STUDY OF PLACES, RELATED TO THE MARKING REFLEX OF THE STONE MARTEN (*MARTES FOINA ERXL*)

S. Peeva*

Department of Animal Production Monogastric and Other Animals, Faculty of Agriculture,
Trakia University, Stara Zagora, Bulgaria

ABSTRACT

The study was conducted in the area of Sarnena Sredna gora mountain and Central part of Stara planina mountain in the period of 03.2013- 02.2014. At least 30 fecal samples were collected monthly from each area. The total number of samples is 923. The typical places, used by stone marten for marking were defined. A gradation of the favorite sites for marking was made, according to the frequency of occurrence of feces deposited. The anthropogenic influence of the marten's scent marking was determined.

Key words: fecal samples, behavior, anthropogenic factor

INTRODUCTION

In carnivores, the secretion produced by the anal glands adheres to the feces during defecation. (1). Signaling by means of odors is undoubtedly the most important for intraspecific relationships (2). Marking behavior is well known, but is not understood yet. It carries information about the social and reproductive status and possibly also for individual identification (3). Some authors compare it to the suspension of listing and circulation to all animals (4).

The Mustelides use different ways of marking their home ranges. As there appear to be three: by urine, by feces and by secretions from anal glands. The smaller sized species (weasel, mink) mark their territory more frequently than the larger ones (badger, polecat, pine marten). Marking activity of all species increase in spring. Carnivores rarely mark boundaries of their home range in the summer and winter (5). The points of marking by urine and excrement prevail in pine marten as well as in the stone marten. They are all deposited at a small height above the ground surface. The home range boundaries are fixed by constantly renewable marks over the same subjects from the surrounding environment (6).

Scent marking in European pine martens is related to reproduction and is involved in intersexual and intrasexual communication (7). Carnivores mark places associated with stress factors. Thus the territory is marked automatically. (2).

Collection of fecal samples across defined transects can be used to determine the density of small predators such as: marten (*Martes foina*), badger (*Meles meles*) and red fox (*Vulpes vulpes*) in different habitats, according to their habitat preference. (8). Knowledge for the places of depositing of animals feces will ensure successful conducting of such study.

In places where human presence is low any unknown object or smell evokes mammals caution. Roads and traffic abound of smells and objects related to human activity. Mustelides are less afraid of human odor than Canides. (2). Stone marten occurs in nature but it is also a typical synantropic species that settle in urban areas.

The aim of our study is to find the typical places and objects used by stone marten for marking by defecation in two habitats with different anthropogenic influence. We also want to determine the influence by human presence and activity on the sites of tagging as part of the marking reflex of the marten.

MATERIAL AND METHODS

1. Study area

*Correspondence to: Stanislava Peeva,
Department of Animal Production Monogastric and
Other Animals, Faculty of Agriculture, Trakia
University, Stara Zagora, Bulgaria,
st.peeva@abv.bg

The study was conducted in two areas in Central Bulgaria that contrast in terms of population density and degree of modification of the landscape by human activities. (**Figure 1**).

The climate here is transitional between continental and continental-Mediterranean: Köppen code: Cfa (9).

Figure 1. Study area (Region 1- urban area, Region 2- area without settlements)

"Region 1" is located near the town of Stara Zagora (42°24-34'N, 25°16-56'E). Its area is about 190 km², composed of hilly terrain with altitude of 240-440 meters above sea level. Agriculture (cereals, orchards and vineyards) and livestock are developed in this region. It is dotted with settlements, at a distance 3-4 km from each other, where the samples were collected. The size of the settlements is related to the number of residents and varies from 38 inhabitants in the village Pastrovo to 1374 inhabitants in the village Dalboki. There is a high number of vacant houses in every village where stone martens settle.

„Region 2“ (42°36-42'N, 25°25-46'E) has an area of 210 km² on the southern slopes of the Central Balkan Mountains, to the north of the town of Kazanlak. The terrain is steep and cut by many short, steep valleys with altitudes ranging between 400-1370 m. The mountains are covered with forests of oak to about 1000 m. alt. and the virgin forests composed of European beech on greater height. This area does not include farmlands.

2. Sampling faces

Samples were collected from two regions in the period 03.2013-02.2014, twice a month for the purposes of another large study, while at the same time locations of defecation were reported. Due to the specifics of Region 1 related to private property, streets in the villages are used as transects.

Because the mountain is difficult to pass in Region 2, three routes with approximately equal length from the foot of the mountain to 1000-1100 a.s.l.: 4 km (highway /E79/- monument Buzludza /5005/), 5 km (highway /E79/- monument Shipka /5/), 5 km (highway /E79/- v. Yavorovets /609/), were used as transects.

Martens' feces were identified according to the diameter (10-15 mm), shape (spindle with a pointed tip), close to the track (in winter) and by their smell (sweet), following the general methods of (10, 11, 12,13).

In Region 1 the diet of stone marten in winter is established in a previous study (14). In this area marten lives together with fox and polecat (15). Their feces, however, vary in size and diameter and cannot be mistaken. These from fox are almost double bigger and wider, and these from polecat are thinner and occur rare.

In mountain areas, unaffected by human activity marten's feces can be mistaken with those of its relative, the pine marten. In Central Bulgaria, pine marten inhabits the area of beech forests to tree line above 1500 m a.s.l the ridges of the Balkan Mountains (16). To minimize the possibility of mistakes in Region 2 transects were set to 1000 meters above sea level, where there is no evidence for the presence of the pine marten.

In a similar study on marking behavior of pine marten (7) are using a methodology in which they separate samples as: left on a smooth or

on a convex surface. For convex they determine that which for the observer stands outside surrounding substrate (soil pile, plants, stones). All other cases are defined as smooth.

For the purpose of our study the objects are divided as:

- Smooth solid substrate- hard concrete, asphalt, stone, under outfall and next to and in drainage channels
- Convex solid substrate- stone, curb, stump of a tree, a house wall, roof, street benches
- Artificial substrate - plastic bag, rags, box of cigarettes, trap predators
- On or next to other feces- own (WC) or deposited by another animal

RESULTS AND DISCUSSION

Some of the places for marking in Region 1 were shoot and shown on **Figure 2** and the results of the two study areas are summarized in **Table 1**.

Figure 2. Some of the marking places in villages

Our data suggest that in places with a high degree of urbanization (Region 1) marten prefers to deposit its feces mainly on smooth solid substrate - 37.37% and convex solid substrate - 36.62% (**Figure 3**). Approximately the same percentage of the distribution of feces testifies the preference of this kind to the

hardness of the substrate at all, and its convexity takes second place. As evidence of this points to the fact that within these two conditional groups of objects the main amount of feces are registered on the concrete -13.94% and on the curb and stairs 17.84% (**Table 1**).

Table 1. Objects used by marten for defecating

Objects	Region 1, num	Region 1, %	Region 2, num	Region 2, %
Concrete	75	13,94	-	-
Asphalt	15	2,79	281	72,99
Stone plate	48	8,92	-	-
Under the outfall	43	7,99	-	-
Next to and in drainage channels	20	3,72	-	-
Smooth solid substrate, Σ	201	37,36	281	72,99
Stone	19	3,53	43	11,17
Curbs and stairs	96	17,84	-	-
Stump of a tree	15	2,79	-	-
Wall of house	27	5,02	-	-
Roof	35	6,51	-	-
Street benches	5	0,93	-	-
Convex solid substrate, Σ	197	36,62	43	11,17
Plastic bag	14	2,60	6	1,56
Rags	27	5,02	-	-
Box of cigarettes	4	0,74	2	0,52
Predators trap	5	0,93	7	1,82
Artificial, Σ	50	9,29	15	3,90
Own scat (WC)	68	12,64	8	2,08
Deposit by another animals scat	17	3,16	19	4,93
On or next to another scat, Σ	85	15,80	27	7,01
Others	5	0,93	19	4,93

Without specific statistics to be done on the specific location of the mark, it is noteworthy that these are places crucial to the movement of marten, namely: crossroads, in front of the doors, to drainage channels and others.

In villages the most of these sites are in close proximity to trees and vines. Fruits appear to be the main food of the stone marten in the area (personal observation). In his study (6) indicates the marking of foraging sites by temporary marks. The most commonly used objects are stones, stumps, trunks of fallen trees, and objects of artificial origin.

Some number of the feces were found deposited by or on other scats- 15.80% (**Figure 3**). In our survey, the large percentage

(12.64%) is in favor of those put on their own previous marks. Stone martens similar to other species of the family Mustelidae make their own toilets. In her research on pine marten (7) considered two or more scats to be a toilet. Their function is to strengthen the animal smell, which is marked before. In a similar study on the weasel (3) found that in the crawl process of their home ranges males visit the places that are already marked with urine or feces, carefully smelled and deposited new scat bearing fresh smell of anal glands. A small part of our samples were found on feces deposit from other animal- 3.16%. Like weasels (3) the stone martens put their smell to overlap the mark made by other animals.

Figure 3. Percentage of sites used by marten for defecating in urban area

There has been a low rate of occurrence of feces on a substrate of artificial origin (9%). When the path of the stone marten accidentally gets covered by human activities following its instinct it highlighted it as a new object.

In rare cases were found feces placed directly on the soil, on a patch of grass and under the trees and leaves.

In Region 2 stone marten mostly deposit its feces directly on asphalt roads.

For the purpose of our study samples from Region 2 were collected up to 1000 m. a.s.l. as above this limit they can be mistaken with the feces of the pine marten, which occurs in the higher parts (16). In this area, which is not affected by human activity, the bulk of the feces were deposited on smooth solid substrate- 73% (**Figure 4**). Feces were found on the asphalt up to 30 cm from the end. We explain this by the fact that the asphalt roads serve as corridors for the movement of wildlife

species and at the same time are open space. Because of the low human presence and absence of settlements the physical characteristic of the landscape is simplified. (2) indicates that the greatest amount of excrement were deposited in the outskirts of the forest (41.5%), followed by open areas (36.5%) and at least in the woods (22%). A small part (11%) of feces were found on stones on the road or nearby. According to (17) stone marten more often than other predators defecates on stones. This fact is probably associated with its typical habitat, from where its name is derived in different languages- Russian kamennaya kunitza, English stone marten and others. It hides, feeds and marks its home range in here. This fact ensures the preference of stone marten to marks substrate. Projection of stones provides prominently set of markings. It is well known that the orientation of the small predators within their home range includes both olfactory and visual signs.

Figure 4. Percentage of sites used by marten for defecating in an area with low human presence

7% of the samples were found next to or on scat from other animal. In a similar study conducted in the Osogovo mountain (18) found two interesting cases of fox / stone marten scats laid on pellets left by birds of prey, demonstrating their food competition. They had also found scat marking left by stone marten and fox on the same place, as display of indirect competitive behavior, most probably due to the common food resource. (3) show that weasels entered their smell to overlap the markings made by other animals.

In places where human presence is low any unknown object or smell evokes mammals' caution. We believe that the low percentage (4%) of find on an artificial substrate scats is

due to adventitious waste on the road, which martens are passing.

5% of feces were found in leaf piles on grass and others. Scats are often placed on grass in the middle of forest paths. The same spot may be marked repeatedly (19).

CONCLUSIONS

- Stone marten prefers solid substrate (concrete, stone, etc.) to express its own marking reflex.
- In entirely anthropogenic environment stone marten takes advantage of the diversity of terrain, which extends the range of selected objects.
- All points for marking are situated at key points in its home range.

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