. <https://www.doi.org/10.3390/insects12050442>

1. ***[21]*** The scope of phytosanitary treatments does not include issues related to pesticide registration or other domestic requirements for contracting parties’ approval of treatments. Treatments adopted by the Commission on Phytosanitary Measures may not provide information on specific effects on human health or food safety, which should be addressed using domestic procedures before contracting parties approve a treatment. In addition, potential effects of treatments on product quality are considered for some host commodities before their international adoption. However, evaluation of any effects of a treatment on the quality of commodities may require additional consideration. There is no obligation for a contracting party to approve, register or adopt the treatments for use in its territory. [↑](#footnote-ref-1)