

A note on rearing of the monarch butterfly, *Danaus plexippus* (L.) on an artificial diet

PRITAM SINGH AND GRAEME K. CLARE

Entomology Division, DSIR, Private Bag, Auckland, New Zealand

ABSTRACT

An artificial diet and rearing method for the monarch butterfly has been developed in the laboratory. The butterflies that emerge are comparable in size and colour to field collected specimens.

Keywords: *Danaus plexippus*; monarch butterfly; rearing; artificial diet.

INTRODUCTION

The flight of the monarch butterfly, *Danaus plexippus* (Linnaeus) (Lepidoptera: Danaidae) is one of the most common sights around homes and gardens in New Zealand. The swan plant, *Asclepias fruticosa* (Linnaeus), a member of the milkweed family Asclepiadaceae, is the usual host of the brightly coloured caterpillars, and many people grow swan plants to encourage the butterflies to visit their gardens. As the caterpillars are voracious feeders they quickly defoliate these plants, limiting the food supply. As a result many immature caterpillars do not complete development.

This work was done: (1) to develop an artificial diet so that caterpillars could be successfully reared from egg to adult; (2) to provide an experimental insect so that research could be carried out all year round; and (3) to develop a "kitset" to study the life cycle of this attractive butterfly.

COMPOSITION OF DIET

The composition of the artificial diet is given in Table 1.

Table 1: Composition of artificial diet

Ingredients	Amount	%
Freeze-dried <i>Asclepias fruticosa</i> powder	50 g	13.9
Agar	4 g	1.1
Mould inhibitor**	6 ml	1.7
Distilled water	280 ml	77.9
Soluble casein	4 g	1.1
Yeast hydrolysate	2 g	0.6
Ascorbic acid	1 g	0.3
Sucrose	4 g	1.1
Vanderzant vitamin mixture modified supplement for insects***	0.8 g	0.2
Wheatgerm	4 g	1.1
Streptomycin sulphate BP*	60 mg	
Penicillin*	60 mg	
2% Formalin solution	4 ml	1.1
	359.8 g	100%

* not included in total weight

** Preparation of stock mould inhibitor solution

Nipagin (methyl *p*-hydroxybenzoate) 37.5 g

Sorbic acid 50.0 g

95% Ethyl alcohol 425 ml

Table 1:—continued

*** VANDERZANT VITAMIN MIX MODIFIED SUPPLEMENT FOR INSECTS	
INGREDIENTS	PERCENT
Vitamin E Acetate (50%)	1.600
Ascorbic Acid	27.000
Biotin	0.002
Calcium Pantothenate	0.100
Choline Dihydrogen Citrate	10.550
Folic Acid	0.025
i-Inositol	2.000
Niacin	0.100
Pyridoxine HCL	0.025
Riboflavin	0.050
Thiamin HCL	0.025
B-12 (0.1%)	0.200
Sucrose	58.323
	100.000

Leaf powder preparation

Asclepias fruticosa leaves were collected, washed and freeze-dried, then ground up into a very fine powder (mesh No. 36, 420 μ) and stored at 5°C until required.

Diet preparation

- Two hundred and fifty ml of distilled water and agar were heated until clear and then simmered for 5 minutes, with continuous stirring.
- Vanderzant vitamin mixture, soluble casein, yeast hydrolysate, ascorbic acid, sucrose, streptomycin sulphate, penicillin and 30 ml of distilled water were mixed together using a magnetic stirrer.
- The agar-water mixture was removed from heat and *A. fruticosa* powder and wheatgerm slowly mixed in.
- The mixture was then cooled to 60°C and the mould inhibitor solution, vitamin solution, and formalin added and mixed thoroughly.
- Diet was then thinly spread onto 6 × 1 cm strips of fine muslin cloth and stored at 5°C until required.

Eggs

Eggs were collected in the field from leaves of *A. fruticosa*, by using a moist fine camel-hair brush, and stored in petri dishes on moist filter paper until hatching.

Larval rearing

Larvae were kept in a controlled environment room at 25°C, 50% RH and an 18 h L:6 h D photoperiod. They were reared in small clear polystyrene vials (6.0 × 4.5 cm diameter) containing a strip of muslin-coated diet suspended from the centre of the lid by a wire hook. The lid was modified by making a 1 cm diameter hole in the centre and covering it with a fine nylon gauze.

Initially 5 neonate larvae were placed in each vial and later separated and reared individually to the 5th instar. Fresh diet was added daily until the completion of larval development. Larvae pupated on the fine nylon gauze of the lid.

Chrysalides

Each chrysalis was removed from the nylon gauze by carefully loosening the silken attachment pad holding it to the gauze. They were weighed and then hung by their silken pad by the use of a clothes peg attached to a wire until adult emergence (Fig. 1).

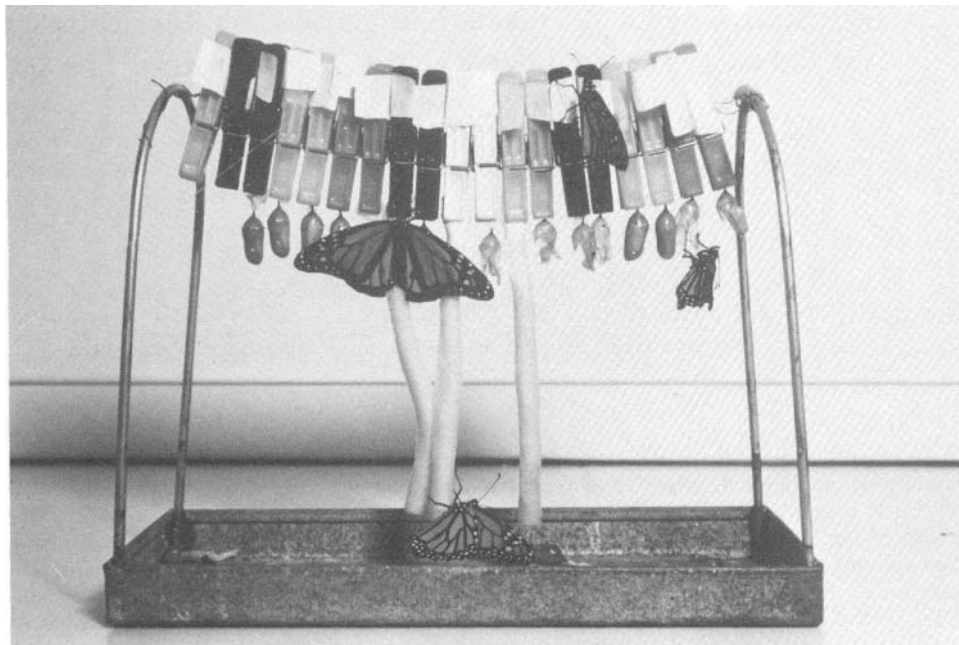


Fig. 1: Diet reared chrysalides hung on clothes pegs and emerging butterflies feeding on sugar solution via a cotton wick.

The developmental stages are given in Table 2. Adults produced were comparable to field collected specimens in size and colour. Fecundity data were not obtained due to the small number of specimens reared. Some voucher specimens have been deposited in the New Zealand Arthropod Collection.

Table 2: Development of *D. plexippus* on artificial diet

	Sex	n	Mean \pm S.E	Minimum	Maximum
Larval period (Days)	M	7	20.6 \pm 0.4	19	22
	F	7	19.6 \pm 0.8	16	21
Pupal Period (Days)	M	7	10.7 \pm 0.4	10	13
	F	7	10.1 \pm 0.3	9	11
Pupal weight (gm)	M	6	1.28 \pm 0.1	1.04	1.40
	F	7	1.30 \pm 0.1	1.10	1.47
Days to adult	M	7	31.0 \pm 0.5	29	33
	F	7	29.9 \pm 0.3	29	31