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Protein Content in *Oecophylla Smaragdina*, Fabricius Consumed in upper Assam of North East India.

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ABSTRACT

Different species of edible insects contribute to variation in nutritional value which depends on the host plant, season and geographic location. The present study was aimed to assess the amount of protein of Oecophylla smaragdina, Fabricius in different developmental stages, castes and in different seasons of the year collected from Upper Assam, North East India. Significant differences ($p<0.05$) were observed among all the groups and between same caste of queen and worker. The protein content in this particular species Oecophylla smaragdina of present study was 10-60 percent. Differences in developmental stages, caste and impact of season are quite evident in the study.

KEYWORDS: *Weaver ant, Oecophylla smaragdina, protein, host plant, caste.*

INTRODUCTION

The practice of using insects and their larva as food is an age old culture. Over 1600 species of insects are eaten by humans but the culture varies from active avoidance to occasional and substantial consumption (Raubenheimer and Rothman, 2012). Among various cultures especially in many developing countries insects are eaten as vital and preferred food and an essential source of protein and other essential nutrients (Durst and Shono, 2010). Vant (2003) reorted that use of traditional food is sustainable and has economic, nutritional and ecological benefits for rural communities in developing countries. Numerous studies have reported the nutritional value of insects. But the different species of edible insects contribute to variation in nutritional value and even the chemical composition of related species may vary as it depends on the plant they feed on season and geographic location. Raksakantong *et al.* (2010) suggested the insects as the cheapest source of animal protein. Edible insects are reported to play an important role as a part of human nutrition in many parts around the world such as Africa, Asia and Latin America (Alletor, 1995).

Assam is one of the oldest states of India with diverse ethnic population which consume varieties of edible insects. With the development and modernization of human life style, eating of edible insects has been lost in urban area but the custom of eating insects is still prevalent in some rural places in Assam. The weaver ant, *Oecophylla smaragdina*, Fabricius (locally known as- 'Amroli porua') is used as traditional food amidst Ahom community of upper Assam of North East India. But still it is far away from commercialization and is yet to be popular among the urban population.

Studies on nutrient composition of different insects from different habitats have reported that insect bodies are rich in protein, amino acids, fat, vitamins and trace elements. (Alamu *et al*., 2013). Researchers from different parts of the world presently give attention to formulate insect food as an alternative and sustainable food source with cost effective production for underdeveloped and developing countries which are facing increasing food scarcity of high nutritive value . It is therefore of utmost importance to develop the culture practice with proper knowledge of nutritive composition of individual insect along with their different body parts. The present study is therefore undertaken to assess further the protein content of *Oecophylla smaragdina*, Fabricius available in Upper Assam of North East India in different developmental stages and different seasons of the year depending on availability of the insect.

MATERIALS AND METHODS

Live insects of three different developmental stages as larva, pupa and adult of two castes as queen and worker were collected from mango tree from Upper Assam of North East India. Insects were collected in different seasons from January to June and November and December.

Protein was estimated in larvae, pupae and adult stages of worker and queen *Oecophylla smaragdina* following the method of Lowry *et al*.(1951).Whole body homogenate was used for the estimation of protein content.

A standard protein and distilled water was used as reference and blank with the

following reagents for the estimation. 1.5 ml of alkaline solution (0.5 ml of 4% solution of sodium-potassium-tartarate was added to 50 ml of 2g% solution of Na2CO3 and shaked. Then 0.5 ml of 2g% CuSO4 solution was added to the mixture and shaked well). Then 150µl folin reagent (Freshly prepared by adding 0.5ml of folin ciacaltau reagent in 1 ml of distilled water) was added. Optical densities were measured at 670 nm in a computerized Photometer (BTS-320)

RESULTS AND DISCUSSION

The interest in the use of insects as food has been reported in several reports (Umoh et al., 1980; Dreyer and Wehmeyer, 1982; Ukhun and Osasona, 1985; ashiru, 1988; Onigbinde and Adamolekun, 1998; Ekpo, 1989, 2003; Ekpo and Onigbinde, 2004, 2005, 2007). These insects are usually eaten as part of a meal or complete meal. Insects are believed to have higher proportion of protein than beef and fish. In the northwest Amazon contribution of protein from mature insects is 12 to 26 percent during May to June when a peak in availability occurs (Feng et al., 1999).

The insects are generally consumed in this locality during the period of March to June due to their prevalence during this period. In rainy season due to nonavailability of the insects, the study was restricted only for a period of eight months from November to June. The protein content in Queen Pupa was observed to be highest from March to June. During this period comparison of mean values as presented in Table II exhibited significant differences ($P<0.05$) among all the groups and between same castes of Queen and worker. But these differences in protein content of different study groups in rest of the period from November to February was apparent only without any significant differences ($P>0.05$).

From nearly 100 analyzed edible insects at different stages of development the raw protein is reported to be 20-70 percent (Chen and Feng, 1999; Yang, 1998; Hu, 1996; DeFoliart, 1992; Mitshuhashi, 1992; Comby, 1990; Ramos-Elorduy and Pino, 1989). In the present study conducted on *Oecophylla smaragdina*, Fabricius from Upper Assam area showed 27 to 59% in queen larva, 26 to 46% in queen pupa and 26% protein in adult queen during the period of March to June. But comparatively lower values were observed in case of different stages of worker caste which were recorded as 15 to 35% in worker larva, 12 to 27% in worker pupa and 10 to 18% in adult worker. The reports of the present study though supports the findings of the earlier workers still it depicts relatively lower range of protein content in this particular insect from this locality. During winter season from November to February the range of protein content was observed as 12 to 14% only in almost all the groups. Relatively higher amount was observed in larval stage of both castes (Queen and Worker). The role of habitat plant cannot be ignored in this case because the present study was restricted only to the *Oecophylla smaragdina* of the mango tree. Alamu *et al.* (2013) reported that host plant variation plays a significant role in the nutrient composition of edible insects. Seasonal variation, caste variation and difference of protein content in developmental stages were distinctly observed in the present study. The highest amount of protein was observed in the month of March in all the developmental stages and in both the castes. The value was found to be declining gradually with the season and lowest amount was observed in the month of February. (Table I)

Variation in protein content is observed in the present study with the stage of the insects and period of their availability and abundance. Omotoso and Adedire (2007) reported that protein content of mature Palm weevil is higher than that of the immature.

The protein content of *Oecophylla smaragdina* collected from Upper Assam of North East India was found in the range of 10 to 60%. Lower amount was observed in worker caste and seasonal variation was quite distinct in all the study groups.

Detail study with different body parts and host plant effect is needed for commercialization of this edible insect as a good food source.

The protein contents of larvae, pupae and adults of queen and worker *Oecophylla* and variation between different stages are presented in Table- II.

Table- I: Mean, and ±SD of Protein (mg/gm) in different developmental stages of *Oecophylla smaragdina*, Fabricius

Stages	Stat.	March	April	May	June	November	December	January	February
Queen larva	Mean	587.50	475.00	387.84	273.46	136.16	132.45	133.67	125.61
	±SD	133.99	108.53	88.51	62.25	30.78	29.90	30.18	28.56
Queen pupa	Mean	456.67	525.00	278.27	262.12	135.29	130.61	132.92	123.27
	±SD	104.09	119.98	63.39	59.69	30.57	29.48	30.01	28.05
Queen adult	Mean	263.33	283.33	214.86	258.3	130.32	120.21	130.21	122.85
	±SD	59.77	64.51	48.84	58.78	29.41	27.10	29.39	27.96
Worker larva	Mean	350.83	112.50	120.51	146.50	135.31	124.05	124.05	116.33
	±SD	79.79	25.36	27.19	33.12	30.55	27.97	27.97	26.54
worker pupa	Mean	267.50	124.26	98.89	139.23	129.62	125.54	123.54	114.82
	±SD	60.77	28.05	22.24	31.46	29.24	28.32	27.85	26.21
Worker adult	Mean	184.17	97.79	103.21	130.25	120.69	119.58	119.58	115.61
	±SD	41.71	21.98	23.22	29.40	27.20	26.95	26.94	26.38

Table -II: Showing significance of differences in the mean values of Protein (mg/gm) in the different developmental stages of *Oecophyllasmaragdina*Fabricius

Months	Differences	Queen			Worker			Queen Larva and Worker Larva	Queen Pupa and Worker Pupa	Queen Adult and Worker Adult
		Larva and Pupa	Larva and Adult	Pupa and Adult	Larva and	Larva and Adult	Pupa and Adult			
March	t	3.45	9.88	7.20	3.72	8.28	5.86	6.79	7.02	4.86
	p	<0.05	<0.05	<0.05	<0.0	<0.05	<0.05	<0.05	<0.05	<0.05
	df	38	38	38	38	38	38	38	38	38
April	t	-1.38	6.79	7.93	-1.39	1.96	3.32	14.55	14.55	12.17
	p	>0.05	<0.05	<0.05	>0.0	>0.05	<0.05	<0.05	<0.05	<0.05
	df	38	38	38	38	38	38	38	38	38
May	t	4.50	7.65	3.54	2.75	2.17	-0.60	12.91	11.94	9.23
	p	<0.05	<0.05	<0.05	<0.0	<0.05	>0.05	<0.05	<0.05	<0.05
	df	38	38	38	38	38	38	38	38	38
June	t	0.59	0.79	0.20	0.71	1.64	0.93	8.05	8.14	8.72
	p	>0.05	>0.05	>0.05	>0.0	>0.05	>0.05	<0.05	<0.05	<0.05
	df	38	38	38	38	38	38	38	38	38
November	t	0.09	0.61	1.65	0.60	1.60	1.00	0.09	0.62	1.07
	p	>0.05	>0.05	>0.05	>0.0	>0.05	>0.05	>0.05	>0.05	>0.05
	df	38	38	38	38	38	38	38	38	38
December	t	0.20	1.36	1.16	-0.17	0.51	0.68	0.92	0.55	0.07
	p	>0.05	>0.05	>0.05	>0.0	>0.05	>0.05	>0.05	>0.05	>0.05
	df	38	38	38	38	38	38	38	38	38
January	t	0.08	0.37	0.29	0.06	0.51	0.46	1.05	1.02	1.19
	p	>0.05	>0.05	>0.05	>0.0	>0.05	>0.05	>0.05	>0.05	>0.05
	df	38	38	38	38	38	38	38	38	38
February	t	0.26	0.31	0.05	0.18	0.09	0.09	1.06	0.98	0.84
	p	>0.05	>0.05	>0.05	>0.0	>0.05	>0.05	>0.05	>0.05	>0.05
	df	38	38	38	38	38	38	38	38	38

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