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Composition of morphology and biochemical in Crab

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The freshwater crabs were collected from the Padma river near the Rajshahi district of Bangladesh during May, 2015 to October, 2015 to investigate its morphology and proximate composition. The present study showed that the available range of the body weight (BW) was 6-10 g; carapace width (CW) 26-30 mm; carapace length (CL) 21-25 mm; abdomen width (AW) 11-15 mm and abdomen length 11-15 mm. The sex ratio was varied from month to month and overall sex ratio was found 1:1.68. The sex ratio was uneven in most size groups and in most of the months. The chi-square (χ^2) value was significant for P. lamellifrons. T-test shows the difference between male and female crab. The present study was also conducted to evaluate the proximate composition of P. lamellifrons. Total body parts of crabs were cut into three fragments (cephalothorax, cheliped and legs) and their proximate composition were analyzed using instrumental technique. In the present study proximate composition moisture, protein, fat, ash and cholesterol were ranges from (56.01-68.92)%, (34.23-34.46)%, (0.53-9.34)%, (9.54-18.05)% (0.06137-0.2168)% respectively. Among the different body parts of the collected freshwater crab cephalothorax contents highest amount of moisture, protein, fat and cholesterol compared to cheliped and legs whereas, cheliped contain highest amount of ash than cephalothorax and legs. Except ash, amount of moisture, protein, fat and cholesterol were observed in the different body parts of the investigated crab in the following order Cephalothorax>Cheliped>Legs. Present investigation results revealed the presence of essential nutrient specially protein in the all body parts of the crab.

Keywords: Biochemical Composition, Freshwater Crab, Morphology, Padma River, *Paratelphusa lamellifrons.*

INTRODUCTION

Crustaceans comprises 15% of the total fishery catch, among them crab are highly nutritious and are excellent means of obtaining protein, lipids, minerals and vitamins hence are economically important group of crustaceans

(Aygul and Mehmet *(*2008); Rameshkumar et al., 2009). Crabs are belongs to the phylum Arthropoda and subphylum Crustacea. The fresh water crabs is significantly an important for biological role in the food webs. More than 6,700 known species of Brachyuran crabs and over 1300 true fresh water crabs were identified along in the world. The true freshwater crabs are fully adopted for freshwater, semi-terrestrial or terrestrial appears of life and has with the ability of characterization of complete the life cycle entirely in that region. The freshwater crabs are good source of food and medicinal values and are an important role in the food chain of aquatic ecosystem (Cobb et al.,1975; Fang et al., 1992). Crabs are part of the basic components of the ecosystem and they are consumed as food in many countries. Freshwater crabs are also consumed for purported medicinal and tonic properties, including treatment of stomach ailments and physical injuries (Dai 1999). Crab is one kind of shellfish that is a good source of high-quality protein. Crab fishery in its fast developing and there is a scope for crab meat due to its delicacy and nutritional richness. Some species of crabs are edible and number of others is commercially important for fisherman industry. The crabs are increasingly realized as potential food sources of various minerals and high-quality protein (Ravichandran et al., 2009; Ravichandran and Kanagalakshmi, 2012). The proximate composition of crustaceans has become necessary as crustaceans are used for food by man and their processing wastes are utilized for the manufacture of livestock feeds (Medenhall, 1971). Any information on the proximate composition is helpful in assessing the nutritive value of organisms and has a great importance due to the good effect on human health (Banu, 2007). Although the nutritive value of freshwater crabs is very much crucial yet there is no clear cut information about the nutritional status of freshwater crabs in Bangladesh. So, an attempt has been made to study the morphology and proximate composition (moisture, protein, fat, ash and cholesterol) in the different body parts of freshwater crab *P. lamellifrons from* Padma River of Rajshahi City of Bangladesh.

MATERIAL AND METHODS

Collection of specimen

The freshwater crabs *Paratelphusa lamellifrons* were collected from the Padma River of the Rajshahi City of Rajshahi district from May, 2015 to October, 2015 by using net or 'kholsoon'. The collecting device was mainly "kholsoon". Besides Net, Thusi, Duayr were used to collect crabs species. Sometimes crabs were collected through hand.

Transportation process

Transportation is one of the most important sides of the study. The plastic container can be used for short time transportation. On the other hand, the banana bark and jute bag can be used for long time transportation. When transporting through banana bark, few small pores are formed for proper aeration to the banana box. In case of jute bags, the bags are tight carefully. Supply of water and food during the transportation were not necessary. In present study plastic containers were used for transportation. When transporting through plastic containers, few small pores were formed for proper aeration to the plastic containers.

Acclimatization in the laboratory

Live crabs were transported to the Ecology Research Laboratory, Department of Zoology, Rajshahi University. The collected crabs were acclimatized in the laboratory. The laboratory condition or prepared habitat was not properly similar to their natural habitat. The variation in water quality was found. So the crabs were kept near the rearing plot or aquarium for the several days without food and then released them into the aquarium.

Rearing in the laboratory

Rearing technique was maintained by following process: collected crabs were immediately transferred to the laboratory and were kept in aquarium made by glass and in a soil pot. These were filled with tap water which was maintained with constant gentle aeration. The aquarium and the tub were kept both dry and wet places for crabs. The supplied crabs feed were SIS fish, small snail (*Pila globosa*), aquatic weeds (*Hydrilla sp.)* and sometimes flour (in pellet form) was supplied as a food item for crabs. Water was changed from the aquarium and the soil pot. The dead crabs were picked up to keep the environment afresh.

Food feeding during the rearing

In general, crabs are opportunistic omnivorous, eating on a variety of food, with a preference for animal food. The freshwater species *Paratelpusa lamellifrons* is omnivorous, feeding on algae, water plant, detritus and insect larvae. The animal food usually consists of bivalve molluses (*Pila globosa*) and SIS fish (Mola, Kholisa, Dhela. Shrimps etc). It shows aquatic weeds (*Hydrilla* sp.) as the most favorable food, where kolmilata and helencha were taken as less favourable. On the other hand, snail flesh (*Pila globosa*) was taken as favorable food item among animal food.

Measurement Process

Before measuring the crabs perfectly they were placed on deep freeze for 20 minutes for anesthetizing. The carapace width, carapace length, abdomen width and abdomen length were measured by using nearest millimeter (mm) digital caliper and bodyweight was measured with electric balance. The carapace width (CW) was defined as the distance between the two anterior lateral spines and carapace length (CL) was defined as the distance between the centers of the frontal inter orbital carapace margin and the posterior margin. Crabs with missing limbs, broken carapaces or any signs of disease were not used.

Preparation of crab for proximate analysis

Collected crab were washed with running tap water to remove any adhering materials and then cephalothorax, cheliped and legs were separated and drying in an electric oven at 60^0C for about 24 hours. The dried crab sample were then crushed into powder form with motor and pestle and kept in refrigerator until further analyses.

Estimation of moisture

Moisture were estimared using automatic moisture analyzer (RADWAG, MAC 50/NH, Germany). About 1-2 gms of represented sample were placed at the pan of the analyzer and then results were displayed within a few minutes.

Estimation of protein

Protein in the sample was determined by Micro-Kjeldahl distillation method AOAC (1990). The samples were digested by heating with concentrated sulphuric acid (H_2SO_4) in the presence of digestion mixture, Potassium sulphate (K_2SO_4) and copper sulphate ($CuSO_4$). The mixture was then made alkaline with 40 % NaOH. Ammonium sulphate thus formed, released ammonia which was collected in 4% boric acid solution and titrated against standard HCl. Total protein was calculated by multiplying the amount of percent nitrogen with appropriate factor (6.25).

Determination of ash

Ash content in crab sample was determined as described by AOAC (1955). About 2 gms of crab powder sample were weighed in a porcelain crucible (which was previously cleaned, heated to about 100^0C, cooled and weighed). The crucible with its content was placed in a muffle furnace for about four hours at about 600^0C. It then cooled in a desecrator and weighed. To ensure completion of ashing, the crucible was again heated in the muffle furnace for half an hour, cooled and weighed again. This was repeated till two consecutive weights were the same and the ash was almost white in colour.

Estimation of fat

Fat content in the crab sample was determind by petoleum ether extraction followed by soxhelt apparatus Jinadasa (2010). For the present study 5 g of finely ground sample was taken in a motor and anhydrous sodium sulphate of twice the weight of the sample was added into it. Then the mixture was ground until a free flowing powder was obtained. Then the powder was transferred to a thimble and sealed the end. Extraction thimble with the sample was placed in the soxhelt apparatus and fixed a previously dried and weighed round bottom flask. 200 mL of extracting solvent (petroleum ether) was added to the flask containing pumice chips. Then the Flask and the condenser were connected to the soxhelt extractor. Sample was allowed to reflux for about five hours. After the extraction flask was removed from the apparatus and kept in the water bath and then in the oven. Then the flask was cooled and weight was taken.

Estimation of cholesterol

The cholesterol content was determined with the modified Libermann-Burchardt colorometric method using a thermoscientific spectrophotometer, USA (Strzezek and Wolos, 1997). The cholesterol was extracted from 0.25 g samples of crab powder with 15 mL chloroform. After filtration, the solotion was supplemented with chloroform in the measurement container to a volume of 25 mL. One mL acetic anhydride and 0.25 mL sulphuric acid were added to 2 mL of the filtrate obtainted. After 5 minutes, the absorption was measured at a wavelength of 620 nm.

RESULTS AND DISCUSION

All morphological data based on the population size and structures in June, 2015 to October, 2015 were listed in Table (1 to 6) and their graphical presentation from Figure. (1 to 6). There were some approaches to study the variables likes BW, CW, CL, AW, AL etc. to detect the correlation among them. In most cases the BW, CW, CL, AW, AL etc. were positively correlated. The experimental data shows that crab (*P. lamellifrons)* having body weight (BW) 6-10 g was most abundant (33.33%) during the

Table-1: Frequency distribution of body weight (BW) of *P. lamellifrons* in different months.

Range of BW (g)	June (%)	July (%)	August (%)	September (%)	October (%)	Total (%)
0-5	31.82	25.50	17.40	10	21.43	21.57
6-10	22.73	29.41	32.60	50	42.86	33.33
11-15	18.18	3.92	17.40	30	28.57	15.69
16-20	9.09	11.76	10.87	10	7.14	10.46
21-25	9.09	15.69	15.22	-	-	11.11
26-30	4.55	5.88	-	-	-	2.61
31-35	4.55	3.92	4.35	-	-	3.27
36-40	-	3.92	-	-	-	1.31
41-45	-	-	-	-	-	-
46-50	-	-	2.17	-	-	0.65
Total	100	100	100	100	100	100

Table-2: Frequency distribution of carapace width (CW) of *P. lamellifrons* in different month.

Range of CW (mm)	June (%)	July (%)	August (%)	September (%)	October (%)	Total (%)
0-5	-	-	-	-	-	-
6-10	-	-	-	-	-	-
11-15	-	-	-	-	-	-
16-20	13.64	9.80	13.04	5	-	9.80
21-25	18.18	15.69	13.04	15	14.29	15.03
26-30	22.73	27.45	30.44	20	35.71	27.46
31-35	18.18	23.53	19.57	45	28.57	24.84
36-40	22.73	17.65	17.39	15	21.43	18.30
41-45	4.55	5.88	4.35	-	-	3.92
46-50	-		2.17	-	-	0.65
Total	100	100	100	100	100	100

N = 153

Table-3: Frequency distribution of carapace length (CL) of *P. lamellifrons* in different months.

Range of CL (mm)	June (%)	July (%)	August (%)	September (%)	October (%)	Total (%)
0-5	-	-	-	-	-	-
6-10	-	-	-	-	-	-
11-15	13.64	17.65	13.04	5	7.14	13.07
16-20	27.27	33.33	21.74	5	42.86	26.14
21-25	31.82	29.41	34.78	60	28.57	35.30
26-30	18.18	11.77	6.52	30	14.29	13.73
31-35	9.09	7.84	17.40	-	7.14	9.80
36-40	-	-	6.52	-	-	1.96
41-45	-	-	-	-	-	-
46-50	-	-	-	-	-	-
Total	100	100	100	100	100	100

Table-4: Frequency distribution of abdomen width (AW) of *P. lamellifrons* in different months.

Range of AW (mm)	June (%)	July (%)	August (%)	September (%)	October (%)	Total (%)
0-5	9.09	-	4.35	-	7.14	3.27
6-10	31.82	33.33	23.91	20	21.43	27.45
11-15	31.82	43.14	43.48	65	35.72	43.79
16-20	13.64	9.80	15.22	10	21.43	13.07
21-25	13.64	13.73	8.70	5	7.14	10.46
26-30	-	-	4.35	-	7.14	1.96
31-35	-	-	-	-	-	-
36-40	-	-	-	-	-	-
41-45	-	-	-	-	-	-
46-50	-	-	-	-	-	-
Total	100	100	100	100	100	100

Table-5: Frequency distribution of abdomen length (AL) of *P. lamellifrons* in different months.

Range of AL (mm)	June (%)	July (%)	August (%)	September (%)	October (%)	Total
0-5	-	5.88	-	-	-	1.96
6-10	27.27	9.80	10.87	5	14.29	12.42
11-15	45.45	37.26	45.65	45	42.86	42.84
16-20	9.09	33.33	30.44	45	35.72	30.72
21-25	18.18	7.85	8.70	5	7.14	9.15
26-30	-	5.88	4.35	-	-	3.27
31-35	-	-	-	-	-	-
36-40	-	-	-	-	-	-
41-45	-	-	-	-	-	-
46-50	-	-	-	-	-	-
Total	100	100	100	100	100	100

Table-6: The monthly variation of sex ratio of the crabs.

Month	No of experiment			Sex ratio Male: Female	χ^2 Value
	Total	Male	Female		
June	22	9	13	1:1.44	0.36+0.36=0.72
July	51	18	33	1:1.83	2.20+2.20=4.4
August	46	17	29	1:1.70	1.57+1.57=3.14
September	20	8	12	1:1.5	0.4+0.4=0.8
October	14	5	9	1:1.8	0.57+0.57=1.14
Total	153	57	96	1:1.68	10.20

study period. On the other hand body weight (BW) 46-50 g was least abundant (0.65%). In June *P. lamellifrons* having (BW) 0-5 g was most abundant. In July, August, September and October (BW) 0-5 g were most abundant. In case of carapace width (CW) crabs having carapace width (CW) 26-30 mm were most abundant (27.46%). On the other hand carapace width (CW) 46-50 mm was least abundant (0.65%). In June crabs having carapace width (CW) 26-30 mm and 36-40 mm were most abundant. In July, August and October CW 26-30 mm were most abundant and in September (CW) 31-55 mm were most abundant. In case of carapace length (CL) crabs having carapace length 21-25 mm were most abundant (35.30%). On the other hand carapace length (CL) 36-40 mm was least abundant (1.96%). In July and October crabs having carapace length (CL) 16-20 mm were most abundant. In June, August and September carapace length (CL) 21-25 mm were most abundant. In case of

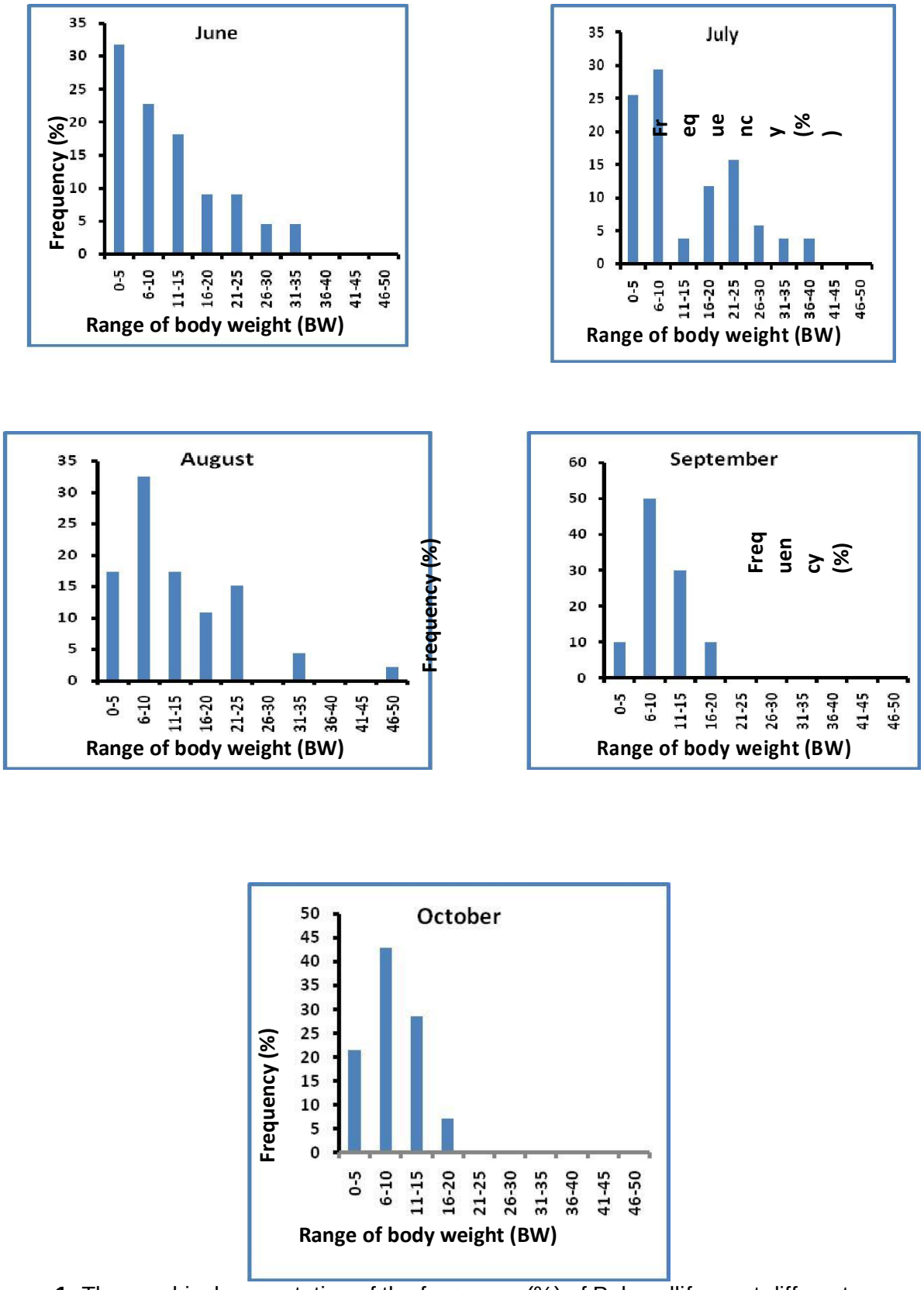

Figure 1: The graphical presentation of the frequency (%) of P. lamellifrons at different ranges of body weight (g) in different months.

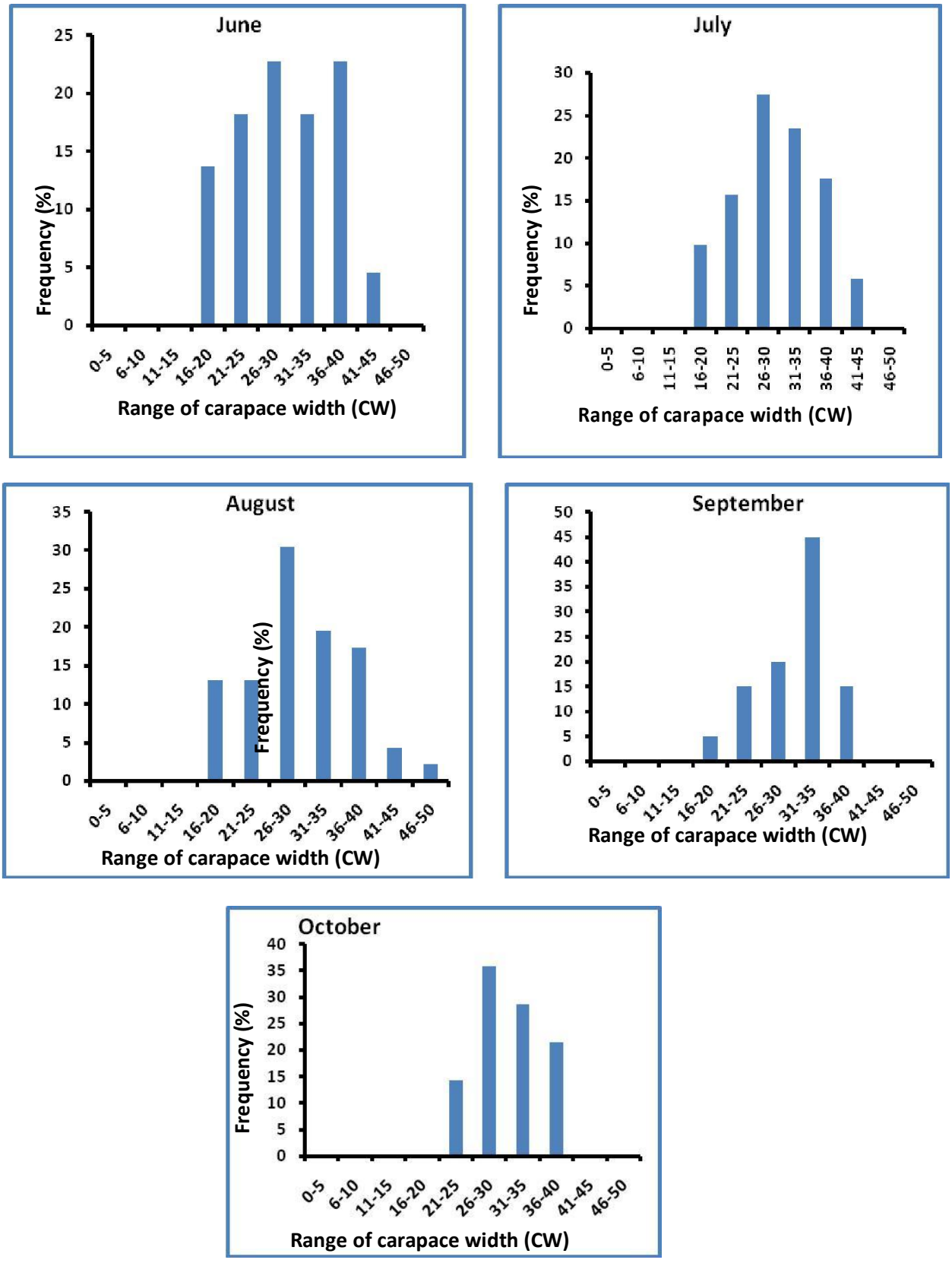

Figure. 2: The graphical presentation of the frequency (%) of P. lamellifrons at different ranges of carapace width (mm) in different months.

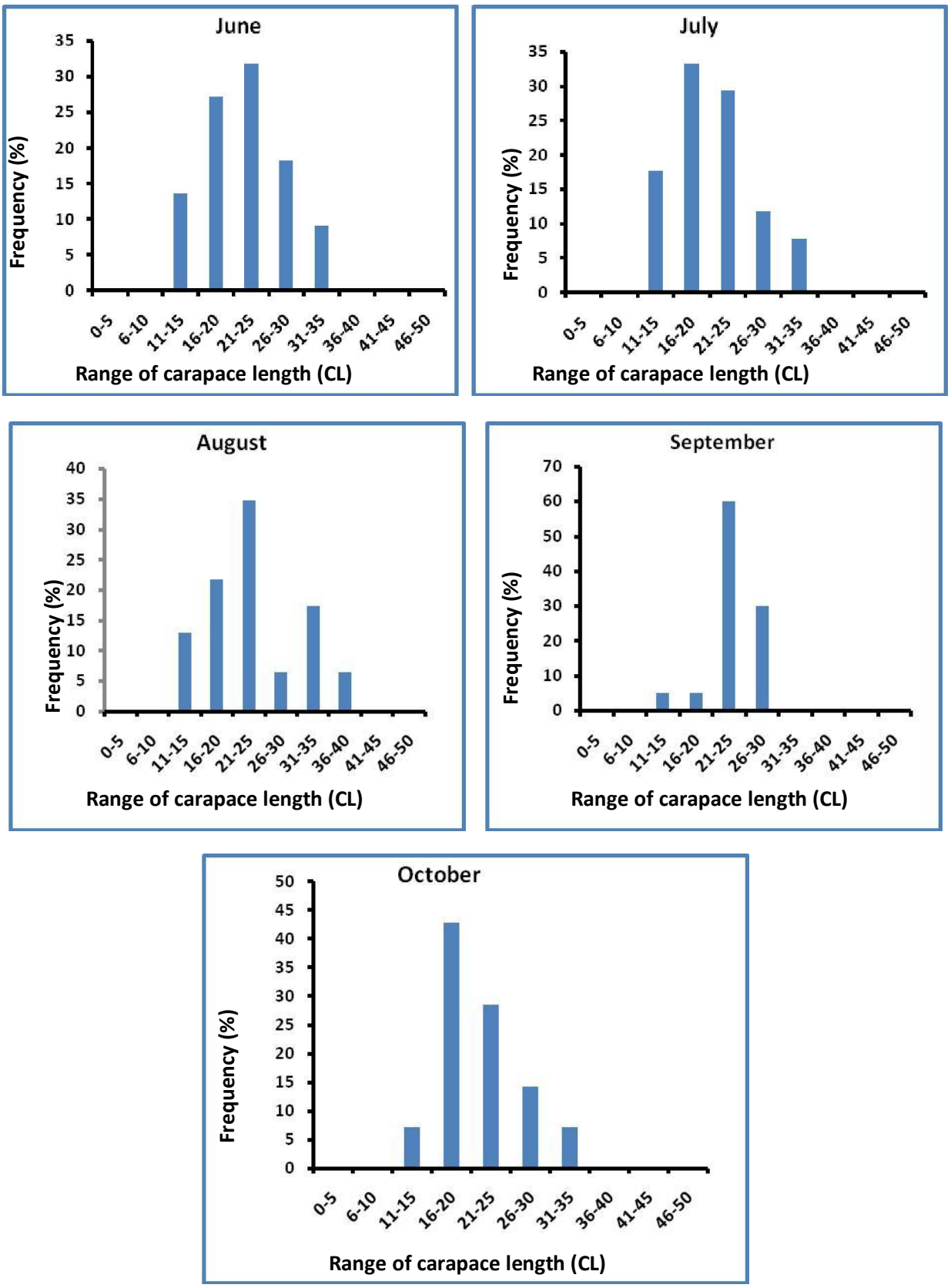

Figure 3: The graphical presentation of the frequency (%) of *P. lamellifrons* at different ranges of carapace length (mm) in different months.

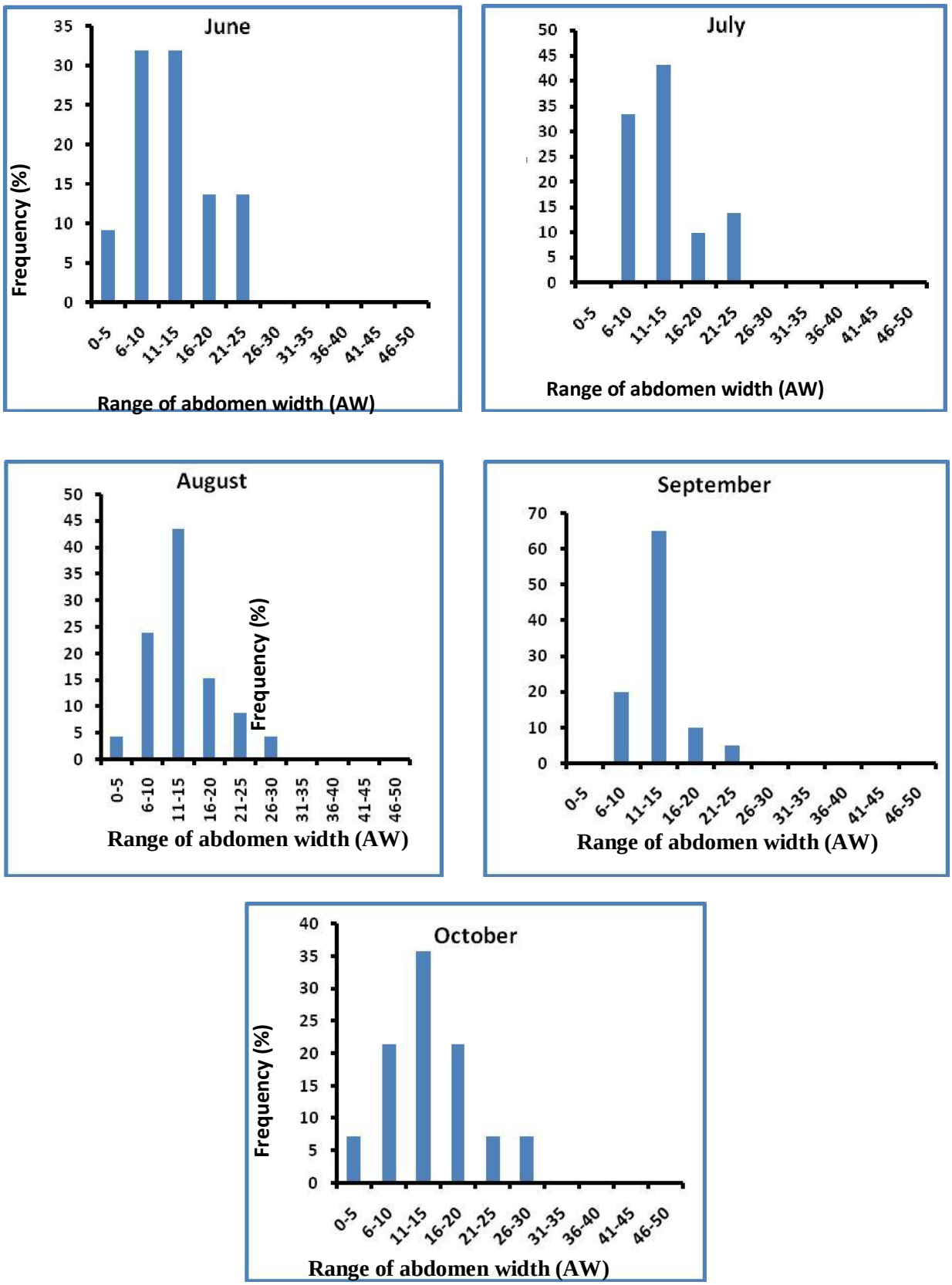

Figure 4: The graphical presentation of the frequency (%) of *P. lamellifrons* at different ranges of abdomen width (mm) in different months.

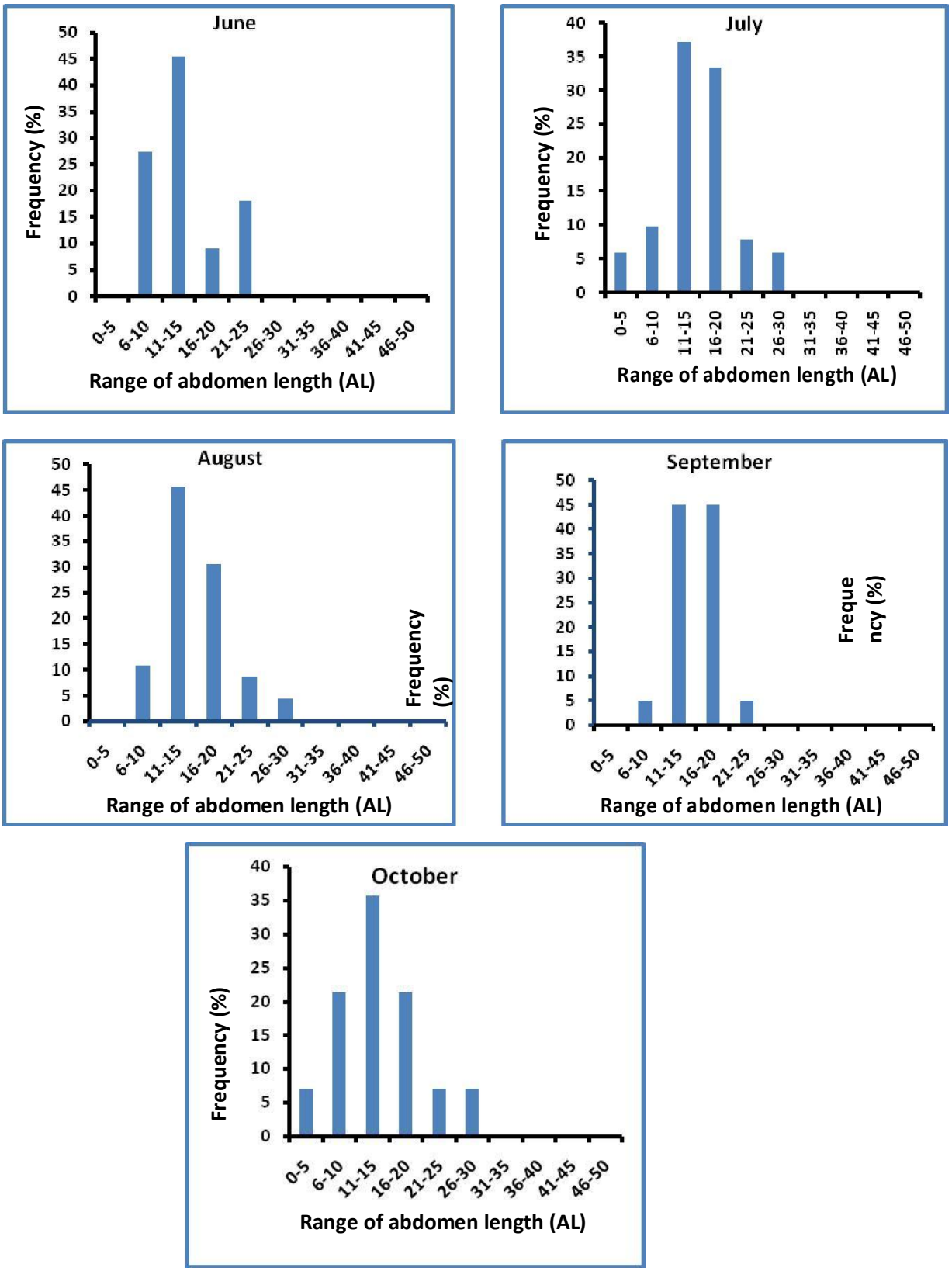

Figure 5: The graphical presentation of the frequency (%) of *P. lamellifrons* at different ranges of abdomen length (mm) in different months.

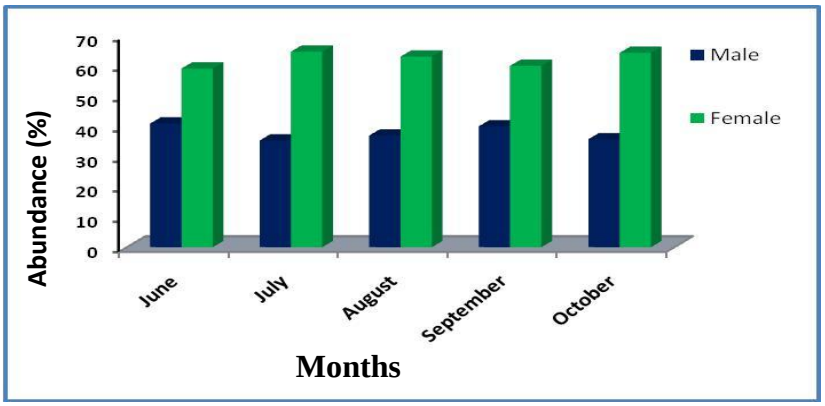

Figure 6: Graphical presentation of the abundance of crab *P. lamellifrons* in different months.

Table 7: Proximate composition of different body parts of *P. lamellifrons* (All values are expressed as dry weight basis except moisture as wet weight basis)

Name of body parts	Moisture (%)	Protein (%)	Fat (%)	Ash (%)	Cholesterol (%)
Cephalothorax	68.92	34.46	9.34	9.54	0.2168
Cheliped	56.51	32.38	0.84	18.05	0.06137
Legs	56.01	34.23	0.53	11.15	0.07276

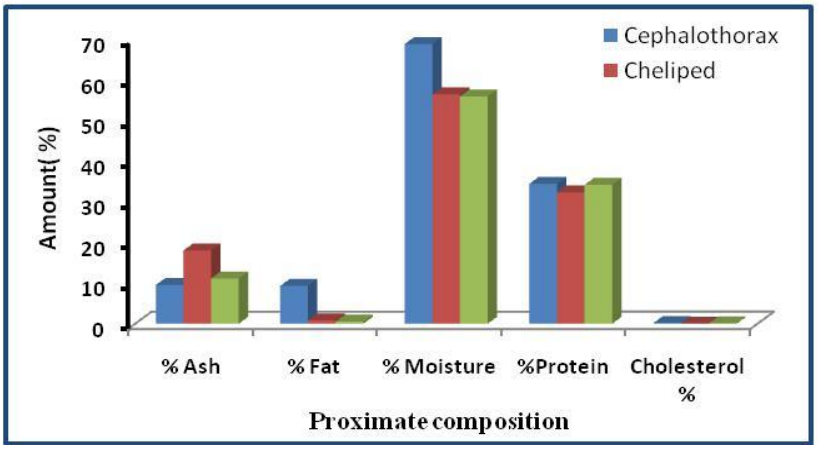

Figure 7: Graphical presentation of proximate composition of different body parts of crab.

abdomen width (AW) crabs having abdomen width 11-15 mm were most abundant (43.79%). On the other hand, abdomen width (AW) 26-30 mm was least abundant (1.96%). In June AW 6-10 mm and 11-15 mm were most abundant. In July, August, September and October abdomen width (AW) 11-15 mm were most abundant. In case of abdomen length (AL) crabs having abdomen length 11-15 mm were most abundant (42.84%). On the other hand, abdomen length (AL) 0-5 mm was least abundant (1.96%). In all the month (June, July, August, September and October) (AL) 11-15 mm were most abundant. Abundance of crab *P. lamellifrons* in different months was shown in Figure 1.

Proximate composition of the collected freshwater species has been estimated and listed in Table 7 and their graphical presentation was shown in Figure. 7. From

the present investigation it is evident that the different body parts of crab contents significant amount of nutrient like moisture, protein, fat, ash and cholesterol which might play very crucial role for proper function of the human body to protect the health from illness. The present study reveals the percentage of average protein content value of cephalothorax, cheliped and legs was 39.69, moisture 60.48, fat 3.57, ash 12.61 and cholesterol 0.1169 respectively. The protein value was found to be higher (34.46 %) in cephalothorax and followed by legs (34.23%) and cheliped (32.38)%. All other component such as moisture, fat and cholesterol was also found to be higher in cephalothorax compared to cheliped and legs. High value of ash was also recorded in cheliped (18.05%) in comparison to legs (11.15%) and cephalothorax (9.54%).

There are various types of water habitat such as freshwater habitat, marine habitat, estuarine habitat etc. The present study was in freshwater habitat. In freshswater habitat, the crabs were most abundant during breeding season. In *P. lamellifrons* the body weight 6-10 g was most abundant (33.33%) and 46-50 g was least abundant (0.65%). The carapace width 26-30 mm was most abundant (27.46%) and 46-50 mm was least abundant (0.65%). The carapace length 21-25 mm was most abundant (35.30%) and 36-40 mm was least abundant (1.96%). The abdomen width 11-15 mm was most abundant (43.79%) and 26-30 mm was least abundant (1.96%). The abdomen length 11-15 mm was most abundant (42.84%) and 0-5 mm was least abundant (1.96%). The sex ratio of *P. lamellifrons* were 1:1.44, 1:1.83, 1:1.70, 1:1.5 and 1:1.80 in June, July, August, September and October respectively. The maximum average temperature was observed in June (34.2°C), When maximum frequency distribution of BW, CW, CL, AW and AL were 31.82%, 22.75% 31.82%, 31.82% and 45.45% respectively. The maximum relative humidity, highest total rainfall and highest number of rainy day were 87%, 353.4 mm and 25 days respectively when the maximum frequency distribution of BW, CW, CL, AW and AL were 29.410%, 27.45%, 33.33%, 43.14% and 37.26% respectively. It is suggested that faster growth of females may be advantageous for freshwater crabs because, it may enable them to increase their reproductive output. Freshwater crabs have direct development, incubating few but large eggs. With maternal care, the females also incubate the newly hatched young in their abdomen for a time. Therefore, a wider abdomen is advantageous for such crabs. This characteristic show allometric growth in young female and decreases after the puberty molt, indicating energy allocation for reproductive processes. The same occurs in the gonopods growth after the maturity molt of males, indicating that this structure has reached on appropriate size to copulate successfully (Micheli et al., 2006).

Sex Ratio

About 153 crabs (*P. Lamellifrons*) were studied in present investigation and their sex ratio were shown in Table 6. Among the 153 crabs, 57 crabs were males and 96 crabs were females giving a sex ratio 1:1.68. The sex ratio was uneven in most size groups and in most of the months. The total chi-square (χ^2) value was significant for *Paratelphusa lamellifrons* where the expected ratio 1:1. The monthly variation of sex ratio is shown in the Table 6. In June, the study found that the male and female ratio was 1:1.44. In July, the study found that the male and female ratio was 1:1.83. In August, the study found that the male and female ratio was 1:1.70. In September, the study found that the male and female ratio was 1:1.5. In October, the study found that the male and female ratio was 1:1.80. Female were significantly more abundant than males in all the months. The maximum and minimum abundance of males were in June (40.19%) and in July (35.30%) respectively. The maximum and minimum abundance of females were in July (64.70%) and in June (59.09%) respectively. The chi-square (χ^2) value in all the month was not significant. The sex ratio of males and females were signified by the chi-square test.

Proximate composition studies are very important from the nutritional point of view. The proximate constituents in animals are known to vary with season, size of the animal, stage of maturity, temperature, and availability of food, and so forth (Sudhakar et al., 2009). The results from the Table 6 showed that the proximate composition of the collected crab species varies significantly between its different body parts (chephalothorax, cheliped and legs). Proteins are “building blocks of life” which acquires vital importance to the survival of living things (Albert et al., 2004). Proteins from crabs are known to be useful in the transformation of gas building of organ components, water and metabolic regulation of organisms (Ackman and Mcleod, 1989). The protein content in crabs has a high biological value with its growth promoting capacity. In the present study the protein content recorded were ranges from 34.46% to 32.38%. Cephalothorax contains highest amount of protein (34.46%) followed by legs (34.23%) and cheliped (32.38%).

Lipids are highly efficient as sources of energy and they contain more than twice the energy of carbohydrates and proteins (Naczk et al., 2004). The lipid value recorded in the different body parts of the crab species ranges from (0.53-9.34)%. Highest fat content were recorded in chephalothorax (9.34%) whereas legs content lowest amount of fat (0.53%).

From Table 7. it is evident that different body parts of crab contents highest amount of moisture (68.92-56.01)% compared to other component like protein (34.46-32.38)%, fat (0.53-9.34)%, ash (9.54-18.05)% and cholesterol (0.06137-0.2168)%. High moisture contents in organisms are considered as an advantage because of

its contribution in the stabilization of the organism during movements (Eddy et al., 2004).

The ash content of species is an indication of the mineral concentration in the organisms (Eddy et al., 2004; FAO, 2005). Ash content of different body parts of crab shown in Table 7 varies from 9.54% to 18.05%. Presence of ash in Cheliped (18.05%) was higher than legs (11.15%) and cephalothorax (9.54%).

Cholesterol is an essential component of cell membranes, brain and nerve cells, and bile, which helps the body absorb fats and fat-soluble vitamins. Cholesterol is a precursor for steroid hormones including the adrenal gland hormones cortisol and aldosterone, sex hormones progesterone, estrogens, and testosterone, and bile acids and vitamin D (Product Manual). Cholesterol which was estimated in the present study found to be very low compared to moisture, protein, fat and ash (Table 7). Among the different body parts of the crab cephalothorax content highest percentage of cholesterol 0.2168 whereas cheliped content least amount of cholesterol 0.06137. Cholesterol content in different body parts of crab sample remains in the following order chephalothorax>legs>cheliped respectively. From the present investigation the freshwater crabs can be regarded as a good source of protein and can be recommended as an ideal food item and can also be employed as a supplement of protein and other nutritive matter so as to balance human nutrition to prevent nutritional deficiencies in the future.

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