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An Artificial Diet for Rearing Coccinellid Beetles¹

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One of the most important factors limiting the use of coccinellid beetles in the biological control of certain insect pests is the difficulty experienced in rearing sufficient quantities. The standard method of rearing them on suitable hosts is often impracticable because of their restrictive diets. Such difficulties were encountered when the introduction of some coccinellid beetles was attempted in French Morocco, as a control measure for a coccid (*Parlatoria blanchardi* Targ.) on date trees. The problem of rearing or obtaining the host in sufficient quantity greatly hampered the production of the predators. For this reason, considerable time and effort was devoted to the development of a satisfactory and economic technique for the breeding of these predators on artificial media.

Several formulae were tried with different nutrients. Some gave very poor results in that they proved lethal or had a repellent action. However, the medium which gave best results, and the one which was finally adopted, consisted basically of cane sugar, honey, agar, and royal jelly. The royal jelly is essential to the formula. Presumably, it enriches the medium by virtue of its growth stimulating factors (vitamins and yeast) and, because of its asptic qualities, prevents development of bacteria and other harmful microorganisms. It is prepared as follows: Dissolve 1.3 gm. of agar, 16 gm. of cane sugar and 6 gm. of honey in 100 gm. of hot water and cool to 35-38°C. Separately, add 4.5 gm. of royal jelly to 20 c.c. of the original mixture, and stir constantly until a homogeneous white emulsion is obtained. Combine the two and add 0.5 gm. of alfalfa flour yeast and 2 gm. of pulverized dry insects which are natural prey of the species to be reared. Stir vigorously and cool 5°C. for storing. Slight variations in the above quantities will not affect its stability. The main object is to obtain a medium which should, when cool, be of medium density, neither too hard nor too soft. This diet has proved excellent for the rearing of adult coccinellids, but for the larvae of some species it should be supplemented with three parts beef jelly and one part royal jelly.

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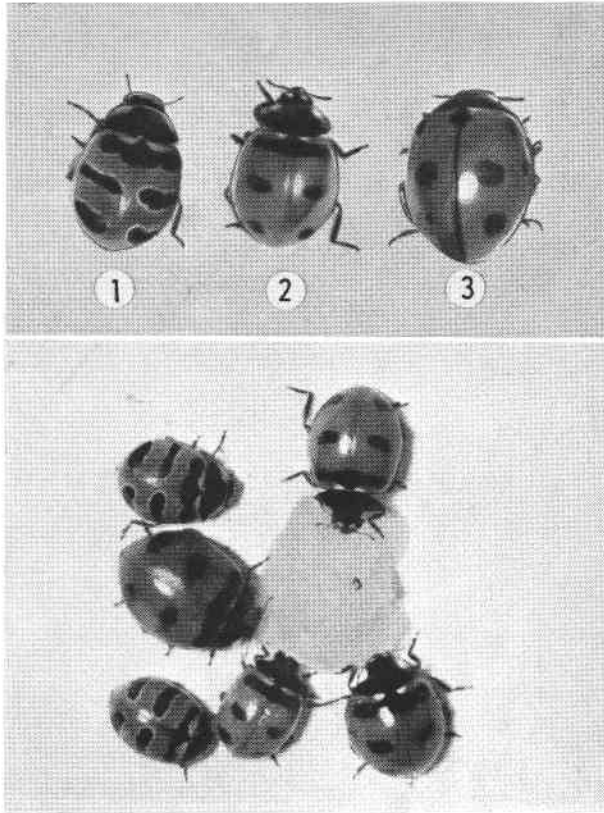


Figure 1. Feeding of coccinellid adults on artificial food.

1. *Coccinella trifasciata* L.,
2. *C. transversoguttata* Fald.,
3. *C. novemnotata* Hbst.

The medium should be fed to the insects at a temperature of 27-30°C., and a relative humidity of 60-80 per cent in the form of small crumble or pellets about 5 cm. in diameter which should be deposited on a piece of white paper. Coloured paper, especially yellow or purple, acts as a repellent. It has also been observed that certain species of coccinellids eat more readily when their food is covered with a piece of paper under which they find protection. Petri dishes make satisfactory rearing chambers.

To date, the following species of coccinellids have been reared successfully on these two artificial media: *Thea vigintiduopunctata* L., *Coccinella septempunctata* L., *Harmonia doublieri* Muls., *Harmonia conglobata* L., *Rhizobius lophantae* Blaisd., *Rhizobius litura* Fab., *Rodolia cardinalis* Muls., *Exochomus anchorifer* All., *Exochomus quadripustulatus* L. var. *floralis* Motsch., *Exochomus nigromaculatus* var. *nigripennis* Er., *Scymnus suturalis* Thung., *Scymnus kiesenwetteri* Muls., *Stethorus punctillum* Weise, *Chilocorus bipustulatus* L., *Scymnus pallidivestis* Muls., *Clitostethus arcuatus* Rossi, *Pharoscyrmus numidicus* Pic, *Pharoscyrmus ovoideus* Sic., *Mycetaea tafilaetica* Smirn.²

All these species developed more rapidly and the life-span for many was much longer than for those reared under natural conditions (Table 1). Furthermore,

²Family Endomychidae

TABLE I.
Comparison of the Longevity of Some Adult Coccinellidae when Fed Artificial
Media as Opposed to Natural Food

Species	Longevity of adults in days			
	Annual generation reared	With natural food	Without food	Fed artificial diet
<i>Exochomus nigromaculatus</i> Er.	III	20	5-10	20
<i>Thea vigintiduopunctata</i> L.	II	30	10	150
<i>Scymnus pallidivestis</i> Muls.	II-III	20-30	5-10	120
<i>Scymnus kiesenwetteri</i> Muls.	III	30-45	10-15	180-210
<i>Pharoscymnus ovoideus</i> Sic.	III	20	5	15-20
<i>Mycetaea tafilaetica</i> Smirn.	II	20-40	10-15	120-140

the adults were more active in that they moved more quickly, flew more frequently, and mated more readily.

Gravid females exclusively fed on this medium refused to lay eggs when left in petri dishes. However, when they were transferred to larger cages containing a small twig of the plant on which the species is ordinarily found in nature, oviposition occurred readily.

The use of the artificial medium has proved extremely advantageous for the mass rearing and retention of coccinellids in the laboratory. Also, when transporting the predators over long distances, the use of this artificial medium eliminates the necessity for the simultaneous transportation of the noxious host.

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