A single grub was found to consume on an average 41.2 to 71.5 eggs/day. It took only 25 sec for consuming a single egg. A single adult beetle consumed as many as 40–50 mites/day including both nymphs and adults. The present investigation reveals the potential predatory nature, especially of the grub of *S. gracilis* on the eggs of *O. indicus* and the preference for nymphs and adults of the mite by the adult beetle. Hence, this predatory beetle can effectively be utilized in the biological control programme against sorghum mite, *O. indicus*.

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INFLUENCE OF PLANT AND ANIMAL FOOD ON FOOD UTILIZATION OF THE FRESHWATER CARP *LABEO ROHITA* (HAM.)

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Food intake, which determines rates and efficiencies of absorption and conversion[1,2] is influenced by both the quantity[3] and the quality[4,5] of food. While reports on the effects of carnivorous diets on food utilization of fishes are considerable[6,7] those on herbivorous/omnivorous diets are scanty. The present investigation deals with the influence of combination of plant and animal food on bioenergetics of the freshwater carp *Labeo rohita*.

Labeo rohita (3 ± 1 g live weight) were acclimated to the laboratory conditions and feeding schedule. Fortyfive glass jars (capacity 3 l) were taken and divided into 5 series and each was further divided into 3 groups (3 jars in each) and *L. rohita* were separately introduced into each jar. The first series (9 jars) of individuals were fed *ad libitum* on 100% plant diet viz: *Amaranthus spinosus, Amaranthus gangeticus* and *Spirogyra maxima*; the second series of *L. rohita* (9 jars) were fed on 100% animal diet (frog thigh muscle, freshwater mussel and goat liver) and the remaining 5 groups were fed on a combination of plant and animal diets (50:50). The test individuals (15 in number) were taken from the original stock dried at 80°C and weighed to measure the initial dry weight of the test individuals[8]. Every day a control sample of 5 g weight of each food was dried at 80°C and weighed and the water content of the different foods was estimated separately for presenting the energy budget values in dry weight. Unconsumed food was removed daily, dried and weighed. Faecal pellets were collected everyday, dried and weighed. The scheme of energy budget followed here is the slightly modified IBP formula[10] represented as follows: C (consumption) = p (growth) + R (metabolism) + F (faeces). The regime was conducted at 28 ± 2°C for 30 days and after that the fish were sacrificed and the weight changes were recorded.

Among the plant food, *L. rohita* showed greater affinity to feed on *S. maxima* (49 mg/g/day) than on *A. gangeticus* (41 mg/g/day) and on *A. spinosus* (29 mg/g/day). When compared with plant diet, the animal food (except in freshwater mussel) produced elevated values in feeding rate. When freshwater mussel alone was supplied the feeding rate was very low (15 mg/g/day). *S. maxima* in combination with goat liver and freshwater mussel yielded high values of 194 mg/g/day and 98 mg/g/day feeding rates respectively. Hence it is suggested that in the case of freshwater mussel and goat liver, the supplementation of plant food (*S. maxima*) accelerated food consumption, whereas in all other combinations supplementation of animal food enhanced food consumption. Working on the energy balance of the fish *Macropodus cupanus* fed on the combination of algal and animal food, Mathavan and Christopher[11] reported the maximum feeding in fish fed exclusively on animal food and the feeding rate declined steadily with increasing proportion of plant (algae) in the food.

L. rohita fed on pure *A. spinosus* showed the maximum conversion rate of 4.1 mg/g/day followed by those fed on pure *A. gangeticus* (2.2 mg/g/day) and pure *S. maxima* (1.8 mg/g/day). Among the animal food, growth rate was negative in the case of goat liver-fed individuals (− 4.9 mg/g/day and was the least in the case of those fed on freshwater mussel (0.5 mg/g/day). Supplementation of plant food to goat liver and freshwater mussel enhanced the growth rate in all the three combinations. Supplementation of frog thigh muscle to *A. spinosus* and *S. maxima* increased the conversion rate from 4.1 to 5.2 mg/g/day and 1.8 to 3.8 mg/g/day respectively, but when supplied with *A. gangeticus*, the same caused a decrease. Previous workers[12] attributed high metabolic demand as the reason for the negative conversion of the grasscarp *Ctenopharyngodon idella* fed on goat liver, and for the poor conversion of the freshwater snail *Pila globosa* fed on 100% plant food[9]. In *L. rohita* too, the negative growth in cent per cent goat liver or the poor conversion in goat liver + *A. spinosus* combination was due to high metabolic demand. Metabolic rate of *L. rohita* fed on goat liver (cent per cent) showed the highest value of 60 mg/g/day (87% of consumed food).

Data obtained for absorption efficiency ranged from 65 to 85% for plant food, 85 to 94% for animal food and 76 to 98% for food combinations. In most cases (except in *A. spinosus*) animal food supplementation increased the conversion efficiency. Similar results were also reported earlier[9,12,13].

In the present investigation, the combination of *S. maxima* and goat liver produced the highest value of 194 mg/g/day feeding rate, which was quite unexpected for the poor conversion efficiency of 2% (table 1). Reddy and Katre[14] reported 120 mg/g/day as the maximum feeding rate for the air-breathing catfish *Heteropneustes fossilis*. Data obtained for the

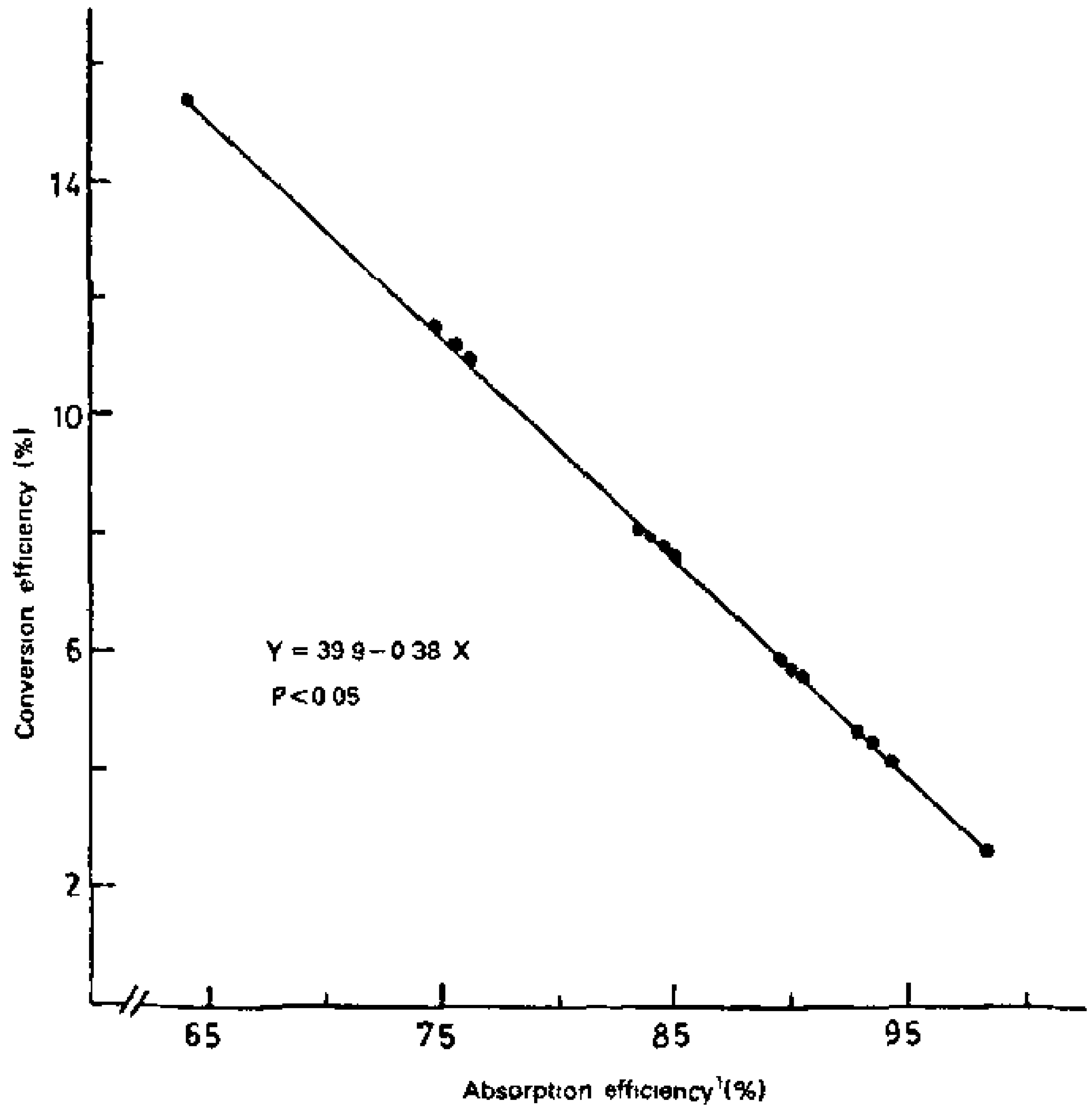

Figure 1. Simple regression for the efficiencies of absorption and conversion of *L. rohita* fed on different combinations of plant and animal food.

feeding rate and conversion efficiency of *H. fossilis* did not show any correlation. Figure 1 shows the relationship between the efficiencies of absorption and conversion (net) in *L. rohita*. Simple regression and students *t* test analysis confirmed a significant ($P < 0.05$) negative correlation. This supports the earlier reports of Vivekananthan *et al*[15], and Odum[16].

Table 1 *Effects of plant food, animal food and food combinations on energy budget of L. rohita (values are mean ± SD of 3 animals one, in each group)*

Food	Feeding rate	Absorption rate	Metabolic rate (mg/g/day)	Conversion rate	Metabolism (% of feeding)
AS	28.8 ± 7.84	18.6 ± 4.60	14.5 ± 3.46	4.1 ± 1.13	50.3 ± 12.01
AG	41.0 ± 1.62	30.7 ± 1.76	28.5 ± 1.48	2.2 ± 0.28	69.5 ± 3.61
SM	49.2 ± 6.92	41.7 ± 3.46	39.9 ± 3.25	1.8 ± 0.21	81.0 ± 6.61
GL	67.1 ± 22.30	63.2 ± 20.90	68.1 ± 20.10	−4.9 ± 0.77	86.8 ± 29.96
FT	76.2 ± 12.16	68.5 ± 11.30	64.4 ± 11.03	4.1 ± 0.28	84.5 ± 14.48
FW	14.8 ± 2.19	12.6 ± 2.89	12.07 ± 2.75	0.53 ± 0.14	81.0 ± 18.46
AS + GL	40.8 ± 3.95	34.4 ± 8.27	34.0 ± 8.34	0.4 ± 0.07	83.3 ± 20.44
AS + FT	67.1 ± 8.20	60.3 ± 1.55	55.1 ± 2.26	5.2 ± 0.70	82.1 ± 3.37
AS + FW	30.8 ± 6.22	25.9 ± 1.69	24.4 ± 2.62	1.5 ± 0.56	99.2 ± 7.34
AG + GL	26.8 ± 5.02	25.0 ± 4.80	22.5 ± 3.67	2.5 ± 0.42	83.9 ± 13.69
AG + FT	45.8 ± 9.47	42.5 ± 7.14	40.5 ± 7.28	2.0 ± 0.14	88.4 ± 15.90
AG + FW	80.4 ± 10.56	60.7 ± 8.65	53.0 ± 6.86	7.7 ± 1.13	65.9 ± 8.53
SM + GL	194.4 ± 53.02	175.5 ± 44.83	17.25 ± 43.90	3.3 ± 0.91	88.5 ± 22.58
SM + FT	46.3 ± 1.69	35.2 ± 0.70	31.4 ± 0.84	3.8 ± 0.14	67.8 ± 1.81
SM + FW	98.0 ± 20.64	96.3 ± 13.29	90.2 ± 14.84	6.1 ± 1.48	92.0 ± 15.14

AS – *Amaranthus spinosus*; AG – *Amaranthus gangeticus*; SM – *Spirogyra maxima*; GL – Goat Liver; FT – Frog thigh muscle; FW – Freshwater mussel.

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GENOTOXIC ACTIVITY OF NAPHTHYL CARBAMATE IN THE LARVAL STAGES OF *DROSOPHILA*

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For an evaluation of the practical significance of mutagens, the value of the sex-linked recessive lethal (SLRL) test in *Drosophila melanogaster* is generally recognized[1]. Today this test is regarded as the most sensitive one available in the *Drosophila* system as it can detect point mutations and other genetic changes[2-5].

Naphthyl carbamate (Sevin) is shown to induce chromosomal breakages in plants[6]. Brzheskii[7] described his results in the SLRL tests as inconclusive. Sinha and Sinha[8] demonstrated the induction of sex-linked recessive lethals by Sevin in *Drosophila*. Because of conflicting reports on the mutagenicity of Sevin in different systems, the present study was undertaken to evaluate its mutagenic property through SLRL tests in the larval stages of *D. melanogaster*.

Three *Drosophila* stocks, 1. w^{co}/w^{co}, 2. $fs(1)\ K_{10}\ w/Y$ and 3. M-5/M-5 (for details of markers please see Lindsley and Grell[9]) have been used in the present studies. All these stocks are maintained on standard cornmeal–molasses–agar–yeast culture medium at 25 ± 2°C. The eggs were collected after mating the virgins of stock-1 with males of stock-2 on petri dishes containing normal food for duration of four hours. On hatching, different aged (72 hr, 48 hr and 24 hr) larvae were collected by floating them off in 50% glycerine and were fed in vials with Sevin supplemented food for a period of 48, 72 and 96 hr respectively. The LD_{50} (median tolerance limit) dose of different larval treatments was determined by counting the emerged adults from the vials. For each treatment hour, the LD_{50} dose (lethal) and 50% of this dose (sublethal) were taken into account (table 1) and the standard Muller-5 mating scheme was carried out[10,11]. The statistical methods are based on the tables of Kastenbaum and Bowman[12] and the χ^2 test of goodness of fit to the Poisson distribution.

The mutagenicity of naphthyl carbamate on the male germ line cells of *D. melanogaster* has been tested through the M-5 technique and the results are summarized in table 1. Figure 1 depicts the comparison of lethal induction between the control and the treated series. The frequency of induction of sex-linked recessive lethality increases over the control frequency in all the treated series at 1% level of significance. The dose-effect curves (figure 2) indicate the increase in lethality is related to both the concentration of Sevin as well as the treatment hours.

The 24 hr and 48 hr larvae, on being fed with the LD_{50} dose, yielded 2 individual males in the former and 1 from the latter-two lethal chromosomes each. These appear to be an indication of induction of clusters[13,14]. Such clusters are expected to have a common origin when the lethality is induced in premeiotic cells of the developing gonad. Clark[13]