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A Preliminary Study of the Food of the Dwarf Snake, *Eirenis modestus* (Martin, 1838) (Serpentes: Colubridae), in İzmir and Manisa Provinces

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Abstract: The stomach contents of 14 (4 ♂♂, 4♀♀ and 6 juveniles) *Eirenis modestus* specimens captured during various field studies in İzmir and Manisa provinces were examined, and a total of 44 prey items were found. An analysis of the stomach contents revealed that prey belonging to the classes Insecta (75%), Chilopoda (11%), and Reptilia (2%) constituted the diet of the species; the remaining prey could not be identified. The most frequently consumed prey were the orders Coleoptera (32%) and Orthoptera (21%) by number; Coleoptera (36%), Orthoptera (36%), and Scolopendromorpha (29%) by frequency; and Scolopendromorpha (72%) by volume. Based on these results, *Eirenis modestus* feeds predominantly on arthropods found under stones (86%).

Key Words: Dwarf snake, *Eirenis modestus*, food composition

İzmir ve Manisa ili Uysal Yılan, *Eirenis modestus* (Martin, 1838) (Serpentes: Colubridae),'ın Besini Üzerine Bir Ön Çalışma

Özet: Bu çalışmada, İzmir ve Manisa illerinde yapılan arazi çalışmaları esnasında yakalanan 14 (4 ♂♂, 4♀♀ ve 6 juv.) *Eirenis modestus* örneğinin sindirim sistemi içeriği incelenmiş, toplam 44 av tespit edilmiştir. Sindirim sistemi içeriğine göre, türün besinini Insecta (% 75), Chilopoda (% 11) ve Reptilia (% 2) sınıflarına ait avlar oluşturmaktadır ve geriye kalan avlar tanımlanamamıştır. Bulunma oranı bakımından Coleoptera (% 32) ve Orthoptera (% 21); görülme sıklığı bakımından Coleoptera (% 36), Orthoptera (% 36) ve Scolopendromorpha (% 29); hacim bakımından Scolopendromorpha (% 72) takımları en yüksek orana sahip av gruplarıdır. Bu sonuçlara göre, *Eirenis modestus* büyük oranda taş altı eklembacaklı faunası (% 86) ile beslenmektedir.

Anahtar Sözcükler: Uysal yılan, *Eirenis modestus*, besin kompozisyonu

Introduction

Snakes are prominent predators in many terrestrial, aquatic, and marine communities (Luselli, 2006a, 2006b). Consequently, information related to their feeding habits enhances our understanding of trophic relationships in diverse ecological assemblages (Rodrigues-Robles, 2002). An obviously fundamental question about the foraging ecology of snakes is what they eat (Shine, 1977; Greene, 1997). Mushinsky's (1987) review of this topic revealed that there are still many species for which we lack basic dietary information.

Eirenis modestus (Martin, 1838), a medium-sized colubrid snake reaching a maximum total length of 70 cm, is distributed mainly in the Caucasus, Northwest Iran, Turkey, Syria, Lebanon, and Cyprus, as well as on the islands of Lesvos, Chios, and Samos. It occurs in all parts of Turkey except for Southeast Anatolia. In Eastern Anatolia, it exhibits a vertical distribution of up to 2000 m (Başoğlu and Baran, 1977).

This species inhabits rocky areas with sparse vegetation and often hides under stones. Previous work has shown that this species eats mostly insects, but has

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also shown that it sometimes preys on earthworms and mollusks as well (Terentjev and Chernov, 1949; Baran, 1976). However, the details of its feeding habits and ecology are not well known. The objective of this study was to determine the types and variety of prey consumed by *Eirenis modestus* in İzmir and Manisa provinces, where this species occurs extensively.

Materials and Methods

Fourteen *Eirenis modestus* specimens (4 ♂♂, 4 ♀♀ and 6 juveniles) were captured during field studies conducted in İzmir and Manisa provinces in 2004 [(3 ♂♂) Yukarı Çoban İsa Village, (1 ♀) Sütçüler Village, (4 juv.) Deynekler Village, Gölmarmara; (1 juv.) Kula, (1 juv.) Seyitoba Village, Saruhanlı, Manisa; (1 ♂) Beşpınar Village, (2 ♀♀) Egekent, (1 ♀) Kemalpaşa, İzmir]. The biotope where the specimens were collected contained a *Pinus brutia* forest growing above other dominant species including *Quercus coccifera* and *Juniperus excelsa.* Snakes were generally found under stones or around trees in open spaces rather than in densely treed inner parts of the forest. Two specimens were encountered in an olive grove (*Olea europea*) in Manisa province. The temperature ranged between 20 and 32 ºC and the weather was sunny on the days the specimens were collected.

The snakes were etherized and fixed in 10% formalin solution within half an hour following their capture. They were then preserved in 70% ethyl alcohol. Snout-vent length and total length values of the individuals were measured in the laboratory and recorded. The snakes were dissected along the ventral side and their sexes were determined. After that, the digestive systems were removed and placed in small bottles containing 70% ethyl alcohol.

For a dietary analysis, the digestive tract was dissected with a lancet and the prey items were identified to the finest possible taxonomic resolution using a stereo microscope. Prey volume was calculated using the ellipsoid formula (Dunham, 1983): $V= 4/3\pi (L/2) (W/2)^2$ (V: prey volume; L: length of prey; W: width of prey). Stomach contents were evaluated in terms of numeric proportion (the number of snake stomach containing a particular prey type, n %), frequency of occurrence (the frequency of an individual prey items in all snake stomachs , f %) and volume (the volume of prey items in all snake stomachs, v %).

Results

Mean snout-vent length (SVL) (mean ± 95% CI) and mean total length (TL) of the 14 (4 ♂♂, 4 ♀♀ and 6 juveniles) *Eirenis modestus* specimens collected were 262.9 ± 53.1 mm (range = 116-415) and 329.2 ± 66.3 mm (range = 144-542), respectively. A total of 44 prey items found in the stomach contents were examined. Prey items identified in the stomach contents of *Eirenis modestus* included 34 insects (75.0%), 6 chilopods (11.4%), and 1 reptile (2.3%) (Table). The remaining 3 prey items could not be identified as they were largely digested. In addition, 2 pebbles and a small amount of soil were also found in the stomach contents. However, we think that these were inadvertently swallowed during feeding and therefore we did not consider them food items.

Table. Food composition of 14 (4 ♂♂, 4 ♀♀ and 6 juveniles) dwarf snakes, *Eirenis modestus*. F(%): Frequency of occurrence (the frequency of an individual prey items in all snake stomachs); N(%): Numeric proportion (the number of snake stomachs containing a particular prey type); V(%): Volumetric proportion (the volume of prey items in all snake stomachs).

Prey Taxa	F (%)	N (%)	V (%)
Insecta	85.7	75.0	18.3
Collembola	7.1	11.4	<0.1
Orthroptera	35.7	20.5	8.5
Acrididae	21.4	6.8	4.7
Gryllidae	14.3	6.8	1.9
Tetrigidae	14.3	6.8	1.9
Coleoptera	35.7	31.8	9.3
Carabidae	14.3	9.1	3.8
Coccinellidae	14.3	13.6	3.3
Tenebrionidae	14.3	9.1	2.2
Hymenoptera	7.1	11.4	0.4
Formicidae	7.1	11.4	0.4
Chilopoda	28.6	11.4	71.8
Scolopendromorpha	28.6	11.4	71.8
Scolopendridae	28.6	11.4	71.8
Scolopendra sp.	28.6	11.4	71.8
Reptilia	7.1	2.3	8.0
Squamata	7.1	2.3	8.0
Lacertidae	7.1	2.3	8.0
Ophisophs elegans	7.1	2.3	8.0
Unidentified	21.4	6.8	1.5

The prey group exhibiting the greatest variety was the class Insecta. Four orders and 7 families belonging to this class constituted 75.0% of the diet. Coleoptera (35.7%), Orthoptera (35.7%), and Scolopendromorpha (28.6%) were the most frequently encountered orders in the stomach contents of the individual snakes (f% > 20%), whereas Hymenoptera (7.1%) and Collembola (7.1%) were the least frequently represented orders; the only non-arthropod order, Squamata, also occurred infrequently (7.1%). Coleoptera (31.8%) and Orthoptera (20.5%) were the groups containing the highest number of prey items (n% > 20%). Squamata (2.3%) had the lowest number with only one prey item (*Ophisops elegans*) identified. Scolopendromorpha (71.8%) had the highest prey volume (v% > 20%), while the lowest volume belonged to Collembola (<0.1%) and Hymenoptera (0.4%).

Discussion

Our results revealed that the dwarf snake, *Eirenis modestus*, feeds mainly on terrestrial arthropods, supporting previous observations made by a number of researchers. Those previous studies have reported prey from the taxa Orthoptera, Coleoptera, Isopoda, Myriapoda, Scorpiones, and Aranea (Terentjev and Chernov, 1949; Bannikov et al., 1977). Although we found prey belonging to Orthoptera, Coleoptera, and Myriapoda in the stomach contents of snakes, we did not encounter any prey from Isopoda, Scorpiones, or Aranea. However, in previous field studies, we observed that *Eirenis modestus* from an Aegean population ate scorpions (unpubl. data). Most of the prey items we found in the stomach contents, except for the orthopterans, belonged to arthropod groups that either are poor flyers or cannot fly at all, and are commonly found under rocks. Thus, the dwarf snake feeds mainly on arthropods found under rocks, and is possibly preying on them opportunistically, as has been seen in numerous other colubrid species (Rodrigues-Robles et al., 1999; Shewchuk and Austin, 2001; Gregory and Isaac, 2004; Luiselli, 2006a).

Lizards frequently fall prey to larger colubrids. For example, they make up 63.4% of the diet of *Coluber constrictor*, *Masticophis flagellum*, and *Elaphe guttata* (Hamilton and Pollack, 1956). However, arthropods can also constitute a substantial percentage of the diet composition of some species (e.g., *Tantilla* - Hamilton and Pollack, 1956). *Tantilla gracilis* feeds exclusively on coleopteran larvae (families Alleculidae, Elateridae, and Tenebrionidae), centipedes (orders Lithobiomorpha and Scolopendromorpha), and snails (order Stylommatophora) (Cobb, 2004). Furthermore, Shewchuk and Austin (2001) reported that 91% of the diet of *Coluber constrictor mormon* consisted of insects. *Coronella girontica* fundamentally is saurifagous, including sporadically in its diet ground arthropods (mainly chilopods), earthworms, and micromammalian (e.g., *Crocidura russula*, *Microtus lusitanicus*) prey (Galán, 1988, 1997; Luiselli et al., 2001). Italian and Spanish populations of *Coronella girontica* consumed terrestrial prey or the prey dwelling under rocks more than 95% of the time (Luiselli et al., 2001). Consumption of invertebrates by small snakes has also been observed in nearby areas (e.g., *Vipera ursinii* in the central Apennines, see Agrimi and Luiselli, 1992). *Eirenis modestus* seems to be another example of such a species.

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