

*Short note*

## *Summer diet of the red fox (*Vulpes vulpes* Linnaeus, 1785) in agricultural areas in South-Eastern Bulgaria*

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**Abstract.** The summer diet of the red fox (*Vulpes vulpes* Linnaeus, 1785) in agricultural areas of South-Eastern Bulgaria was studied. Fecal samples were collected and processed in the laboratory of University of Plovdiv "Paisii Hilendarski". Insects, rodents, and fruits were the most commonly used dietary components. A relatively high percentage of reptiles were also found, which was observed in agricultural areas with a Mediterranean climate in Greece.

**Key words:** fecal samples, frequency of occurrence, dietary items.

### **Introduction**

In the 21st century, many natural habitats have been modified by humans (Gosling, 2020). Much of the natural habitats are being converted into agricultural lands to meet the growing food needs of the human population (Blann, 2006). This forces many animals living in human-influenced areas to adapt to the new conditions.

The red fox (*Vulpes vulpes*) is among the predators successfully surviving in such habitats, which manages to find food even in highly modified agricultural areas (Remonti et al., 2012). The high trophic plasticity of the predator allows it to adapt to the food resources of agroregions (Goldyn et al., 2003; Díaz-Ruiz et al., 2013).

Few studies have been conducted in Bulgaria on the food spectrum of this species in agricultural lands, and therefore this study aims to supplement the information on the summer diet of one of the most widespread predators in the country (Petrov et al., 2016; Petrov et al., 2024).

### **Materials and Methods**

The survey was conducted from June 1, 2021 to August 31, 2021 in the area of Svilengrad municipality, South-Eastern Bulgaria (Fig. 1).

Agricultural production in the municipality is mainly aimed at growing tobacco, vineyards, cereals and fruits. Agriculture has a leading economic function in the municipality (Penin, 2007).

A total of 90 fecal samples (30 per month) were collected from areas with highly developed agriculture (the villages of Levka, Pastrogor, Lisovo, Mladinovo and Dipchevo). The samples were placed in plastic bags and processed in laboratory conditions at the University of Plovdiv "Paisii Hilendarski". Processing of the samples included deworming with 70% ethyl alcohol and water, washing through a sieve of 0.5 mm, determination of macrocomponents and their separation into 9 different groups.

The relative frequency of occurrence (RFO %) of all food components and food groups was calculated by dividing the number of occurrences of a certain food component by the sum of occurrences of all food components.

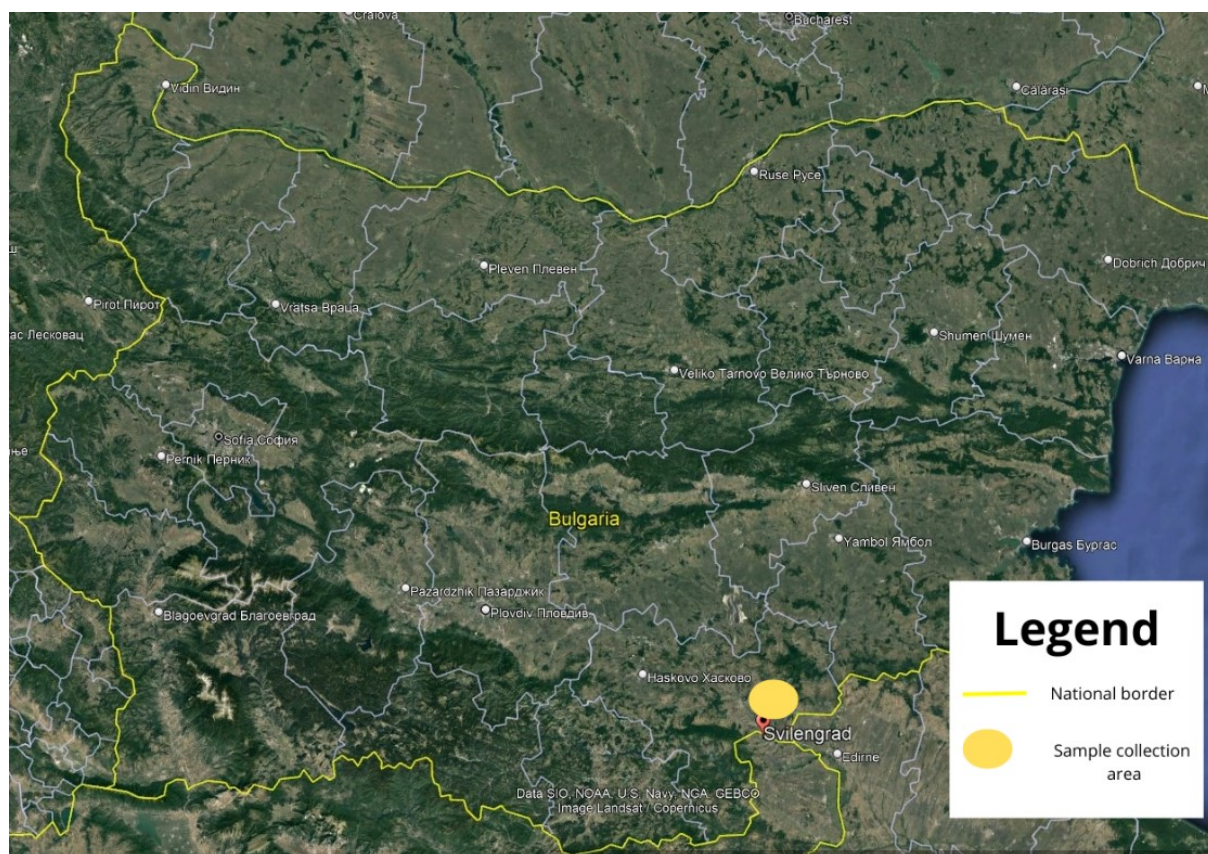


Fig. 1. Sample collection area.

### Results and Discussion

Insects (32.32%), fruits (26.22%) and rodents (25.61%) were the most common food components found in the diet of the fox in South-Eastern Bulgaria, Svilengrad region during the summer season (Table 1). We agree with Goldyn et al. (2003) and Cancio et al. (2017) that the mosaic landscape, combining pastures, fields and fragments of oak forests, provides a variety of foraging opportunities. A relatively high percentage was also found in the captured reptiles (4.88%), which was also observed in other similar studies conducted in agricultural regions, but with a Mediterranean climate (Díaz-Ruiz et al., 2013; Bakaloudis et al., 2015).

Other studies of the fox diet in Bulgaria confirm that insects have a high frequency of

occurrence in the feces during the warm months, with only rodents and fruits being more common than them (Kyurkchiev, 2008; Petrov et al., 2016; Petrov et al., 2024).

Domestic birds (0.61%) and domestic mammals (2.44%) represented an extremely low percentage of the fox's diet during the study period. Much more preferred are rodents (25.61%) and mainly voles (14.2%). This shows the study predator's preference for hunting animals that humans find to be pests and its contribution to the regulation of rodent populations.

Seasonal fruits are also often used by the fox in this part of Bulgaria. The mulberry is one of the most frequently used food resources, which we explained by its accessibility and high distribution in the area.

**Table 1.** Number of cases (n) and relative frequency of occurrence of food items in the faces (30 per month) of *Vulpes vulpes* in agricultural regions of South-Eastern Bulgaria.

Dietary items	June (n=30)		July (n=30)		August (n=30)		Total	
	S	RFO%	S	RFO%	S	RFO%	S	RFO%
<b>Fruits</b>	12	21.82	15	31.91	16	25.81	<b>43</b>	<b>26.22</b>
Grapes ( <i>Vitis</i> sp.)	0	0.00	0	0.00	2	3.23	2	1.22
Mulberry ( <i>Morus</i> sp.)	12	21.82	15	31.91	14	22.58	41	25.00
<b>Domestic mammals</b>	0	0.00	1	2.13	3	4.84	<b>4</b>	<b>2.44</b>
Goat ( <i>Capra domesticus</i> )	0	0.00	0	0.00	1	1.61	1	0.61
Sheep ( <i>Ovis aries</i> )	0	0.00	0	0.00	1	1.61	1	0.61
<b>Wild mammals</b>	0	0.00	1	2.13	1	1.61	2	1.22
Wild hare ( <i>Lepus europaeus</i> )	0	0.00	0	0.00	1	1.61	1	0.61
Roe deer ( <i>Capreolus capreolus</i> )	0	0.00	1	2.13	0	0.00	1	0.61
<b>Rodents</b>	14	25.45	10	21.28	18	29.03	<b>42</b>	<b>25.61</b>
Common wood mouse ( <i>Sylvaemus sylvaticus</i> )	1	1.82	1	2.13	3	4.84	5	3.05
House mouse ( <i>Mus musculus</i> )	3	5.45	2	4.26	5	8.06	10	6.10
Rat ( <i>Rattus norvegicus</i> )	1	1.82	0	0.00	0	0.00	1	0.61
Vole ( <i>Microtus</i> sp.)	7	12.73	7	14.89	9	14.52	23	14.02
Eadible dormouse ( <i>Glis glis</i> )	2	3.64	0	0.00	1	1.61	3	1.83
<b>Wild birds</b>	1	1.82	0	0.00	1	1.61	<b>2</b>	<b>1.22</b>
Passeriformes	1	1.82	0	0.00	1	1.61	2	1.22
<b>Domestic birds</b>	0	0.00	0	0.00	1	1.61	<b>1</b>	<b>0.61</b>
Hen ( <i>Gallus gallus domesticus</i> )	0	0.00	0	0.00	1	1.61	1	0.61
<b>Reptiles</b>	3	5.45	2	4.26	3	4.84	<b>8</b>	<b>4.88</b>
Lacertilia - undet.	3	5.45	2	4.26	3	4.84	8	4.88
<b>Insects</b>	20	36.36	16	34.04	17	27.42	<b>53</b>	<b>32.32</b>
Coleoptera	15	27.27	13	27.66	13	20.97	41	25.00
Orthoptera, Caelifera	3	5.45	3	6.38	4	6.45	10	6.10
Insecta - undet.	2	3.64	0	0.00	0	0.00	2	1.22
<b>Other</b>	5	9.09	2	4.26	2	3.23	<b>9</b>	<b>5.49</b>
Waste	3	5.45	1	2.13	1	1.61	5	3.05
Pebbles, grass	1	1.82	1	2.13	0	0.00	2	1.22
Egg shell	1	1.82	0	0.00	1	1.61	2	1.22
<b>Total</b>	55	100.00	47	100.00	62	100.00	<b>164</b>	<b>100.00</b>

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Received: 13.05.2023

Accepted: 09.06.2024