Rec. zool. Surv. India, **93** (1-2) : 15-29, 1993

FOOD AND FEEDING HABITS OF SOME AMPHIBIAN SPECIES OF NORTHEAST INDIA

S. K. CHANDA

Zoological Survey of India
27, J. L. Nehru Road
Calcutta-700016

INTRODUCTION

Amphibians in general are voracious feeder. They take mainly insects like beetles, termites, flies, grasshoppers, butterflies, moths, bugs, earwigs, dragonflies and also their larvae, etc. Although insects are their principal diet they can feed also on small mammals, rarely small birds, snakes, lizards, other frogs, earthworms, crabs, spiders and in fact any living creature which they can capture and overpower. Some species of frog such as *Rana tigerina* is said to be a regular cannibal and feeds readily on the young of its own species.

Except a number of stray papers by Aitken (1895), Gostling (1895), Chibber (1911), Agharkar (1912), Muller (1912), Davidson (1918), Bhaduri (1945), Gray (1954), Banerjee (1955), Smith (1959), Wadekar (1963), Joshee (1968), Abdulali (1985), on food habits of *Rana tigerina*, no comprehensive work on the food and feeding habits on amphibians has so far been carried out from the Indian region. However, in course of studying the amphibian fauna of northeast India an attempt has been made to report on the food habits of eight species of amphibians of this region viz., *Bufo melanostictus* Schneider, (Fig. 1), *Rana limnocharis* Weigmann, (Fig. 2), *Rana gerbillus* Annandale, (Fig. 3), *Amolops afghanus* (Gunther), (Fig. 4), *Microhyla berdmorei* (Blyth), (Fig. 5), *Microhyla ornata* (Dum. & Bibron), (Fig. 6), *Polypedates leucomystax* (Kuhl), (Fig. 7), *Philautus shillongensis* Pillai & Chanda, (Fig. 8). Out of these, some observation of food habits of *Bufo melanostictus* have been studied by Behura *et al.* (1960), Rangaswamy and Channabasavanna (1973), and Sabins and Kolhatkar (1977).

MATERIALS AND METHODS

To achieve the purpose of the present work collections were made from different localities of northeast India *viz.*, Assam, Meghalaya, Arunachal Pradesh, Manipur, Nagaland, Mizoram and Tripura, from different habitats such as marshes, pools or streams, river banks, under big boulders and stones, vicinity of shaded mountain streams and so on. As the amphibians swallow only the living creatures, most of the

food materials were found either intact, half-digested or partly digested form and where ever identifications were possible they were identified upto the levels of orders and the rest have been mentioned as "miscellaneous" (for broken materials) and / or unidentified food particles. The data collected from the gut-contents from each of eight species during different period of the year was recorded. The whole year was divided into three different periods. i. Pre-breeding period. ii. Breeding period. iii. Post breeding period. Percentage of food consumption for each variety of food for the above species have been represented histographically. In histograme of each species the apex (AB) stands for the percentage of food materials whereas the base (BC) stands for the types of food taken.

TABLE—I

Table showing the species, collection localities, season and year of collection of different species.

Sl. No.	Species	Collection localities	Season	Year of collection
1.	*Rana gerbillus* Annandale	Assam, Meghalaya, Arunachal Pradesh, Mizoram, Nagaland, Manipur, Tripura.	January-December	1968-1978
2.	*Rana limnocharis* Weig.	Assam, Meghalaya, Arunachal Pradesh, Mizoram, Nagaland, Manipur, Tripura.	January-December	1968-1979
3.	*Amolops afghanus* (Gunther)	Assam, Meghalaya, Arunachal Pradesh, Mizoram.	January-April, June-November	1971-1972 1975-1978
4.	*Bufo melanostictus* Schn.	Assam, Meghalaya, Arunachal Pradesh, Mizoram, Nagaland, Manipur, Tripura.	January-July, Oct.-Dec.	1968-1979
5.	*Microhyla berdmorei* (Blyth)	Assam, Maghalaya, Arunachal Pradesh, Mizoram.	January-March, April, July-October, December.	1971-1976, 1978, 1983.

Sl. No.	Species	Collection localities	Season	Year of collection
6.	*Microhyla ornata* (Dum. & Bibron)	Assam, Meghalaya, Mizoram, Nagaland, Tripura.	January-March, July, Oct.-Dec.	1971-1972, 1976, 1978.
7.	*Polypedates leucomystax* (Kuhl.)	Assam, Meghalaya, Manipur.	December-May, July-Oct.	1966-1968, 1971-1973, 1975.
8.	*Philautus shillongensis* Pillai & Chanda	Meghalaya	January-May, July-August, Oct.-Dec.	1970-1978.

In *Bufo melanostictus*, the analysis of the gut-contents reveals that the maximum food-intake is during breeding period followed by pre-breeding and post-breeding period. During breeding period this species prefers isopteran insects which is 15% of the total gut-contents examined and in that list of preference, coleopteran and orthoptern insects (2.5%) are found at the bottom. Hymenopteran insects (11%) follow the isopteran insects. Miscellaneous food items, which are half-digested and broken materials (6.5%) follow the hymenopteran insects.

During pre-breeding period, food-intake is comparatively less than the breeding period. During this period they prefer as in the breeding period the isopteran insects which is 8% of the total gut-contents examined and in that list of preference, orthopteran insects which is 1% is found at the bottom of preference. Hymenopteran insects (5%) follow the isopteran insects. Rest of the food-items in decreasing orders are miscellaneous food items (2%) and coleopteran insects (1.5%).

During post-breeding period, food-intake is lowest in comparison to the previous ones. During this period they prefer hymenopteran insects which is 4.5% of the total gut-contents examined and in that list of preference, coleopteran and orthopteran insects are found at the bottom, which is 1% each. Rest of the food-items in decreasing order are miscellaneous food-items (1.8%) and isopteran insects which are in equal percentage. The percentage of food-items have been shown in histogram (Fig. 1).

The analysis of the gut-contents of *Rana limnocharis* shows that food-intake during pre-breeding and breeding period is maximum followed by post-breeding period.

During breeding period this species prefers coleopteran insects which is 7.8% of the total gut-contents examined and in that list of preference, dermapteran insects (.5%) are found at the bottom of preference. Dipteran insects constituting 6.5% of the gut-contents come next to coleopteran insects.

Miscellaneous food items (2.7%) follow the dipteran insects. Isopteran insects (2.5%) and orthopteran insects (1.5%) follow the miscellaneous food items.

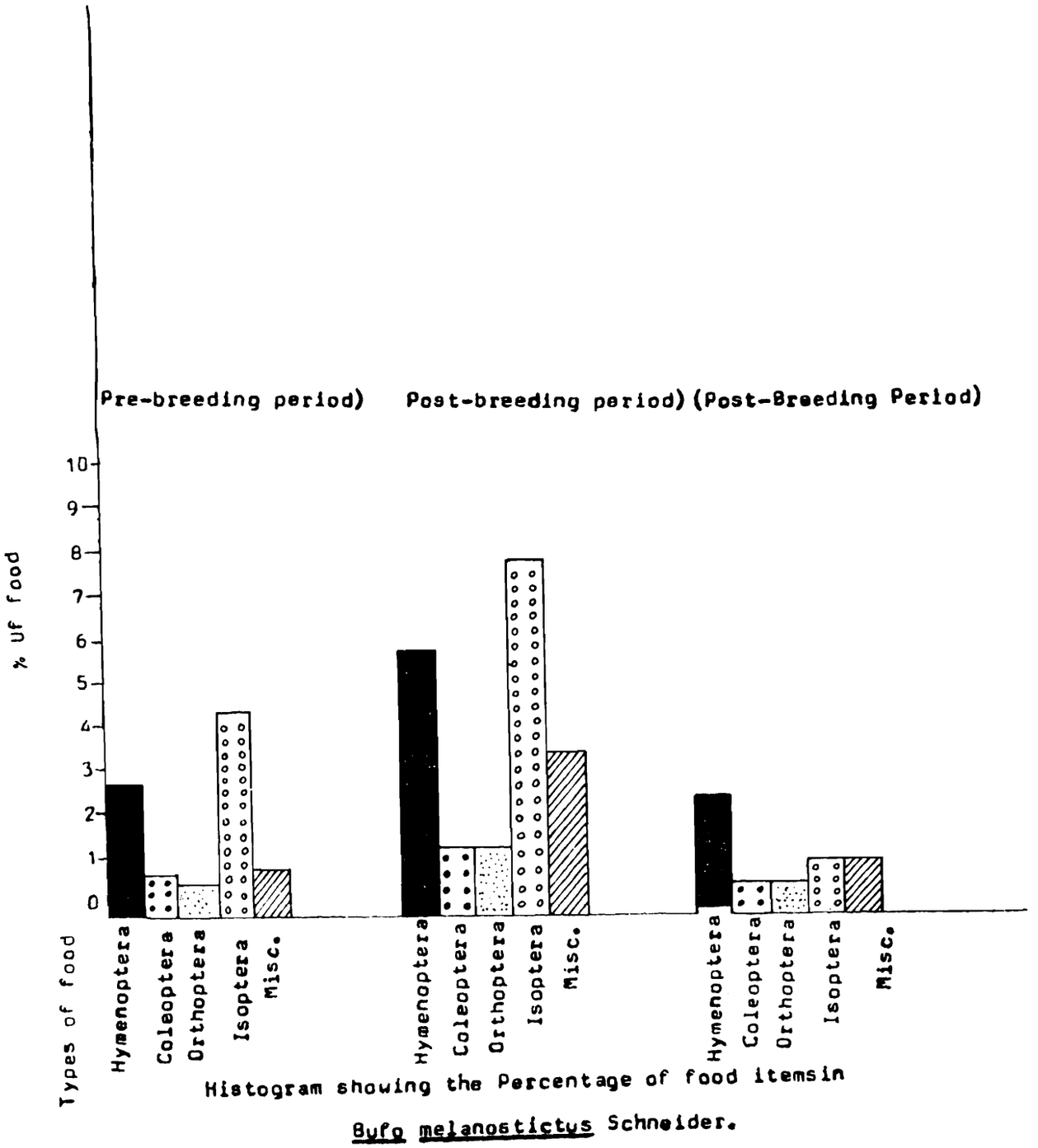

Fig. 1.

Percentage of food intake during pre-breeding period is same like breeding period. During this period this species prefers dipteran insects which is 8.2% of the total gut-contents examined and in that list of preference, dermapteran insects as in the breeding period which is only 0.5% is found at the bottom of preference. Coleopteran insects (8.2%) comes next to the dipteran insects. Miscellaneous food

items (1.8%), orthopteran insects (1.8%) and isopteran insects (0.8%) are observed in decreasing order.

Food-intake during the post-breeding period is lowest in comparison to the previous ones. During this period this species prefers the coleoptran insects which

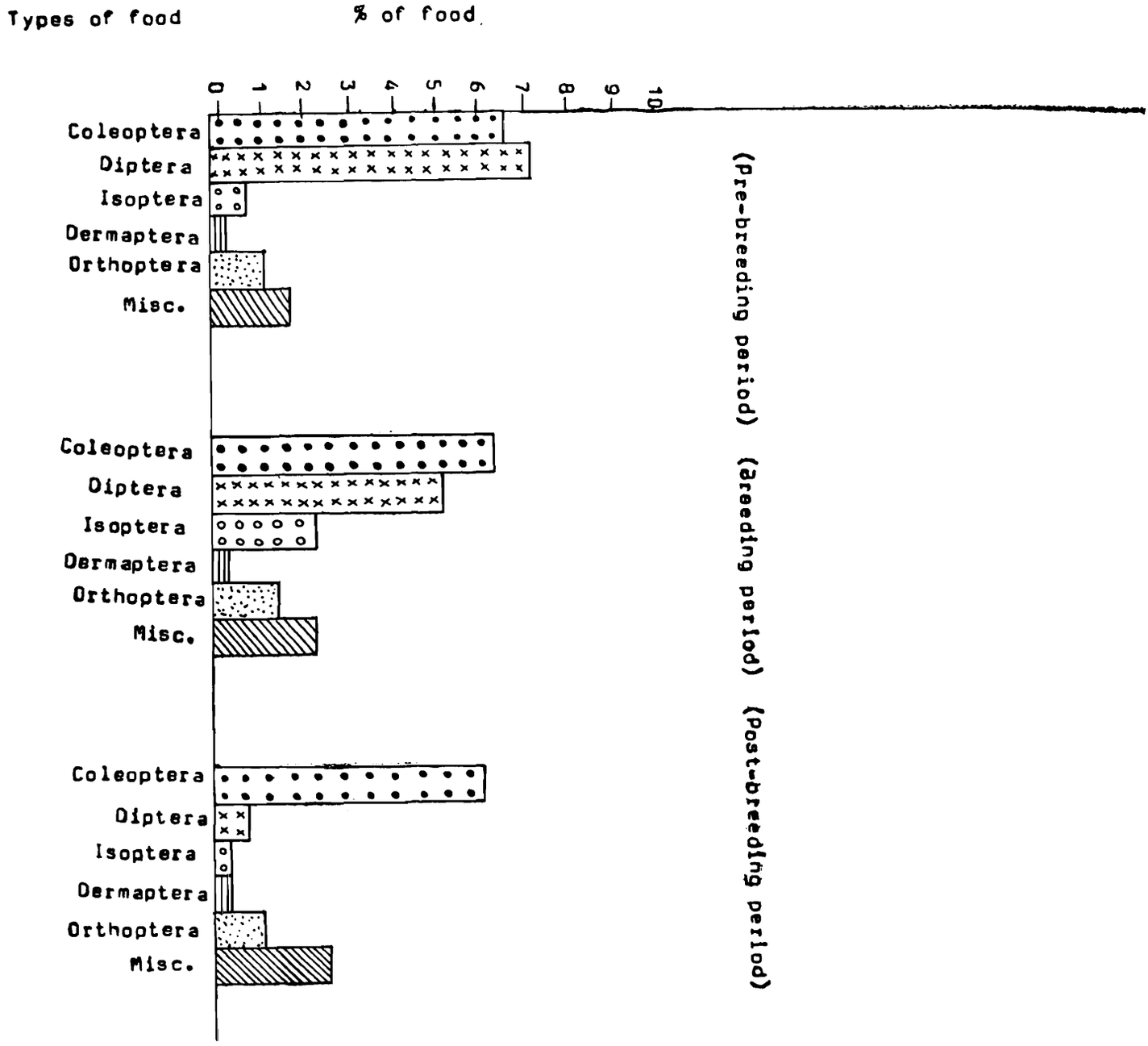

Fig. 2. Histogram showing percentage of food items in *Rana limnocharis* Weigmann

is 7% of the total gut-contents examined and in that list of preference, isopteran and dermapteran insects, each represented by 0.5%, are found at the bottom. Miscellaneous food-items (3%), comes next to coleopteran insects, and orthopteran and .dipteran insects which are 1% and 0·5% come respectively next to miscellaneous food-items. The percentage of food-items have been shown in histograme (Fig. 2).

Analysis of the gut-contents of *Rana gerbillus* reveals that the maximum food-intake takes place during the breeding period followed by pre-breeding and post-breeding period.

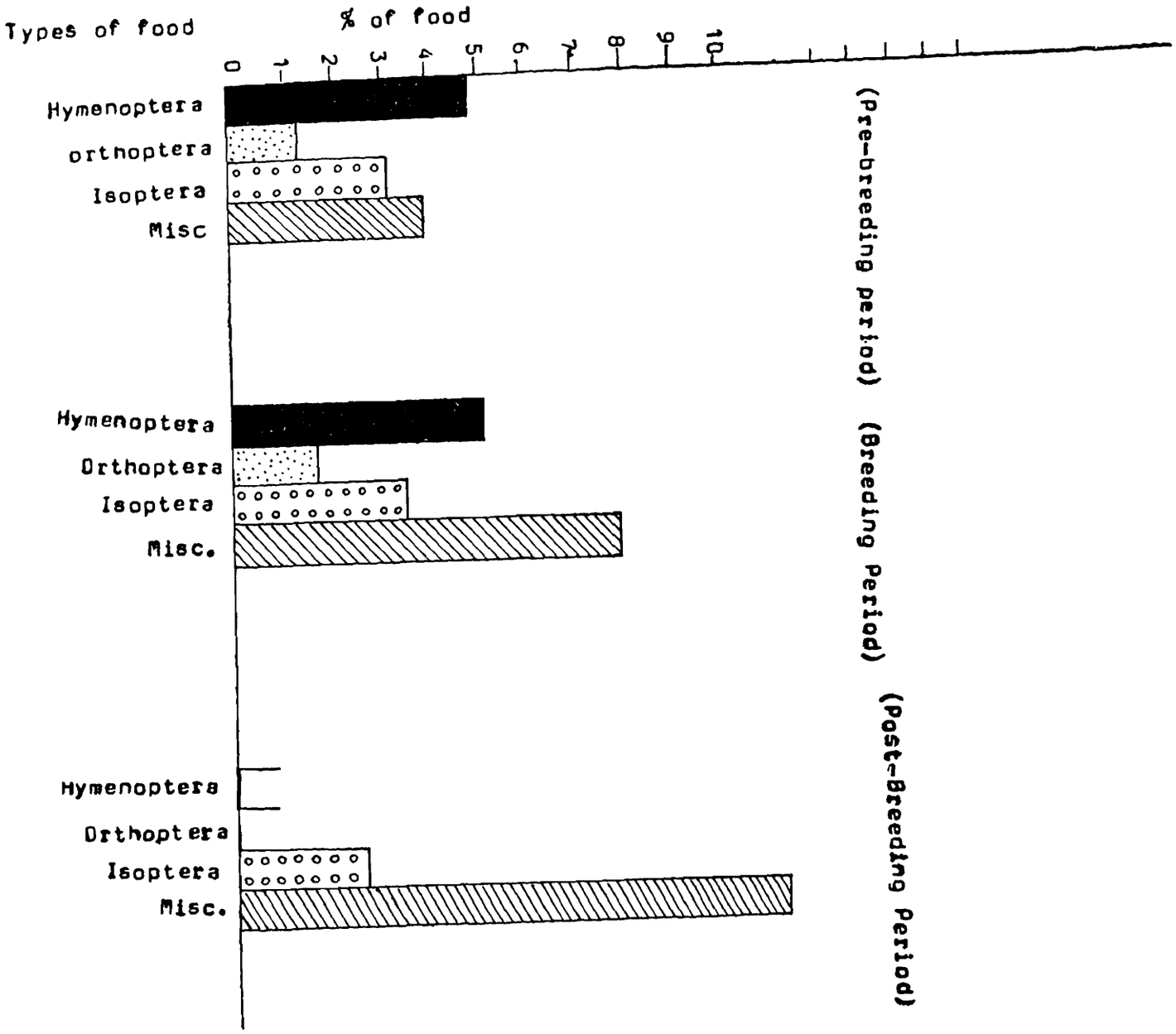

Fig. 3. Histogram showing the percentage of food items in *Rana gerbillus* Annandale

During breeding period this species has been found to consume the highest percentage of the miscellaneous food-items which is 10.5% of the total gut-contents examined and in that list of preference, orthopteran insects (2.5%) is found at the bottom of preference. Hymenopteran insects (6.5%) comes next to the miscellaneous food-items and isopteran insects (4.5%) are followed by hymenopteran insects.

During pre-breeding period food-intake is comparatively less than the breeding period. During this period this species prefers hymenopteran insects which is 6.5% of the total gut-contents examined as in the breeding period and in that list of preference, orthopteran insects (1.8%) is found at the bottom of preference. Miscellaneous food-items and isopteran insects are 5.2% and 4.2% come respectively next to hymenopteran insects.

Food-intake during post-breeding period is very negligible. During this period this species prefers only the miscellaneous food-items and isopteran insects which are 14.8% and 3.5% respectively. The percentage of food-items have been shown in histograme (Fig. 3).

In *Amolops afghanus* the analysis of gut-contents reveals that the maximum food-intake takes place during the breeding period followed by pre-breeding and post-breeding period.

During breeding period this species prefers orthopteran insects which is 15.8% of the total gut-contents examined and in that list of preference, hymenopteran insects (1%) are found at the bottom. Miscellaneous food-items constituting (12.5%) of the total gut-contents come next to orthopteran ones. Hemipteran insects (10%) follow the miscellaneous food-items. Rest of the food-items in decreasing orders are dermapteran insects (3.5%) and dipteran insects (2.5%).

Food-intake during pre-breeding period is comparatively less than the breeding period. During this period they prefer as in the breeding period orthopteran insects which is 13.2% of the total gut-contents examined and in that list of preference, dermapteran insects (2%) are found at the bottom of preference. Isopteran insects (9.5%) come next to orthopteran insects. Rest of the food-items in decreasing orders are miscellaneous food-items (8.2%), dipteran insects (5.8%), hymenopteran insects (5.8%) and hemipteran insects (2.8%).

Food-intake during post-breeding period is lowest in comparison to the previous ones. During this period they prefer hymenopteran insects and miscellaneous food-items and both of them are 14% of the total gut-contents examined. Rest of the food constituting of dipteran insects, hemipteran and isopteran insects which are in equal percentage (2%) and orthopteran insects (8%). The percentage of food-items have been shown in histograme (Fig. 4).

Analysis of the gut-contents of *Microhyla berdmorei* reveals that the maximum food-intake takes place during the post-breeding period followed by breeding and pre-breeding period.

During breeding period this species has been found to consume highest percentage of miscellaneous food-items which is 11.5% of the total gut-contents examined and

in that list of preference, coleopteran insects (5.2%) are found at the bottom of preference. Hymenopteran insects (7.5%) and isopteran insects (7.2%) come next to miscellaneous food-items.

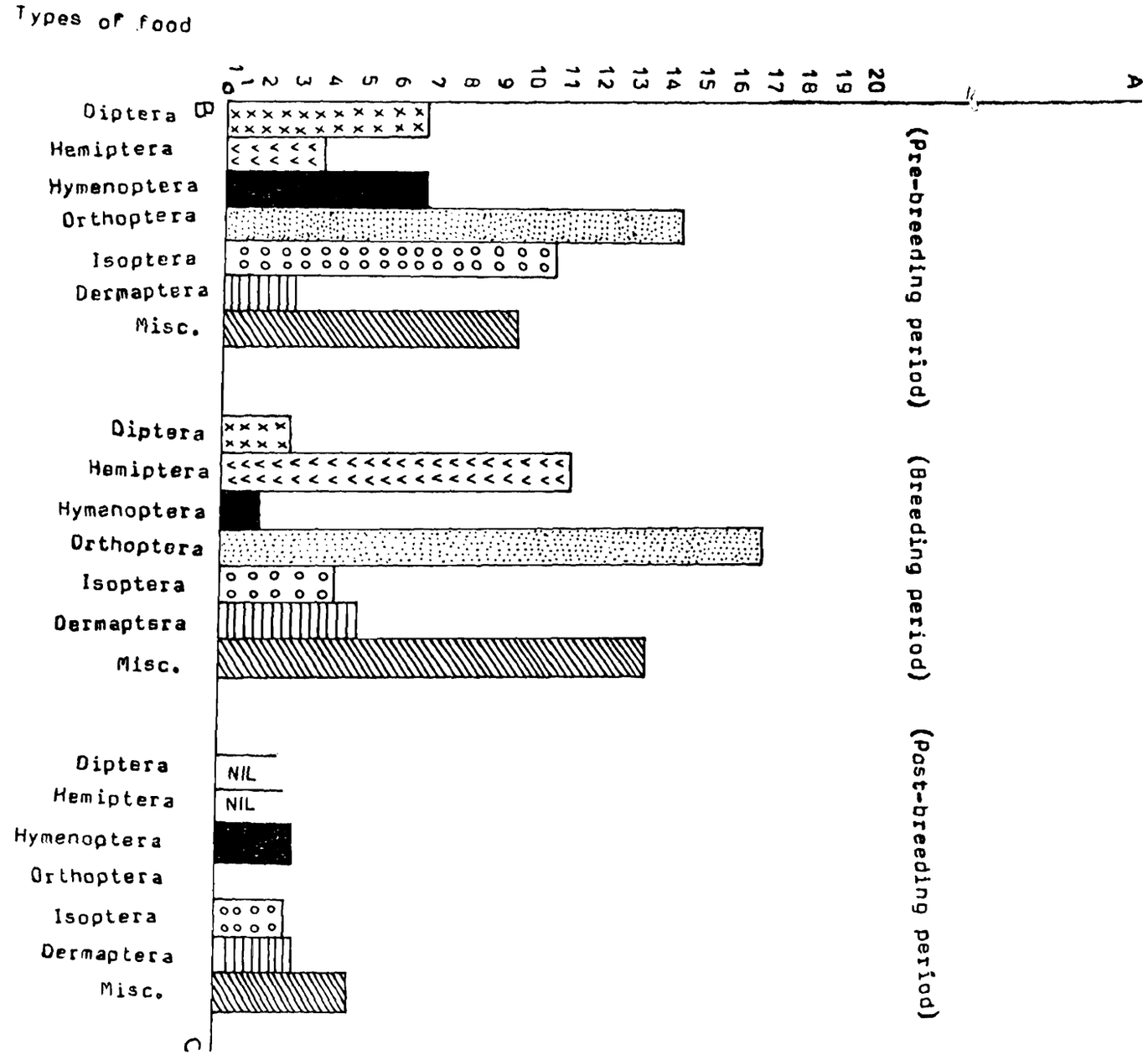

Fig. 4. Histogram showing the percentage of food items in *Amolops afghanus* (Gunther)

Food-intake during pre-breeding period is eomparatively less than the breeding period. During this period this species has been found to consume highest percentage of miscellaneous food-items as in the breeding period which is 8% of the total gut-contents examined and in that list of preference, hymenopteran insects (1.2%) are found at the bottom. Coleopteran and isopteran insects are 7% each comes next to miscellaneous food-items.

Food-intake during post-breeding period is maximum in comparison to the previous ones. During this period this species consume highest percentage of food-items which is 22% of the total gut-contents examined and in that list of preference, coleopteran insects (3.8%) is found at the bottom. Hymenopteran insects (11%) and isopteran insects (8%) come next to miscellaneous food-items. The percentage of food-items have been shown in histograme (Fig. 5).

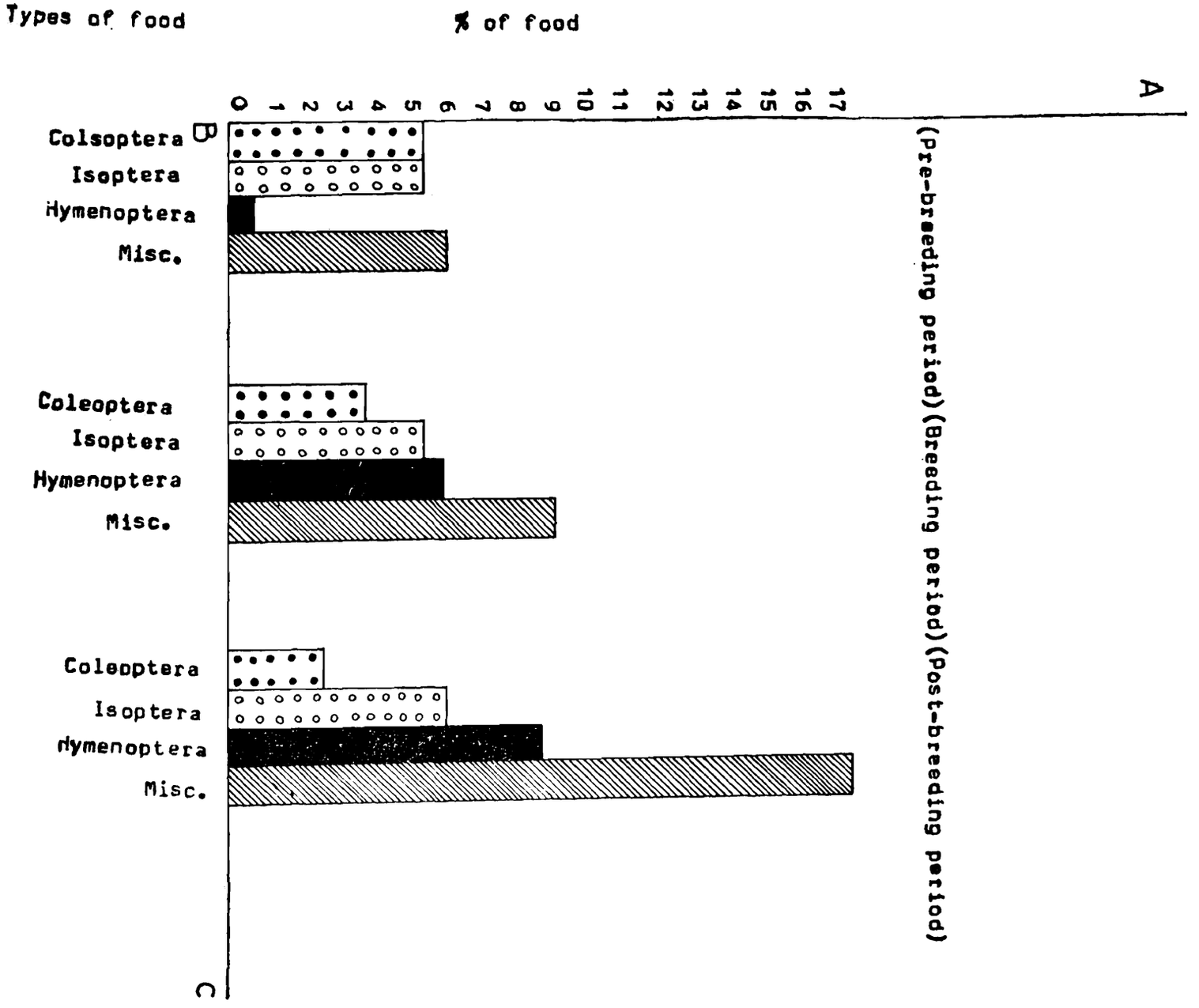

Fig. 5. Histogram showing the percentage of food items in *Microhyla berdmorei* (Blyth)

In *Microhyla ornata* the analysis of the gut-contents shows that food-intake during breeding period is maximum followed by pre-breeding and post-breeding period.

During breeding period this species preferes coleopteran and hymenopteran insects, both of them are 9.8% of the total gut-contents examined and in that list of

preference, miscellaneous food items (2.8%) are found at the bottom of preference. Isopteran insects constituting 6% of the gut-contents come next to coleopteran and hymenopteran insects.

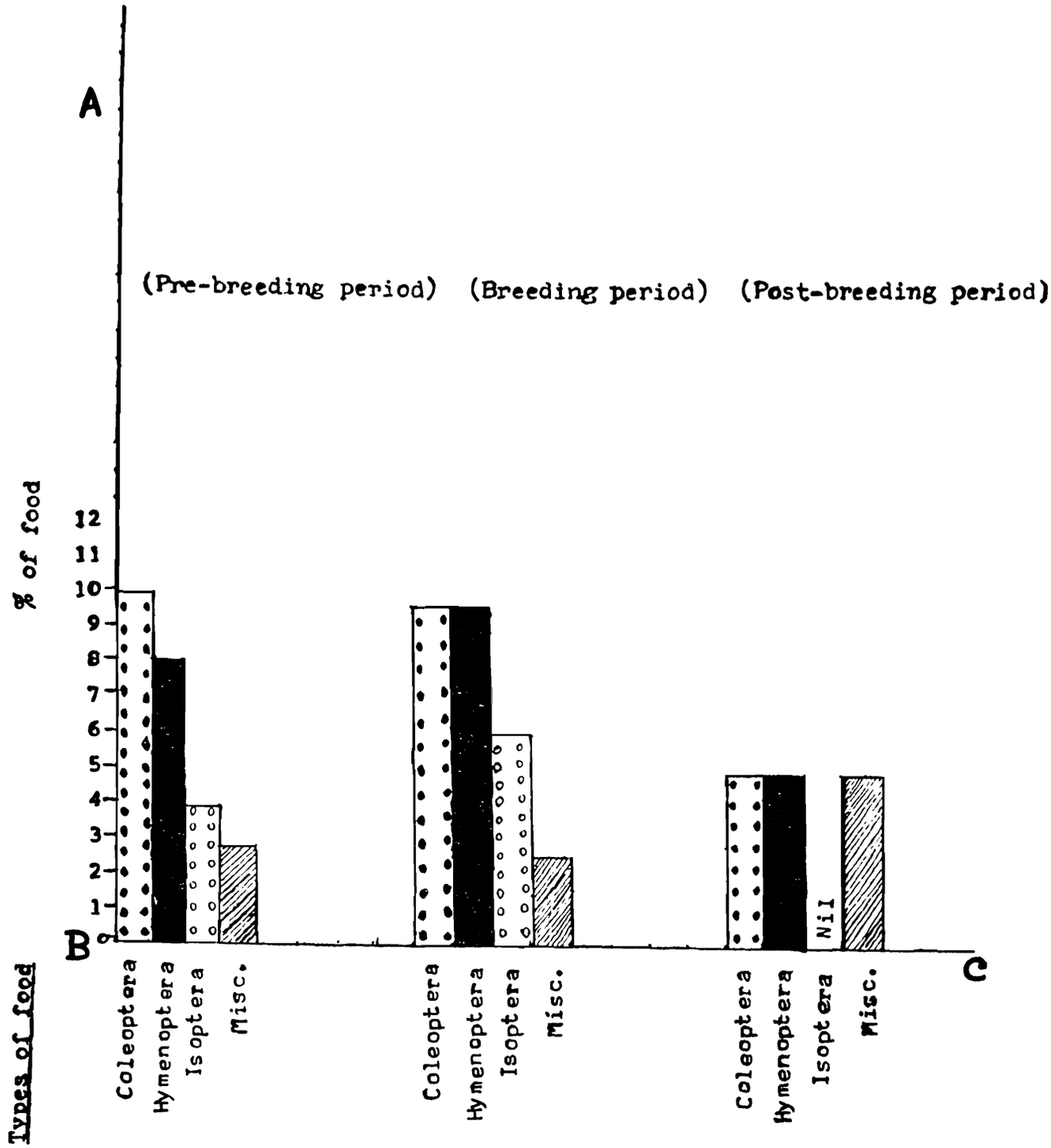

Fig. 6. Histogram showing the percentage of food items in *Microhyla ornata* (Dum & Bibr.)

Food-intake during pre-breeding period is comparatively less than the breeding period. During this period this species prefer coleopteran insects which is 9.8% of the total gut-contents examined and in that list of preference, miscellaneous food-items (2.8%) are found at the bottom of preference. Hymenopteran insects (8%) and isopteran insects (3.8%) respectively each come next to coleopteran insects.

During post-breeding period food-intake is lowest in comparison to the previous ones. During this period this species shows no preference for their food. Food normally is composed coleopteran of insects (5%), hymenopteran insects (5%) and miscellaneous food items (5%) each of the total gut-contents examined. The percentagc of food-items have been shown in histograme (Fig. 6).

Analysis of the gut-contents of *Polypedates leucomystax* reveals that the maximum food-intake takes place during breeding period followed by pre-breeding and post-breeding period.

During breeding period this species has been found to consume highest amount of miscellaneous food-items which is 11% of the total gut-contents examined and in that list of preference, coleopteran insects (1.5%) are found at the bottom of preference. Dipteran insects (4.5%), isopteran insects (4.5%) and hymenopteran insects (4.3%) each come next to miscellaneous food-items in decreasing order.

In pre-breeding period food-intake is comparatively less than the breeding period. During this period this species has been found to consume maximum amount of hymenopteran insects and miscellaneous food items, both of them are 6.5% of the total gut-contents examined and in that list of preference, isopteran insects (0.8%) are found at the bottom of preference. Rest of the food-items in decreasing order are dipteran insects (4.2%) and coleopteran insects (2.5%) come next to hymenopteran insects and miscellaneous food-items.

Food-intake during post-breeding period is lowest in comparison to the previous ones. During this period this species has been found to consume the highest amount of miscellaneous food-items which is 9% of the total gut-contents examined and in that list of preference, dipteran insects are found at the bottom which is 0.5%. Isopteran insects (5%) come next to miscellaneous food-items. Rest of the food-items in decreasing order are coleopteran insects (2.8%) and hymenopteran insects (1%). The percentage of food items have been shown in histograme (Fig. 7).

In *Philautus shillongensis* the analysis of the gut-contents reveals that the maximum food-intake takes place during post-breeding period followed by breeding and pre-breeding period.

During breeding period this species has been found to consume highest amount of miscellaneous food-items which is 11.5% of the total gut-contents examined. Isopteran insects (6.2%) and dipteran insects (0.8%) each come next to miscellaneous food items in decreasing order.

Food-intake during pre-breeding period is comparatively less than the breeding period. During this period this species has been found to consume maximum amount

of miscellaneous food-items like breeding period which is 13% of the total gut-contents examined. Isopteran insects (5%) and dipteran insects (0.8%) each come next to miscellaneous food items in decreasing order.

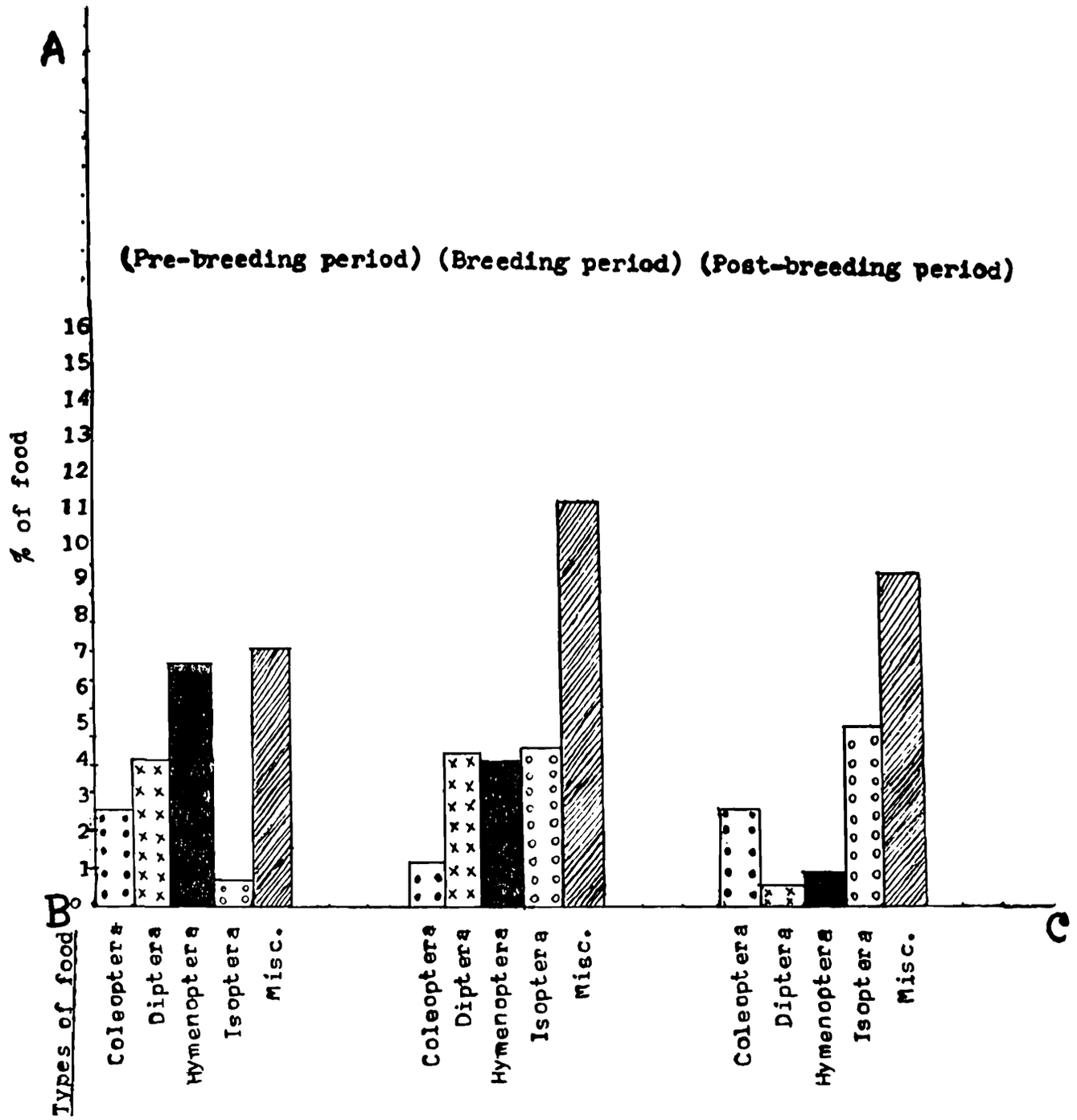

Fig. 7. Histogram showing percentage of food items in *Polypedates leucomystax* (Kuhl)

During post-breeding period food-intake is highest in comparison to the previous ones. During this period this species has been found to consume highest amount of miscellaneous food-items like pre-breeding and post-breeding period which is 18.5%

of the total gut-contents examined. Dipteran insects (1%) and isopteran insects (6%) each come next to miscellaneous food-items in decreasing order. The percentage of food items have been shown in histograme (Fig. 8).

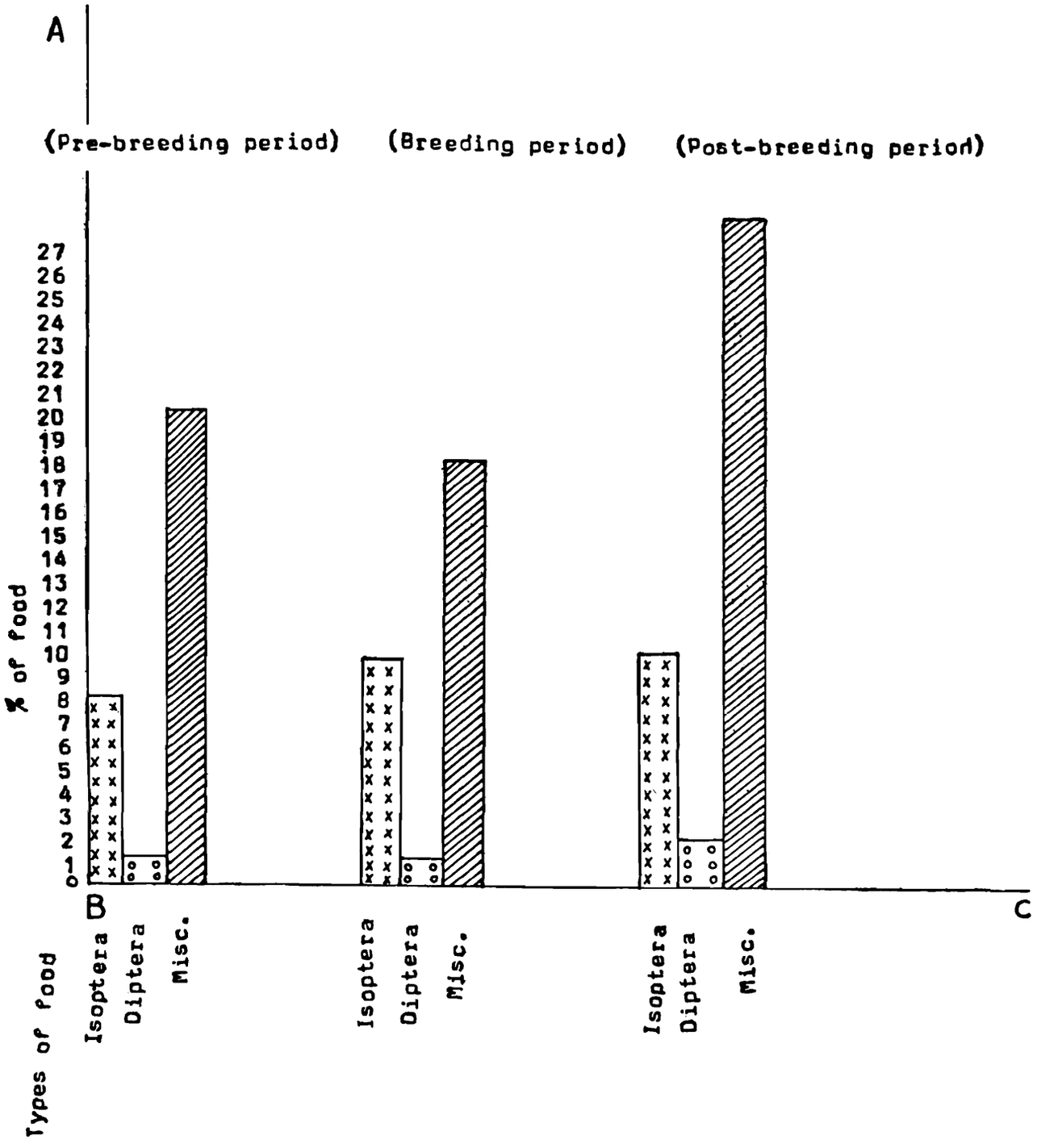

Fig. 8. Histogram showing the percentage of food items in *Philaitus shillongensis* Pillai & Chanda

Discussion

It has been observed that in most species food-intake is the minimum during hibernating period which increases gradually during the pre-breeding period and becomes maximum during the breeding period when they consume food voraciously. This may be attributed to the availability or puausity of the preferred type of food material, which in turn is governed by seasonal effect.

Acknowledgements

I am greateful to Dr. A. K. Ghosh, Director, Zoological survey of India, for providing facilities for this work and critically going through the manuscript.

References

Abdulali, H. (1985). On the export of frog legs from India. *J. Bombay nat. Hist. Soc.*, **82** (2) : 347-375.

Agharkar, S. P. (1912). The diet of Bull frog *Rana tigerina*. *J. Bombay nat. Hist. Soc.*, **21** (2) : 687.

Aitken, E. H. (1895). Food of the Bull frog. *J. Bombay nat. Hist. Soc.*, **21** (2) : 500.

Banerjee, A. (1955). Food of the Bull frog (*Rana tigerina*). *J. Bombay nat. Hist. Soc.*, **52** (2) ; 689.

Behura, B. K., Mahanty, P. K. & Ghosh, G. S. (1960). On the diet and the feeding habits of common toad *Bufo melanostictus* Schn. *Proc. Indian Sci. Congress.*, **47** (3) : 480-481.

Bhaduri, J. L. (1945). The Indian Bull frog *Rana tigerina* (Daud.) a menace to the fishery. *Sci. & Cult.*, **11** (4) : 205-206.

Chanda, S. K. (1986). A study on anuran (Amphibia) of northeast India. Ph. D. Thesis, Kalyani University, West Bengal.

Chibber, H. M. (1911). The food of a Bull frog. *J. Bombay nat. Hist. Soc.*, **20** (3) : 865.

Davidson, N. (1916). Food of the Bull frog (*Rana tigerina*). *J. Bombay nat. Hist. Soc.*, **25** (1) : 152.

Gostling, D. (1895). The food of the Bull frog. *J. Bombay nat. Hist. Soc.*, **10** (1) : 50.

Joshee, A. K. (1968). Food habit of Bull frog *Rana tigerina* (Daud). *J. Bombay nat. Hist. Soc.*, **65** (2) : 498.

Issac, S. & Rege, M. S. (1975). Food of *Rana tigerina* (Daud). *J. Bombay nat. Hist. Soc.*, **72** (1) ; 143-157.

Muller, J. P. (1912). The food of Bull frog (*Rana tigerina*). *J. Bombay nat. Hist. Soc.*, **21** (4) : 41.

Rangaswamy, H. R. & Channabasavanna, N. (1973). Food and feeding habits of the toad *Bufo melanostictus* Schn., (Amphibia : Bufonidae). *J. Bombay nat. Hist. Soc.*, **70** (3) : 558-563.

Sabins, J. H. & Kolhatkar, B. L. (1977). Observation on the food preference of *Rana cyanophlyctis* Schn. *Comp. Physiol. Ecol.*, **2** (4) : 232–233.

Smith, S. J. (1959). The food of the Bull frog. *J. Bombay nat. Hist. Soc.*, **56** (3) : 642.

Wadekar, U. L. (1963). The diet of the Indian Bull frog (*Rana hexadactyla*). *J. Bombay nat. Hist. Soc.*, **60** (1) : 263-268.