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Development of the Rice Moth, *Corcyra cephalonica* (St.) on Different Grains

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ABSTRAK

Perkembangan rama-rama beras, Corcyra cephalonica *di dalam 'millet', sekoi, jagung, gandum, padi dan beras dalam keadaan bitirin dan hancur telah dikaji. Parameter-parameter berikut telah diamati:— peratus dewasa yang menjelma, purata jangka masa perkembangan dari peringkat telur hingga penjelmaan dewasa dan berat segar badan dewasa betina. Pada amnya bijirin-bijirin yang hancur adalah lebih baik sebagai bahan pembiak* C. cephalonica *dibandingkan dengan bijirin dalam keadaan bitirin. Beras hancur telah didapati sebagai bahan yang terbaik untuk membiak rama-rama ini diikuti dengan 'millet' bentuk bitirin.*

ABSTRACT

The development of the rice moth, Corcyra cephalonica *in millet, sorghum, corn, wheat, padi and milled rice, both as whole kernels and coarsely ground media, was studied. The parameters observed were:— percentage adults that emerged, average development time from oviposition to adult emergence and the fresh body weight of females. In general, ground kernels of all grains were more satisfactory for rearing* C. cephalonica *compared to whole kernels. The best all-grain ground and whole kernel media were milled rice and millet, respectively.*

INTRODUCTION

The rice moth, *C. cephalonica* infests padi and milled rice (Hutson, 1920; Kennard, 1965) millet and maize (Baloch, 1977 and Highlands, 1978), sorghum (Rao, 1954) and several stored agricultural products (Hodges, 1979).

Urs and Mookherjee (1966) studied the development of *C. cephalonica* on ground nut *Arachis hypogeae,* and 'til' *Sesamum indicum.* The percentage development of *C. cephalonica* on groundnut is higher (90.13%) compared to 'til' (66.85%). The number of eggs laid per female on ground and 'til' is 255 and 159, respectively.

The five hosts in the order of preference for *C. cephalonica* were: sorghum, maize, groundnut, rice and wheat (Sharma *et al.*, 1978).

Ayyar (1934) reported that the larvae of *C. cephalonica* developed more rapidly on maize (38 days) than on wheat, cotton seeds and groundnut-pods. It developed the slowest on cowpea (66 days).

Studying the development of the larvae of *C. cephalonica* on different rearing media, Cheng *et al.* (1978) found that the poor media were husked rice (cooking rice) and wheat flour.

Russel *et al.* (1980) studied the development of *C. cephalonica* on whole sorghum and millet.

The overall performance of *C. cephalonica* is better on millet than on sorghum.

This study was conducted to determine the influence of millet, sorghum, corn, wheat, padi and milled rice, both as whole and ground kernels, on the development of *C. cephalonica;* and to select a rearing medium that would best support the development of this moth.

MATERIALS AND METHODS

The stock culture of *C. cephalonica* and the recipe for the standard medium were obtained from the USDA Stored-Product Insects and Research Development Laboratory at Savannah, Georgia. The stock culture and experimental insects were maintained at 28 ± 1°C, 68 ± 3% RH and a photoperiod regime of 14L : 10D.

The standard medium was included as control. Its preparation was similar to that used in the previous experiment (Osman *et al.*, 1983).

Both whole and ground kernels of hard red winter wheat, yellow dent corn, pearl millet, light red sorghum and a medium-grain padi and milled rice were used. Whole kernels of grains were cleaned by sieving, using appropriate sized screens to remove foreign materials and broken kernels. Ground kernels were obtained by using a coffee grinder (Hobart Manufacturing Co.) set on 'extra coarse'. No yeast was added to these media. Cultures were inoculated with 25 mg (636 eggs) of 12 ± 12-hr-old eggs per quart Mason jar each containing 150 g of one of the media. Pupation sites, which consisted of corrugated cardboard rolls, were placed on the surface of the medium. Jars were closed using lids with brass screen and filter paper. Three replicates of each medium were set up.

The cultures were observed daily for adult emergence. The development period from oviposition to adult, fresh body weight of females, and the percent survival to adulthood were determined.

RESULTS AND DISCUSSION

In general *C. cephalonica* developed faster on ground grain than on whole kernels. No one grain type ranked the best in all the three parameters observed.

Adult Survival

The percentages of survival to adulthood for *C. cephalonica* reared on different grain media are presented in Table 1. Survival to adulthood was greatest on the standard medium ($P < 0.05$). Ground sorghum and milled rice allowed the highest survival of *C. cephalonica.* Ground corn, millet, wheat and padi along with the whole millet, sorghum and milled rice are in another group similar in effect on survival. Whole corn and wheat were poor survival media while padi was the poorest medium for adult survival.

TABLE 1
Percentage of survival to adulthood for *Corcyra cephalonica* St. reared on six different grains, at 68% RH and 30°C

Grain	% Survival[1]	
Standard medium	83.39	a
Sorghum (ground)	49.36	a
Milled rice (ground)	48.39	b
Corn (ground)	37.66	bc
Millet (ground)	34.13	c
Wheat (ground)	33.64	c
Millet (whole)	31.52	c
Rough rice (ground)	31.08	c
Milled rice (whole)	30.72	c
Sorghum (whole)	23.28	cd
Corn (whole)	14.41	d
Wheat (whole)	12.55	de
Rough rice (whole)	0.37	e

[1]Means followed by the same letter are not significantly different at 5% level, Duncan's Multiple Range Test.

Development Period from Oviposition to Adult Emergence

The development period of *C. cephalonica* was significantly shorter on the standard medium than on the whole and ground kernels (Table 2). Millet, both ground and whole, support the shortest development period of the all-grain media. Grains that ranked the lowest for number of adults produced were also least suitable for insect development. Insects reared in whole wheat and padi had the longest development period, 117.17 and 126.30 days, respectively.

Fresh Body Weights of Females

The standard media was surpassed by ground and whole kernels of both wheat and milled rice for the production of heavy females (Table 3). *C. cephalonica* had a very long development period both on ground and whole wheat compared to the standard medium (Table 2). This probably allowed for the extra weight gain of the female. Whole milled rice and millet produced lighter females and a shorter development time. Although insects raised in millet had the shortest development time compared to other grains, (52.29 days), the females were not the lightest.

TABLE 2
Development period of *Corcyra cephalonica* St. reared on six different grains, at 68% RH and 30°C

Grain	Days[1]	
Standard medium	42.82	b
Millet (ground)	52.29	ab
Millet (whole)	58.52	bc
Sorghum (ground)	59.87	bcd
Corn (ground)	61.43	bcde
Milled rice (ground)	71.72	bcde
Sorghum (whole)	72.87	def
Corn (whole)	75.26	ef
Milled rice (whole)	76.04	f
Rough rice (ground)	79.64	f
Wheat (ground)	80.30	f
Wheat (whole)	117.17	g
Rough rice (whole)	126.30	g

[1] Means followed by the same letter are not significantly different at 5% level, Duncan's Multiple Range Test.

TABLE 3
Fresh body weights of female *Corcyra cephalonica* reared on six different grains at 68% RH and 30°C

Grain	Weights[1] (mg)	
Wheat (ground)	38.94	a
Milled rice (ground)	38.94	a
Milled rice (whole)	35.19	b
Wheat (whole)	34.01	b
Standard medium	29.77	c
Millet (whole)	29.57	cd
Sorghum (whole)	29.12	cd
Millet (ground)	28.43	cd
Sorghum (ground)	28.41	cd
Corn (ground)	27.92	d
Corn (whole)	26.35	e
Rough rice (ground)	23.82	f
Rough rice (whole)	4.47	g

[1] Means followed by the same letter are not significantly different at 5% level, Duncan's Multiple Range Test.

Fresh body weights of females (Table 3) could be influenced by the nutritional value of the different grains. Wheat, compared to other grains studied, has the highest protein, fibre and vitamin content. Since padi, both ground and whole kernels, did not support *C. cephalonica* well in any of the three parameters observed, probably the husk that covers the rice kernels resists larval penetration or components in the husk of ground kernels affect larval development and survival.

Table 4 compares the development of *C. cephalonica* on six grains averaged either as

TABLE 4
Comparison of the development of *Corcyra cephalonica* St. on whole and ground kernels of six different grains

Parameter	Whole kernels	Ground kernels
Number of adults	51.56	106.78
Development period from oviposition to adult (days)	87.69	67.54
Percent adults that survived from eggs	18.81	39.04
Fresh body weights of females (mg)	26.45	31.08

whole or ground kernels. In general, *C. cephalonica* developed better on ground than on whole kernels. More adults were produced, development period was shorter, the percentage of adults that survived from the eggs was greater, and fresh body weight of females was higher than in whole kernels.

The 13 media were ranked from 'best' to 'poorest' for each parameter observed. The ranking for each medium was then averaged and the treatments were reranked from those with the highest number of points to the lowest (Table 5). The standard medium was the best medium for rearing *C. cephalonica,* while whole corn, wheat and padi were the poorest.

Rearing *C. cephalonica* at 28°C and 70% RH on sorghum that had 18% damaged kernels and 12.17% moisture content, Russel *et al.* (1980) determined that Tchad and Camaroon strains had a developmental period from egg hatch to adult of 46.00 and 58.33 days, respectively. In the present study, the similar parameter on sorghum, ground and whole kernels, was found to be 59.87 and 72.87 days, respectively. On millet (10% visible damaged grains and 12.9% moisture content), the same two strains took 33.28 and 41.0 days to develop, respectively. In this study *C. cephalonica* developed in 52.29 days on ground millet and 58.52 days on whole millet.

TABLE 5
Average ranking of grain types, based on 3 parmeters observed

1.	Standard medium
2.	Milled rice (ground)
3.	Sorghum (ground)
3.	Millet (ground)
4.	Millet (whole)
5.	Wheat (ground)
6.	Corn (ground)
7.	Milled rice (whole)
8.	Sorghum (whole)
9.	Wheat (whole)
10.	Corn (whole)
10.	Rough rice (ground)
11.	Rough rice (whole)

Sharma *et al.* (1978) found that the percentage of adults that survived on broken kernels of rice, maize, sorghum and wheat at 28°C, 75% RH and 12L : 12D photoperiod were 85.00, 81.67, 93.33 and 28.33, respectively.

The differences apparent between the present study and the findings from other authors would most probably be due to differences in experimental conditions, insect strains, the characteristics of the grain such as variety, moisture content and whether they are whole or ground kernels.

CONCLUSION

Ground kernels were more satisfactory for the development of *C. cephalonica* than whole kernels. Of the media used, ground milled rice was the best all-grain medium for support of *C. cephalonica.* It could be used as a culture medium in place of the standard medium. Millet was the best whole grain medium. Whole millet and ground milled rice provided the most rapid growth and shortest generation time. Rice should then be stored as padi to reduce damage from *C. cephalonica.*

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