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Research Article
Impact of Milk Protein Additive to Adult Diet on Biological Parameters of *Bactrocera cucurbitae* (Diptera: Tephritidae)

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Abstract

Background and Objective: The melon fly, *Bactrocera cucurbitae* is a very serious pest of fleshy fruits and vegetables in Bangladesh. Damage levels can be reached up to 100% of unguarded cucurbit crops. The impact of milk protein casein hydrolysate as additive to adult diet on the biological parameters of *B. cucurbitae* was studied. The objective of this study was to examine the effects of 2 artificial adult diets on different biological parameters of *B. cucurbitae*. **Materials and Methods:** Experiments were conducted by using same sizes of adult rearing cages fencing with nylon net. Two different diets (Yeast extract: Sugar, 1:3 as $Diet_1$ and Casein hydrolysate: Yeast extract: Sugar, 1:1:3 as $Diet_2$) were served as adult food source and tap water with soaked cotton as water. Sweet gourd was given as egg laying and larval food medium. **Results:** Mean egg incubation period was 2.33 days in both diets. Larvae and pupae of D_2 took slightly higher duration than D_1. Adult emergence% and male-female ratio indicate a positive correlation to D_1 though a slightly higher population of overall adult and female produced in D_2 in F_1. Pupae and their weight also indicate a better result in D_1. Results showed no significant differences for egg incubation period, larval duration, pupal period, pupae recovery, adult emergence and sex ratio of *B. cucurbitae*, reared on 2 different adult diets. It indicates that casein hydrolysate as milk protein additive had no remarkable effect on different biological parameters of the melon fly, *B. cucurbitae*. **Conclusion:** Results revealed that yeast extract and sugar (1:3) diet (D_1) was most suitable for the development of melon fly in sterile insect technique under laboratory condition.

Key words: *Bactrocera cucurbitae*, rearing, artificial adult diet, cost-effective, sterile insect technique

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Fruit flies (Diptera: Tephritidae) are extremely noxious pests of fruits and vegetables. They are very common insect pests of economic importance in tropical, subtropical and several temperate regions[1]. Their wide spread nature makes them internationally importance in sustainable fruit and vegetable production as well as trade issues. Most of the species of fruit flies are polyphagous and thus damage a wide range of fruits and vegetables[2]. There are 5,000 documented species in Tephritidae family under 6 subfamilies and 500 genera are available throughout the world. Among them 70 species of fruit flies are important agricultural pests on different vegetables and fruits of tropical and subtropical regions[3,4] that are considered the main horticultural pests worldwide[5,6]. Feeding by their larvae (maggots) damages the fruit internally, causing it to ripen prematurely and rot. Upto 100% of fruits may damage by fruit fly when lift uncontrolled. As such, their infestation not only reduces the fruit yield but also affects the quality and commercial value of the crop. Therefore, billions of dollars of agriculture commodity are lost due to these pests every year worldwide. Around 40 species of fruit flies under the *Bactrocera* genera are considered the most significant group of insect pests from the economic point of view. These are *Bactrocera dorsalis* (Oriental fruit fly), *B. cucurbitae* (Melon fly), *B. oleae* (Olive fruit fly), *B. tryoni* (Queensland fruit fly) and *B. zonata* (Peach fruit fly)[7].

The melon fruit fly, *B. cucurbitae* (Coquillett) (Diptera: Tephritidae) has 125 plant species as host in Hawaii, whereas 42 host species in South-East Asia. It is also known as *Dacus cucurbita*. In Bangladesh, among other fruit flies infestation in different vegetables *B. cucurbitae* covers 74.5% of the total population[8]. It is a primary pest of cucurbits, tomatoes and peppers as well as some uncultivated plants. The fruits of bitter gourd (*Momordica charantia*), Muskmelon (*Cucumis melo*), snap melon (*Cucumis melo*), snake gourd (*Trichosanthes anguina* and *T. cucumeria*) and bottle gourd (*Lagenaria siceraria*) are also highly cherishing host of this species[9].

Various methods have been applied to control insect pest in different regions of the world. Among them sterile insect technology (SIT) has been proved as an efficient tool for controlling this pest and it is a target-specific environmentally safe control method for insect pests. Before applying SIT, it is essential to ensure a clear knowledge of biological parameters of the target pest and a pre-requisite is to develop healthy adult. To produce healthy adult it is necessary to maintain the lab reared colony with a good dietary supplement that is cost effective for a successful application of SIT in the field[10]. Thus, the objective of this study was to observe the effects of 2 artificial adult diets for *B. cucurbitae*. A series of tests was done in which milk protein additive (i.e., casein hydrolysate) was added to the existing artificial adult diet to determine the effect on some biological parameters of the fly. The experiments could identify the role of milk protein enriched diet in mass reared flies under laboratory condition.

MATERIALS AND METHODS

Experiments were conducted during July, 2017 to March, 2018 at the laboratory of Institute of Food and Radiation Biology (IFRB), Atomic Energy Research Establishment (AERE), Savar, Dhaka. Effects of adult diet on biological parameters of *Bactrocera cucurbitae* i.e., egg incubation period, larval and pupal period, pupal volume, pupal weight, adult emergence and sex ratio were studied.

Fruit fly stock culture: Laboratory cultures of *B. cucurbitae* were maintained in the fruit fly laboratory, Radiation Entomology and Acarology Division, Institute of Food and Radiation Biology (IFRB), Atomic Energy Research Establishment (AERE), Savar, Dhaka. Adult flies were reared in a steel frame cage (12×10×8 cm) covered with nylon net. Temperature and relative humidity (RH) of the rearing room were maintained at 25±2°C and 65-70%, respectively and of 10:14, light:dark photoperiod.

Diet preparation and delivery system: Experiments on adult diets were conducted using same sizes of rearing cages fencing with nylon net. Adults emerge from randomly selected 50 pupae from the lab stock were kept in those cages. After adult emergence, certain amount of 2 different diets (Yeast extract: Sugar, 1:3 and Casein hydrolysate: Yeast extract: Sugar, 1:1:3) were served in petri dish in 2 separate adult rearing cages as adult food source. Fifty mililiter conical flask full of tap water with soaked cotton was provided as water source. Residual diets were discarded and fresh diet was provided in every 2 days interval. After 14 days of adult emergence, sweet gourd was collected from the local market and provided in adult rearing cages for egg laying medium. Then sweet gourd was kept in plastic bowl with saw dust for larval development.

Pupae collection: Fifty pupae form the laboratory stock were kept in 2 different adult rearing cages. Adults emerge from these cages considered as parent generation. After maturation, (280.00 g in F_1 and 400.00 g in F_2) sweet gourd was provided in every adult rearing cage. Two (2 h) later

sweet gourd were removed and kept in plastic bowl with sawdust at the bottom for pupation. Sawdust was sieved and pupae were counted and recorded. Recovery of pupae from each parent cages were replicated 2 times namely D_1R_1 and D_1R_2 of Diet 1 (D_1) cage as well as D_2R_1 and D_2R_2 of Diet 2 (D_2) cage in F1 generation (F_1). In F2 generation (F_2), emergence of adult from the above 4 replications were again replicated 2 time each namely D_1R_1A, D_1R_1B from D_1R_1 cage and D_1R_2A, D_1R_2B from D_1R_2 rearing cage. In D_2 cages same method was followed to get the replication as D_2R_1A, D_2R_1B from D_2R_2 cage, D_2R_2A, D_2R_2B from D_2R_2 rearing cage. Male and female ratio was maintained at 1:3 in F_2 where 48 adult flies were kept in each adult rearing cage.

Statistical analysis: Randomly selected 50 pupae of all replications in 2 generations (F_1 and F_2) weighed with electronic balance (Denver AA-160 USA). Fly mortality was checked daily and dead individuals were removed. Egg incubation period, larval period, pupal duration, numbers of male and female in every replication were recorded sincerely. Pupal volume was calculated by using a 10 mL measuring cylinder and sex ratio was calculated with the formula of female/total flies. The experiments were copied three times. Data were analyzed with statistical software SPSS version 24. Mean values, standard deviation and standard errors were calculated by descriptive statistics. Significant differences among different parameters were compared to the least significant difference (LSD) test by one way ANOVA. Differences were shown in Tukey's HSD test. Significance level in one way ANOVA test was calculated up to 0.05. Graphical presentation was shown by using Microsoft Office software version 2007.

RESULTS AND DISCUSSION

Biology study (egg-pupae): The effects of 2 different artificial diets on the egg incubation period of *B. cucurbitae* are presented in Table 1. Highly insignificant difference ($F = 0.00$, $df = 10$, $p = 1.00$) and equal mean ($M = 2.33$ days) duration in both generations were shown that milk protein casein hydrolysate had no significant effect on egg incubation period. The maximum and minimum egg incubation was 3 and 2 days in D_1 and D_2, respectively. Egg incubation of F_2 with total 8 replications in 2 diets also showed the same result ($F = 0.00$, $df = 22$, $p = 1.00$) (Table 2) and the mean periods were 2.33 days. Flies reared on 2 different adult diets laid eggs in their natural food (sweet gourd). The mean of larval duration of *B. cucurbitae* is shown in Table 1. Highly insignificant ($F = 0.00$, $df = 10$, $p = 1.00$) (Table 2) results showed that larval development period in all replications of F_1 and 4 replications of D_1 in F_2 was same ($M = 5.17$ days). The insignificant ($F = 2.02$, $df = 22$, $p = 0.17$) result of D_2 in F_2 with a minor difference in mean ($M = 5.67$ days) duration indicated that D_2 had no positive effect on larval development. Chang[11] did not find any significance differences in larval productivity of *B. dorsalis* and *B. cucurbitae* in different yeast products.

Table 1: Mean and standard deviation of different biological parameters of *Bactrocera cucurbitae* in 2 consecutive generations under 2 adult diets

Biological parameters	$Diet_1$ Mean±SD	$Diet_2$ Mean±SD
F1 generation		
Egg incubation period (days)	2.33±0.52[a]	2.33±0.52[a]
Larval period (days)	5.17±0.75[a]	5.17±0.75[a]
Pupal period (days)	7.67±0.82[a]	8.17±1.17[a]
Egg-pupae recovery (days)	15.83±1.47[a]	16.00±0.89[a]
Total pupae (number)	259.17±56.91[a]	261.17±53.94[a]
Volume of 100 pupae (mL)	2.77±0.06[a]	2.79±0.08[a]
Pupal weight (g)	0.017±0.002[b]	0.016±0.001[c]
Adult emergence (%)	78.07±0.09[c]	81.25±0.50[d]
Male (%)	49.32±6.52[a]	46.40±0.13[a]
Female (%)	50.87±6.78[a]	53.59±0.13[a]
Sex ratio	0.49±0.12[a]	0.53±0.08[a]
F2 generation		
Egg incubation period (days)	2.33±0.49[a]	2.33±0.48[a]
Larval period (days)	5.17±0.94[a]	5.67±0.78[a]
Pupal period (days)	8.17±1.03[a]	8.75±0.62[a]
Egg-pupae recovery (days)	16.75±1.36[a]	17.00±1.41[a]
Total pupae (number)	567.42±112.18[b]	322.67±131.37[c]
Volume of 100 pupae (mL)	2.77±0.09[a]	2.77±0.09[a]
Pupal weight (g)	0.014±0.002[a]	0.014±0.002[a]
Adult emergence (%)	89.26±4.39[a]	90.38±2.09[a]
Male (%)	47.80±3.91[a]	50.57±6.50[a]
Female (%)	52.20±3.91[a]	49.43±6.50[a]
Sex ratio	0.52±0.08[a]	0.49±0.08[a]

Mean values within a row followed by the same letter do not significantly different from each other (Tukey LSD-α, $p = 0.05$)

Mean pupal period was short in D_1 than D_2, indicating that D_1 could give better result for large scale laboratory rearing of *B. cucurbitae* (Table 1). The relationship between Diet and pupal duration was insignificant ($F = 0.74$, $df = 10$, $p = 0.41$ in F_1 and $F = 2.82$, $df = 22$, $p = 0.11$ in F_2) (Table 2). Mean of egg-pupae recovery in 2 adult diets of *B. cucurbitae* is shown in Table 1. Insignificant difference on both generations ($F = 0.06$, $df = 10$, $p = 0.06$ in F_1 and $F = 0.19$, $df = 22$, $p = 0.66$ in F_2) (Table 2) showed that casein had no remarkable effect on egg-pupae (life span) of the melon fly. Irregular number of pupae was recorded in different replications of 2 diets. Mean number of pupae in F_1 was 259 and 261 in D_1 and D_2 respectively, while approx. double number of pupae were produced in D_1 of F_2 (Table 1). Results indicate that D_1

Table 2: ANOVA table shows the F and p-value of different biological parameters in 2 generation of *Bactrocera cucurbitae* on 2 adult diets

	ANOVA					
	F1 generation			F2 generation		
Biological parameters	Mean square	F	Significance	Mean square	F	Significance
Egg incubation period (days)	0.00	0.00	1.00	0.00	0.00	1.00
Larval period (days)	0.00	0.00	1.00	1.50	2.02	0.17
Pupal period (days)	0.75	0.74	0.41	2.04	2.82	0.11
Egg-pupae recovery (days)	0.08	0.06	0.82	0.38	0.19	0.66
Total pupae	12.00	0.00	0.95	359415.38	24.09	0.00
Volume of 100 pupae (mL)	0.00	0.43	0.52	0.00	0.00	0.98
Pupal weight (g)	0.00	35.64	0.00	0.00	0.72	0.39
Adult emergence (%)	10.11	77.64	0.01	2.49	0.21	0.67
Male (%)	8.49	0.40	0.59	15.29	0.53	0.49
Female (%)	7.45	0.32	0.62	15.29	0.53	0.49
Sex ratio	0.00	0.31	0.59	0.00	0.86	0.37

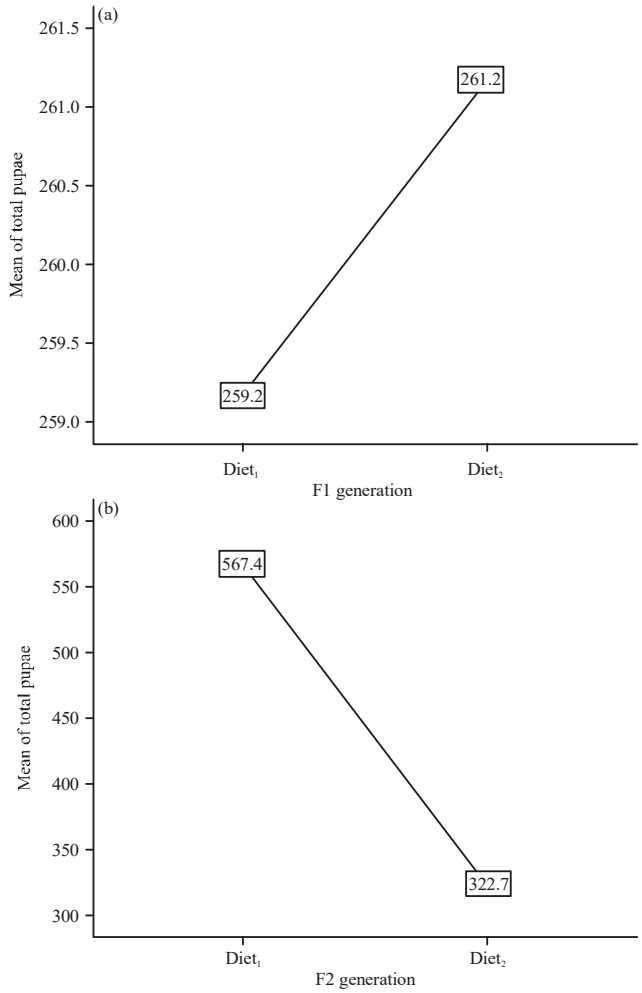

Fig. 1(a-b): Total number of pupae of *B. cucurbitae* produced from 2 different diets in 2 successive generations

performed better as adult diet on *B. cucurbitae*. Molnarova *et al.*[12] suggested that consuming yeasts could be

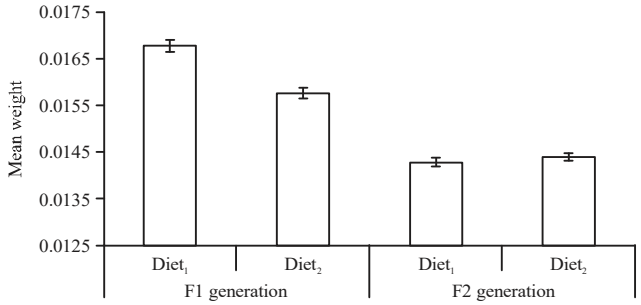

Fig. 2: Pupal weight of F_1 and F_2 generation on 2 different adult diets of *B. cucurbitae*

nutritionally beneficial to the larvae. Saha *et al.*[10] showed that sweet gourd as larval food and yeast: sugar (1:3) as adult food produced large number of eggs and pupae of *B. cucurbitae* in 2 consecutive generations. Number of pupae obtained from 2 different generations on2 adult diets is presented in Fig. 1. The one way ANOVA table revealed that highly insignificant (F = 0.00, df = 10, p = 0.95) difference of pupae was produced in F_1 although the mean number of pupae was not so high (Table 1) in 2 different diets. Opposite result was observed in F_2 and the relation of 2 different diets were highly significant (F = 24.09, df = 22, p = 0.00). Mean number of total pupae recovery in D_1 and D_2 was 567 and 322 respectively. Similar results were reported from the experiment of Saha *et al.*[10] in case of *B. cucurbitae*. Mean of 100 pupae volume in F_1 was high on D_2 and it was similar in F_2 (Table 1) on both diets. Insignificance result of one way ANOVA (Table 2) shows that D_1 is suitable for mass scale rearing of *B. cucurbitae*.

Pupal weight: Results of the present study confirmed that pupal weight in F_1 of 2 different diets were highly significant (F = 47.45, df = 596, p = 0.00) compare with parent generation as well as 2 replications of the both diets (Fig. 2).

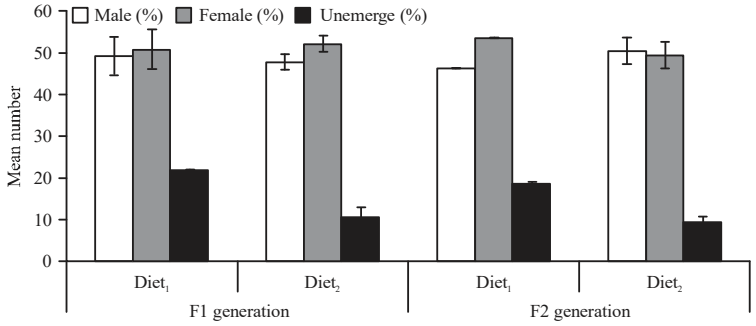

Fig. 3: Percentage of male, female and not emerged pupae in 2 generations under 2 different diets of *B. cucurbitae*

Here the second replication of D_1 gained maximum weight (Mean = 0.018 g) than the second replication of D_2 (Mean = 0.015 g). Tukey's HSD test revealed that the mean difference of D_2R_1 ($p = 0.13$) and D_2R_2 ($p = 0.10$) was not significant compared with D_1R_1 in this generation, Providing similar result of Pascacio-Villafan *et al.*[13]. They showed that yeast had the strongest positive linear effect on pupal weight of *Anastrepha ludens*, followed by corn flour and corncob. Likewise, the second replication of D_2R_1 and D_2R_2 in F_2 demonstrated higher pupal weight (Mean = 0.014 and 0.015 g, respectively) that influence the whole result of F_2. Insignificant difference of ($F = 0.72$, $df = 1198$, $p = 0.40$) one way ANOVA table showed that D_2 perform better in laboratory rearing of *B. cucurbitae* though the mean difference was ignorable in first 2 replications of both diets. Saha *et al.*[10] found heavy weight pupae of *B. cucurbitae* from sweet gourd as larval media than other 6 natural hosts.

Adult flies (emergence rate): Effects of 2 adult diets on adult emergence percentage of *B. cucurbitae* are presented in Fig. 3. Here, D_2 shows higher average mean (Mean (%) = 87.33) of adult emergence while one replication in D_1 shows the highest average mean (D_1R_2A, Mean (%) = 93.81). Insignificant value of one way ANOVA ($F = 0.28$, $df = 10$, $p = 0.61$) supported D_2 as adult diet with a minor high percentage (M (%) difference = 1.80) of adult emergence. Similar result was found in the experiment of Saha *et al.*[10], where they showed that 88.00 and 98.00% of adult flies of *B. cucurbitae* emerged from their natural host sweet gourd in F_1 and F_2, respectively. It also supported the result of Pascacio-Villafan *et al.*[13], they showed that adult emergence rate of *A. ludens* was comparatively higher in yeast than corn and corncob ingredients. Therefore, yeast is considered a major source of nutrition for fruit flies due to its appropriate concentration of protein, sterols, vitamins and minerals. It also an important component and used to mass rearing of larvae and adult diets for rearing of tephritid flies[14].

Male-female percentage: Percentages of average male emergence of *B. cucurbitae* in 2 generations under 2 different adult diets are shown in Fig. 3. Both generations showed insignificant difference in both diets ($F = 0.40$, $df = 2$, $p = 0.59$ in D_1 and $F = 0.52$, $df = 6$, $p = 0.49$ in D_2), where D_1 performed better in F_1 and D_2 evident better performance in F_2 though the mean difference ($D_1 = 2.92$ and $D_2 = 2.76$) was ignorable. In case of female emergence, both generations show insignificant relationship ($F = 0.32$, $df = 2$, $p = 0.62$ in D_1 and $F = 0.53$, $df = 6$, $p = 0.49$ in D_2). The difference of mean percentages of female emergence were ignorable ($D_1 = 2.73$ and $D_2 = 2.77$) (Fig. 3).

Sex ratio: Sex ratio shows a vis-a-vis result in 2 generations of *B. cucurbitae* on 2 diets. In F_1 the ratio enrich in D_2 where it gains in D_1 in F_2 (Table 1). Insignificant results of ($F = 0.31$, $df = 10$, $p = 0.59$ in F_1 and $F = 0.57$, $df = 22$, $p = 0.37$ in F_2) one way ANOVA in both generations reveal that casein hydrolysate had no positive impact on sex ration of *B. cucurbitae* (Table 2).

Panduranga *et al.*[15] evaluated the artificial larval diets for mass rearing of the melon flies in SIT program. They tested 8 different diets containing Brewer's yeast in various quantities (g) as protein sources. In their results pupal recovery, larval duration, pupal weight, adult emergence rate were statistically significant except sex ratio though the total number were not showed remarkable variation with the other tested diets. Comparing with the results of their control diet (LD-C) and our D_1, they found 66.82% pupal recovery, 8.33 days for larval duration, 1.32 g pupal weight, 77.00% adult emergence and 1.16 of sex ratio from the control diet where we found similar fashioned of pupae recovery, larval period, pupae weight, adult emergence rate and sex ratio of D_1 (Table 1). It suggested that a certain amount of yeast diets both for larva and adults were sufficient for mass scale rearing in SIT of melon fly. Moadeli *et al.*[16] experimented and evaluated the yeasts in gel larval diet for *B. tryoni* where they

compared brewer's yeast, torula yeast and hydrolysed yeast mixed with various proportions. In the results they showed *B. tryoni* performed poorly when reared on only or mostly hydrolysed yeast diets with the quality parameters of egg hatch (%), egg-larva duration (days), pupal number, pupal weight, adult emergence (%), adult fliers and sex ratio comparing with brewer's or torula yeast diets. They found no significant difference amongst yeasts in egg hatch (%) and sex ratio. Overall the diets containing large portion of hydrolysed yeast tended to be less effective as larval diets. It suggested that plain yeast based diets are better than hydrolysed yeast based diets in case of *Bactrocera* flies (larva- results of Moadili *et al*.[16] and adult- results of present study) mass scale rearing for SIT. Shinwari *et al*.[17] examined the impact of artificial larval diets on *B. zonata* in laboratory condition with 5 different yeast based diets containing with fixed proportion of basic ingredients (sugar, sodium benzoate, water, wheat bran, mipagen and HCL) and yeast products (yeast extract, protein hydrolysate+Baker's yeast, Torula yeast, protein hydrolysate and Baker's yeast) both in liquid and solid diets composition. They found more or less similar results of various life history parameters (female fecundity, egg hatchability, mean pupae recovery (%), mean adult emergence (%) and mean (%) of male-female sex ratio on different diets. Comparing with the other 4 yeast based diets Baker's yeast (locally produced) was the most economical diets of mass rearing of *B. zonata* they suggested, following the results of the present study we found yeast and sugar 1:3 performed better than protein additive adult diet in the quality parameters of *B. cucurbitae*.

Chang *et al*.[18] compared the effect of Brewer's yeast composition as larval diet in quality parameters of *B. dorsalis*. In large scale rearing, they found diet with 15.00% composition of brewer's yeast perform better than those of 22.5% composition. They showed statistically insignificant results in the quality parameters of pupal weight, adult emergence rate, adult flier (%), eggs/female and egg hatch (%). In case of mean pupal production (%) the result was statistically significant though 15.00% of brewer's composition diet produced remarkable higher (%) of pupae. From their result it can be concluded that the additional proportion of brewer's yeast had not play any effective role in laboratory rearing of this pest flies. Recently, a study was undertaken by Karthik *et al*.[19] to evaluate dietary constituents consisting of honey, water, protein hydrolysate and yeast powder at various quantity. Diet consists of protein hydrolysate, honey, water resulted in shorter pre-oviposition period, longer oviposition period; adult longevity for male and female and high fecundity. Further, the diet consisting of yeast powder, honey, water was also found equality effective on the life history parameters of the melon fly, *B. cucurbitae*. That is both diets containing protein hydrolysate and yeast powder were suitable diets for development of *B. cucurbitae* for mass rearing and continuous availability of the insect, directed towards Sterile Insect Technique (SIT). Larval period almost same in protein hydrolysate+honey+water and yeast powder+honey+water diet on an average the larval period was 10 days respectively. A similar tendency was followed in our results. The authors also noticed that pupal period of *B. cucurbitae* was not significant in the diets mixed with protein hydrolysate+honey+water and yeast powder+honey +water in different proportion, where the average pupal period was 9 days respectively. Supporting the results of present study, we found the mean pupal periods were 7.67 and 8.17 days in D_1 and D_2 with the maximum of 9 and 10 days, respectively in F_1. The pupae of *B. cucurbitae* took maximum 10 days in both diets with statistically insignificant result ($F = 0.74$, $p = 0.41$ in F_1 and $F = 2.82$, $p = 0.11$) in F_2. The present result also followed Rabab *et al*.[20], where they reported that larval and pupal period of *B. zonata* were 10 and 8 days, respectively when reared this insect on diet containing soybean and gelatin as protein source. According to Saha *et al*.[10] as the pupal number were almost similar with the present study on larval natural host (sweet gourd) with adult artificial diet (yeast extract and sugar, 1:3 mixture) compare with other 6 larval natural diet, then mean pupal volume expected to be followed the similar pattern of the present results. Alim *et al*.[21] evaluated 8 dietary effect on various parameters of *B. cucurbitae*. They showed that in case of per-oviposition period the diet of casein: yeast extract: sugar, proteose-peptone: sugar, brewer's yeast: sugar and baking yeast: sugar had almost similar effect. They showed that diet as yeast extract and sugar acted better in melon fly laboratory rearing which supported present study. Da Silva Neto *et al*.[22] conducted a study on the Mediterranean fruit fly, *Ceratitis capitata* (Tephritidae) for mass scale rearing by using low-cost yeast products produced in Brazil. They made a comparison between hydrolysate protein and 2 other commercial yeast base products autolysed yeast and yeast extract on female fecundity, adult survival and egg viability of med fly. Finally, they suggested that hydrolysate protein had no positive effects on the fertility and survival rates of most insects including *C. capitata* with the reference of Burger *et al*.[23]. And the local yeast products demonstrated good result on male and female longevity compared with hydrolysate protein. It supported the result of present

experiment. Chang[11] evaluated yeasts and yeast products in larval and adult diets of three species of tephritid fruit flies (*B. dorsalis*, *C. capitata* and *B. cucurbitae*) where adult flies were reared on diet of yeast and sugar 1:3 ratio. They reported no significant differences in egg hatch (%) regardless of the yeast type in diet of the treated fruit flies. The developing period of the present study of *B. cucurbitae* was 13-18 and 13-19 days respectively in D_1 and D_2 in F_1 where 12-19 and 15-17 days in D_1 and D_2, respectively in F_2. Results are in consistency with the present study, suggesting that local yeast as larval diets as well as adult diets are suitable for laboratory rearing of fruit flies.

CONCLUSION

The present study could play an important role for selecting a cost-effective adult diet for the rearing of melon fly, *Bactrocera cucurbitae* in different experimental procedure related to sterile insect technique (SIT) program. The adding of extra milk protein (casein hydrolysate) to the regular food (Yeast extract: sugar, 1:3) showed no significant difference in the biological parameters of the laboratory rearing of *B. cucurbitae*.

SIGNIFICANCE STATEMENT

This study revealed casein hydrolysate (as milk protein) did not show any significant effect on the biological parameters of the melon fly, *B. cucurbitae*. The regular adult diet (Yeast extract: sugar, 1:3) which is currently used, can be continued to rear the fly under laboratory conditions. Besides, yeast extract is low cost available ingredient than casein hydrolysate; no difficulty for diet preparation and also in preservation. Thus, this diet facilitates fruit fly (Tephritidae) rearing and research in the laboratory for sterile insect technique application.

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