forwards and backwards, reaching beyond the equator of the egg by $4\frac{1}{2}$ hr. and into the posterior third by 6 hr. Descriptive studies confirm that the site of the differentiation centre is the prothoracic segment, as in other insects, and also reveal that subsequent major events in gastrulation begin at this point. Further investigations are now being pursued to localize the differentiation centre of *D. tryoni* more precisely.

The present work also confirms that determination in the cyclorrhaphan egg is completed at a very early stage[5,6], since none of the developing parts here separated by ligature showed regulation.

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Distribution of *Acarapis woodi* (Rennie)

Mites determined as *Acarapis woodi* (Rennie) were found recently on one of the escorts with a queen bee (*Apis mellifera* L.) from California. This suggested a wider distribution than previously recorded, and a survey of commercial apiaries in Queensland was commenced. The mite is widely spread on bees in this State.

In the meantime *A. woodi* was found on bees from other American States, New Zealand, and also from Italy.

These findings certainly extend the known distribution of the species.

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Numerical Regulation of Populations of the Codling Moth, *Cydia pomonella* (L.)

The numerical regulation of the codling moth has been investigated in the Australian Capital Territory. Each year, part of the population undergoes two complete generations and begins a third, most individuals of which fail to survive. The other part of the population enters diapause, and the species overwinters as mature, diapausing larvæ produced mainly in the second generation.

The level of infestation is always very high in unsprayed orchards, irrespective of size of crop. It was found that the pest multiplies each year to densities which are limited by the supply of larval food, that is, pome fruits, particularly apples.

The extreme suitability of the local environment for codling moth is determined by: (1) a very long season, extending from mid-October to late March, during which weather conditions are almost continuously favourable; (2) the extensive use of a very late maturing apple variety (Granny Smith); and (3) the absence of effective antagonists.

Intraspecific competition both for larval food and for cocoon shelter is the essential mechanism for

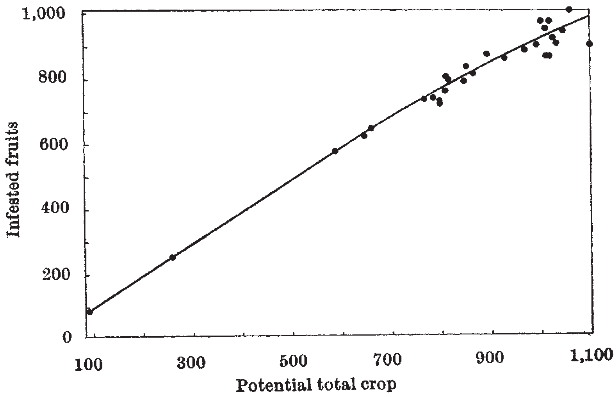

Fig. 1. Relationship between the potential number of fruits and the number of fruits penetrated by codling moth per tree. Dots, observed values; line, calculated values

numerical adjustment of the species in this environment.

It is known that larvæ may feed successively in several fruits, and that several larvæ may develop from the same fruit. However, these occurrences are exceptional. In general, only one individual survives after simultaneous infestation of the same fruit by several larvæ and one mature larva is produced for almost every infested fruit. Competition for larval food is thus a form of contest[1].

In a homogeneous plot of twenty-nine apple bushes, the relation between the potential total crop and the number of penetrated fruits per tree was described satisfactorily by the equation:

$$Y = X\left(1 - e^{-\frac{N}{X}}\right)$$

where Y is observed number of penetrated fruits per tree; X is potential number of fruits per tree (estimated from total numbers of fruit buds in spring); N is number of penetrations per tree (Fig. 1).

This equation is a variant of that used by Nicholson and Bailey[2] to describe random searching. Random search implies that all fruits are equally liable to penetration and that newly hatched larvæ are incapable of avoiding fruits which are already infested or otherwise unsuitable as food. This lack of discrimination intensified contest as population density increases, and makes complete infestation of a crop improbable. Furthermore, the equation postulates that the number of penetrations is similar on all trees of the plot irrespective of size of crop. This does in fact occur when the trees provide a comparable supply of cocoon shelter.

Larval development is completed in the fifth instar. Mature larvæ leave the fruits and seek sites in which to spin a cocoon and pupate. Whereas non-diapausing larvæ are often content to spin a flimsy cocoon in very poor shelter, overwintering individuals search their environment intensively for favourable sites. These occur mainly on the trees, under loose bark and in cracks, wounds and debris. However abundant such sites may be, they are not as a rule found easily by larvæ. Many larvæ fail completely to find adequate shelter and are lost, usually by predation. The favourable overwintering sites are potentially accessible to the remainder, some of which are successful and establish their