

are then transferred to a fresh 10 ml. of propylene oxide, and the complete resin mixture, plus accelerator, is added slowly in 1-2 ml. amounts. The mixture is swirled vigorously between each addition of the resin so that all the resin dissolves. The proportion of resin to solvent is built up slowly over a period of at least a week. The denser the tissue is, the longer this infiltration should be. Finally, the tissue blocks are removed from the resin/solvent mixture, drained on smooth filter paper and allowed to sink through freshly made and well-mixed resin in '00' gelatin capsules. No vacuum treatment is necessary. The blocks are then baked at 35° C. overnight. This lowers the viscosity of the resin, allows the tissue blocks to sink and bubbles to escape. After 12 hr. at this temperature the tissue blocks can be re-orientated and baked for a further two days at 45° C., after which they are ready for sectioning. Silver sections can be used unsupported on 100-mesh hexagonal support grids for low-magnification work and on 200-mesh or 400-mesh for high-magnification work. Millonig's<sup>2</sup> method of section staining to enhance the contrast of osmium tetroxide-fixed material was used successfully, but no section staining is necessary with potassium permanganate fixation.

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<sup>1</sup> Luft, J. H., *J. Biophys. Biochem. Cytol.*, **9**, 409 (1961).

<sup>2</sup> Millonig, G., *J. Biophys. Biochem. Cytol.*, **11**, 736 (1961).

## ENTOMOLOGY

### Sterilization of the Codling Moth by Gamma-Irradiation

WORK is in progress in British Columbia to determine if the codling moth, *Carpocapsa* (= *Cydia*) *pomonella* (L.), can be eradicated by the sterile male technique, which was used so successfully against the screw-worm, *Callitroga hominivorax* (Cqrl.), in Curaçao<sup>1</sup>.

When male pupæ, within 1 day of adult emergence, were exposed to 40,000 rads of  $\gamma$ -radiation, from a cobalt-60 source, dominant lethals were induced in about 99 per cent of the sperm without affecting adult emergence, mating, or adult longevity. Dominant lethality was also induced in 99 per cent of the sperm, without undesirable side effects, when 12-24-hr.-old male moths were subjected to the same dosage. Exposure of male pupæ or adults to higher dosages of radiation reduced the frequency of mating. Dominant lethals were induced in at least 96 per cent of the sperm when mature male larvæ, or eggs that had completed about two-thirds of their development, were subjected to 9,300 rads. However, many of the irradiated insects died before they reached the adult stage, and the frequency of mating was reduced. The female codling moth was sterilized by a lower dosage of  $\gamma$ -radiation than the male. This was true whether the insect was exposed in the egg, larval, pupal, or adult stage, though the difference was most noticeable following pupal irradiation. The female was also more easily killed by  $\gamma$ -radiation than the male, the difference being particularly marked in the egg stage. In general, radiosensitivity of both sexes decreased as development progressed from the egg to the adult stage.

Sperms from irradiated males competed poorly with those from normal males; mating of a single

normal female with a single irradiated male (exposed as a pupa to 40,000 rads), either before or after a mating with a normal male, did not prevent the laying of eggs that were mostly viable.

When irradiated male moths (pupæ exposed to 30,000 rads; this dosage induces dominant lethality in about 90 per cent of the sperm) were caged with an equal number of normal female moths, the sex ratio of the adult offspring was approximately 9 males : 1 female. The female offspring were completely sterile, and the males were mostly so, for when they were mated with normal female moths, less than 2 per cent of the eggs laid were viable. However, when irradiated male moths were caged with normal male and female moths, in the proportion of 10 : 1 : 1, the sex ratio of the adult offspring was 1 : 1 and both sexes were mostly fertile.

In laboratory experiments in which (a) 50 irradiated males, (b) 50 irradiated males and 50 irradiated females, or (c) 50 irradiated females (both sexes exposed as pupæ to 30,000 rads), were added to cages containing 5 normal male and 5 normal female moths, the deposition of viable eggs was reduced 98 per cent in (a), 66 per cent in (b), and 60 per cent in (c).

In orchard experiments (cages over dwarf apple trees) in which both irradiated males and females (exposed as pupæ to 40,000 rads) were caged with normal male and female moths, in the proportion of (a) 10 : 10 : 1 : 1, and (b) 20 : 20 : 1 : 1, the number of adults in the  $F_1$  generation in (a) remained about the same as the number of normal adults present in the parent generation, whereas the number of  $F_1$  adults in (b) was reduced to one-sixth of the number of normal adults present in the parent generation. However, when irradiated males alone were caged with normal male and female moths, in the proportion of (c) 10 : 1 : 1, and (d) 20 : 1 : 1, the number of adults in the  $F_1$  generation was reduced in (c) to about one-third, and in (d) to about one-tenth of the number of normal adults in the parent generation.

These results indicate that the sterile male technique may be a promising method for the control of the codling moth. The method will be tested in the field.

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<sup>1</sup> Knipling, E. F., *Smithsonian Inst. Ann. Rep.*, **58**, 409 (1959).

### A Survey Method of Trypanosome Infections in *Glossina*

THE incidence of trypanosome infections in wild populations of tsetse flies (*Glossina morsitans* West (Muscidae: Diptera)), varies from one locality to another, and seasonal changes also occur. The method hitherto used to determine infection-rates has been the dissection of samples of live flies as described by Lloyd and Johnson<sup>1</sup>. This has the disadvantage of requiring the establishment of a team of microscopists in the bush, so that examination of simultaneously collected samples over wide areas is difficult. The recognition of trypanosomes in the mouthparts of preserved wild *Glossina* is not possible because regurgitation of stomach contents, which may occur when the insect is placed alive in the preservative, renders many of them opaque.