IRRADIATION DOSES FOR PREVENTING ADULT EMERGENCE OF *ANASTREPHA LUDENS* AND *A. OBLIQUA*

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After 30+ years of research, ionizing irradiation is finally being given serious consideration as a quarantine treatment. Recently the U.S. Dept. Agric., Animal and Plant Health Inspection Service (APHIS) published a policy statement on the research needed for irradiation quarantine treatments (Anonymous 1996). Noteworthy among these requirements were statements that large scale confirmatory tests might not be required and that research may be done with "naked" organisms (outside of the commodity). The objectives of our research were to determine irradiation doses necessary to prevent adult emergence from two species of *Anastrepha* (Diptera: Tephritidae): the Mexican fruit fly, *A. ludens* (Loew), and the West Indian fruit fly, *A. obliqua* (Macquart).

With Tephritid fruit flies, the last larval stage (third instar) is usually the stage of concern as it is the stage closest to the adult which is found in fruit. Generally, the more developed an insect, the harder it is to prevent adult emergence with ionizing irradiation. However, on a commercial scale irradiation is applied to fresh commodities after they are packed. The time lag between packing and irradiation may allow for larvae to emerge from the fruit and pupate inside the cartons. It is generally more difficult to prevent adult emergence using irradiation against pupae than against third instars. Therefore, it would be worthwhile to determine irradiation doses necessary to prevent adult emergence from pupae of different ages.

Mexican fruit flies from a colony maintained by the APHIS at Mission and West Indian fruit flies from a USDA-ARS colony at Weslaco were subjected to different doses of ionizing irradiation with a Hussman irradiator (Isomedix) containing cesium 137 and yielding a rate of about 0.4 Gy/sec during the duration of the study. The insects were kept at about 24C and 80% RH until the adults emerged.

Results and discussion: The minimum doses necessary to prevent adult emergence from several stages of Mexican and West Indian fruit flies are given in Table 1. These doses are being confirmed with large numbers of insects to insure that probit 9 security ($LD_{99.9968}$) is reached. That level of security is generally demanded by APHIS for fruit flies (Shannon 1994). The first day after pupariation seems to be slightly more susceptible to irradiation than third instars. (Usually by 24 hours after pupariation the pupa has formed.) Tolerance to irradiation begins to change dramatically on the fifth day, with Mexican fruit fly pupae more tolerant than West Indian.

The doses needed to prevent adult emergence of Mexican and West Indian fruit flies from irradiated third instars were lower than those found by Bustos et al. (1993) when irradiating fruit fly-infested mangoes (over 40 Gy). We feel that this was due to the fact that the mango

Table 1. Minimum ionizing irradiation doses required to prevent adult emergence from Mexican and West Indian fruit fly third instars and puparia

Insect stage	Minimum dose (Gy) per fruit fly	
	Mexican	West Indian
Third instar	14	16
Puparium (1 day-old)	12	12
Puparium (2 day-old)	14	14
Puparium (3 day-old)	14	14
Puparium (4 day-old)	16	16
Puparium (5 day-old)	35	20
Puparium (6 day-old)	100	50
Puparium (7 day-old)	200	110

flesh absorbed some of the irradiation, thus, larvae deep inside the fruit received less than the applied dose. As APHIS has indicated (Anonymous 1996) we feel that it is preferable to determine doses needed to prevent adult emergence of fruit fly immatures *in vitro*. This information together with measurements and calculations of the irradiation dose reaching the most protected part of a fresh commodity load will allow irradiator operators and regulators to determine doses needed to be applied to the surface of loads of irradiated commodities to insure that the minimum dose necessary to prevent adult emergence reaches the most protected part of the load.

Because fruit fly tolerance to irradiation increases as the pupa ages, limits to the time between packing and irradiating fresh commodities should be established to prevent the possibility that pupae are present that are old enough to tolerate the dose applied. We suggest this time to be no more than 4 days for the two species of flies studied. This time limit should pose no problem as fruit will probably never be packed and setting at ambient temperature for 4 days; however, it is best to establish a time limit to account for unforseen circumstances.

References Cited

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