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THE DIET OF *MICROHYLA HEYMONSI* VOGT (MICROHYLIDAE) AND *RANA CHALCONOTA* SCHLEGEL (RANIDAE) IN A POND ON WEST JAVA

Paul Erftemeijer and **Boeadi**

ABSTRACT. - The stomach contents of two west Javan anurans, *Microhyla heymonsi* (Microhylidae) and *Rana chalconota* (Ranidae) were examined. Insects were the main food organisms for both species. Both species showed a strong preference for ants (Formicidae), which accounted for more than 50% of their diets. *Rana chalconota* tends to feed on a few large prey, whereas *Microhyla heymonsi* feeds on larger numbers of smaller prey. Although both species occur sympatrically in the study area, no other significant differences were found between their diets.

INTRODUCTION

Although the amphibians of Southeast Asia are taxonomically well known (van Kampen, 1923; Inger, 1966; Berry, 1975), this is not the case for their ecology and behaviour (Whitten *et al.*, 1984). Data on habitat preference, geographical distribution and reproductive ecology are scarce (e.g. Premo, 1985). There is little available information on the feeding ecology of Southeast Asian frogs and toads (Berry & Bullock, 1962; Berry, 1963; Inger & Greenberg, 1966; Inger, 1969 & 1986).

In this study, the diets of *Microhyla heymonsi* Vogt, 1911 (Microhylidae) and *Rana chalconota* (Schlegel, 1837) (Ranidae) were studied by stomach dissections. Both species are widely distributed throughout Java, Borneo, Sumatra and Peninsular Malaysia, occuring in non-forested habitats in close proximity to freshwater.

Paul Erftemeijer - P.O. Box 624, Ujung Pandang, Sulawesi, Indonesia. **Boeadi** - Balitbang Zoology, Research and Development Centre for Biology, Jalan Juanda 3, Bogor, 16122, Java, Indonesia.

DESCRIPTION OF STUDY AREA

All specimens of *M. heymonsi* and *R. chalconota* were collected from or near a freshwater pond in the Cibodas Botanical Gardens. These gardens are situated in West Java, Indonesia (107°00'E, 6°45'S). The park covers 25 ha and is situated near the Gede-Pangrango National Park, a well preserved tropical rainforest reserve of approximately 7500 ha. The anurans of this reserve have been described in detail by Liem (1971). The pond is situated about 1450 m above average sea level and covers about 200 square meters. The aquatic vegetation of the pond is dominated by *Lotus* sp., *Typha* sp., *Sagittaria* sp. and *Nymphaea* sp. The pond is surrounded by grassland and some *Altingia* trees. It has a maximum depth of 1 m with a muddy bottom. The specimens were collected between 21 and 23 January 1986, and on 8 July 1986. After dissection, the stomachs were preserved in 70% alcohol.

RESULTS

Taxonomic Composition of the Diets

Seventy-six stomachs of *M. heymonsi* and 139 stomachs of *R. chalconota* were examined. The taxonomical composition of their contents is presented in Table 1.

Table 1. Taxonomic composition of the diets of *Microhyla heymonsi* (76 stomachs) and *Rana chalconota* (139 stomachs), showing total numbers and percentages of different prey taxa that were found, with their frequency in the stomachs.

	Microhyla heymonsi			*Rana chalconota*		
Prey taxon	Total No. of food items	% of food items	% of stomachs	Total No. of food items	% of food items	% of stomachs
Mollusca	3	0.47	3.9	2	0.53	1.9
Nematoda	3	0.47	3.9	2	0.53	1.9
Acarina	31	4.84	18.4	4	1.07	2.9
Araneida	2	0.31	2.6	26	6.95	18.3
Myriapoda	4	0.62	5.3	0	-	-
Collembola	3	0.47	2.6	0	-	-
Dermaptera	2	0.31	2.6	12	3.21	9.6
Blattidae	0	-	-	4	1.07	3.8
Saltatoria	0	-	-	18	4.81	17.3
Thysanoptera	2	0.31	1.3	1	0.27	1.0
Hemiptera	15	2.34	11.8	9	2.41	8.6
Coleoptera	23	3.59	23.7	23	6.51	18.3
Formicidae	531	82.84	82.9	215	57.49	37.5
Vespoidea	2	0.31	2.6	1	0.27	1.0
Diptera	2	0.31	2.6	23	6.15	18.3
Lepidoptera larvae	2	0.31	2.6	15	4.01	13.5
Unidentified insect larvae	11	1.72	7.9	4	1.07	3.8
Miscellaneous	1	0.16	-	15	4.01	-
Total	461	99.68	-	374	100.00	-

Insects were the main source of food for both species (93.29% of the diet of *M. heymonsi* and 90.11% of the diet of *R. chalconota*). In addition, some other invertebrates, including molluscs, nematodes, oligochaetes, annelids, crustaceans, mites, araneids and myriopods were found in the stomachs, but they never consisted more than 10% of the diets of each of the two species.

For both species, ants (Formicidae) were the dominant prey, accounting for 82.84% of the diet of *M. heymonsi* and for 57.49% of the diet of *R. chalconota*. Numerically, second in importance were the arachnids; mainly mites (Acarina) in the diet of *M. heymonsi* (4.84%) and spiders (Araneidea) in the diet of *R. chalconota* (6.95%). Beetles (Coleoptera) accounted for 6.15% of the diet of *R. chalconota* and for 3.59% for *M. heymonsi*. They were represented by several families, including Carabidae, Staphylinidae, Byrrhidae, Elateridae, Tipulidae, Curculionidae, Chrysomelidae, Scarabaeidae and Anthribidae. Diptera, which accounted for 6.15% of the diet of *R. chalconota*, were represented by both Nematocera and Brachycera, the latter of which were represented by Drosophilidae, Mycetophilidae and Stratiomyidae. Saltatoria accounted for 4.81% of the diet of *R. chalconota*, and included Tetrigidae and Acrididae.

Of all stomachs investigated, 36 (= 25.9%) for *R. chalconota* and three (= 3.9%) for *M. heymonsi* were empty. In general, the stomach of *M. heymonsi* was found to contain more prey-items than *R. chalconota*, with an average number of prey per stomach of 8.4 for *M. heymonsi* and 2.7 for *R. chalconota*. The number of prey-items per stomach, however, showed considerable individual differences, varying between 0 and 42 for *M. heymonsi* and between 0 and 45 for *R. chalconota*. Other than recognisable animal prey-items, some plant material, almost certainly consumed accidentally with the insect prey, was also found in the stomachs of both species.

Prey Size

Although no detailed measurements of prey-items were taken, overall data indicated that *R. chalconota* feeds on larger prey than *M. heymonsi*. Maximal prey sizes of 63 mm (an annelid) were found for *R. chalconota* and 6 mm (insect larvae) for *M. heymonsi*. Several *R. chalconota* had eaten grasshoppers (Saltatoria) of over 8 mm in length. The smallest prey found were mites (0.5 mm) in *R. chalconota* and insect larvae (1 mm) in *M. heymonsi*.

The difference in prey size preference might be related to the fact that *R. chalconota* is usually larger (31 to 71 mm) than *M. heymonsi* (19 to 26 mm) (Liem, 1971). Such a relation between body length of anurans and the size of their prey has previously been reported by Loman (1979) for *Rana arvalis* Nillsson, 1842 and *R. temporaria*, Linnaeus, 1758; and by Erftemeijer (1986) for *Bufo calamita* Linnaeus, 1758 and *R. arvalis*.

DISCUSSION

Both *M. heymonsi* and *R. chalconota* showed a rather specialised feeding behaviour, reflected in the high number of ants (Formicidae) found in their stomachs. Ants are an easy prey for anurans. Since they often aggregate in the well-known ant-paths, relatively large numbers can be swallowed within a short time. If the diets of both species are compared, *M. heymonsi* seems to swallow more mites (Acarina) and ants (Formicidae), whereas *R. chalconota* more frequently feeds on Araneidea and Diptera. In general, however, there are no major differences in taxonomical composition between their diets.

It is remarkable that *R. chalconota* generally swallows fewer but larger prey items compared to *M. heymonsi*. Although the present study has no detailed data on the morphometrics of the prey, our findings indicate that prey size selection might be an important mechanism in niche-segregation of the two species. Competition, however, may only occur in situations of restricted food supply and high population densities.

The large variations in the number of prey items found in the stomachs of the frogs (both species) might also reflect differences in individual foraging success. The interpretation of the results of taxonomic studies of the diet of anurans, such as in the present study, needs care. Although some prey species might prevail in terms of numerical percentage of the total diet, their nutritive value and significance to the feeding requirements of the anurans remain unknown.

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