

El volumen fue calculado por trozas de tamaño variable a través de la fórmula de Smalian, considerando la última sección como un cono. Las tablas de volumen fueron desarrolladas usando modelos de regresión logarítmica.

Se probaron 15 modelos de regresión. Se utilizó el índice de Furnival, la distribución de los residuales, el coeficiente de determinación y la significancia de los coeficientes de la ecuación para seleccionar los modelos con mejor ajuste.

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#### A semi-synthetic diet for adult banana fruit scarring beetles, *Colaspis ostmarki* (Coleoptera: Chrysomelidae)

**Resumen.** Una dieta semi-sintética ha sido desarrollada con el propósito de mantener individuos adultos de *Colaspis ostmarki* Blake para ser utilizados en estudios de laboratorio y de campo. Los adultos se alimentan bien de la dieta y pueden ser mantenidos por períodos prolongados bajo condiciones de laboratorio. La longevidad y producción de huevos de estos adultos fue comparada con la de individuos alimentados con varios tejidos de plantas de banano.

Several species of *Colaspis* beetles attack banana fruit throughout the neotropics; *Colaspis ostmarki* Blake is the primary species in Costa Rica and Panama. The beetle is common in the Estrella Valley of Costa Rica plus other areas along the Atlantic Coast in both countries.

Previous attempts to study the insect have been difficult due to the inability to maintain adults under laboratory conditions. To overcome this problem, an artificial diet was developed whereby field collected adults could be held under laboratory conditions, see Singh (1).

#### Materials and methods

An artificial diet used by Wellso *et al.* (2) to feed adult cereal leaf beetles, *Oulema melanopus* (L.), was modified primarily through changes in the inhibitor part of the diet to maintain adult *C. ostmarki* in the laboratory (Table 1). To prepare the diet, the agar was dissolved in water by stirring and heating to boiling on a hot plate. The agar solution was cooled to 60° C and the other components were added in the following order: The components of "B" and "C" were added and blended for 1 min. The components of "D" and "E" were added, and the total mixture blended at high speed for 2 min. The blended diet was dispensed in the shape of a "c" with a aqueeze bottle into Petri dish bottoms. Adults preferred to rest off the diet, and readily moved to and from the diet; this circumstance reduced bacteria and fungal contamination because adult beetles did not walk or defecate as often on the diet. After the diet had cooled for about two hours, dishes were placed in plastic bags and stored in the refrigerator at 4°C for up to 2 weeks. One batch of diet yielded about 175 dishes (1.5 ml each).

Beetles were field collected from bananas in the Estrella Valley and one pair were placed within 24 hours after collection on either the diet or natural foods. Data on the longevity and egg production of

Table 1. Ingredients for semi-synthetic diet for adult *Colaspis ostmarki* (modified from Wellso, et al (2))

Ingredient	Amounts
A. Water	215.0 ml
Agar-agar	2.5 g
B. Formalin	0.75 ml
10% KOH	1.25 ml
Wheat germ oil	1.25 ml
Corn oil	2.80 ml
C. Methyl Paraben	0.35 g
Sorbic acid	0.20 g
l-thyl Alcohol - (Dehydrated U.S.P.) <sup>3</sup>	2.50 ml
D. Vanderzant vitamin Supplement - insect <sup>1-4</sup>	3.0 g 5.0 g
E. Chlorophyllin (Na - K - Cu)	0.10 g
Wheat germ (raw)	9.80 g
Casein	11.40 g
Sucrose	16.40 g
Wesson's salt mix <sup>2</sup>	3.25 g
Torula yeast	2.00 g
Brewers yeast	1.70 g
Alphacel	5.40 g
Egg albumen	2.50 g
Cholesterol	0.75 g
Gelatin	1.75 g
Streptomycin sulfate	0.025 g
Aureomycin	0.030 g

- (1) United States Biochemical Corporation, Cleveland, Ohio, 44128  
 (2) Bio Serv. Inc., P.O. Box BS, Frenchtown, N.J. 08825  
 (3) Methyl Paraben and sorbic acid dissolved in alcohol before adding to diet.  
 (4) Vitamin mixture dissolved in water before adding to diet

the beetles fed either the medium or natural foods were obtained by checking daily for adult beetle mortality and/or eggs. The diet was changed every other day.

Banana leaves, flowers, bracts and fruit were put into Petri dishes within 2 hours of collection. The unrolled leaf and very young fruit that were under the bract at time of collection were used. Banana fingers were cut in half lengthwise and the cut surface placed down on a piece of filter paper in each Petri dish. Food was changed every day.

### Results

Adult longevity and egg production was much higher on the semi-synthetic diet than on the banana tissue tested (Table 2). Young banana fruit supported the best egg production but longevity was about equal to banana flowers or bracts. Banana leaves did not support egg production and longevity was greatly reduced. Field populations commonly feed on the leaves, but these data suggest they can not reproduce without flower or fruit parts. Although adults fed on this diet for an average of 65.3 days and laid an average of 651 eggs per female, young larvae that just hatched from eggs could not be reared on this diet.

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Table 2. Biological data for *Colaspis ostmarki* beetles fed a semi-synthetic diet or natural food (banana leaves, banana flower parts and young green banana fruit).

Food	Number of pairs tested	Average days lived		Average number of egg masses laid per female	Average number of eggs per mass	Total eggs laid-average per female	Average number of eggs/day per female
		females	males				
Diet	25	65.3 (20-129)*	104.1 (14-248)	7.16 (2-17)	91.0 (50-146)	651.6 (155-1833)	9.95 (2.6-18.2)
Banana Leaves	20	8.0 (2-14)	8.2 (2-18)	0.0	0.0	0.0	0.0
Banana Flowers	20	20.1 (2-32)	20.5 (11-31)	0.50 (0-2)	64.3 (8-125)	32.2 (8-125)	1.40 (0.25-6.9)
Banana Bracts	20	18.2 (2-31)	15.2 (4-25)	0.45 (0-1)	58.6 (15-118)	26.4 (15-118)	1.58 (0.83-6.9)
Green Banana Fruit	20	20.1 (2-32)	20.6 (11-31)	0.77 (0-2)	82.3 (11-203)	63.4 (11-203)	3.09 (0.5-13.9)

\* Range

porting this study. Thanks are also due Elinar A. Manley, Italo Maineri, and Victor Urzola for their assistance with diet preparation and rearing aspects of the study.

### Summary

In order to maintain adults of *Colaspis ostmarki* Blake for laboratory and field studies a semi-synthetic diet was developed.

Adults fed well on the diet and lived for extended periods of time under laboratory conditions. Longevity and egg production of adults fed the test diet were compared to various individuals fed banana plant tissues.

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