

ORIGINAL PAPER

ACTIVITY PATTERNS OF WILD RABBIT (*ORYCTOLAGUS CUNICULUS*, L.1758), UNDER SEMI-FREEDOM CONDITIONS, DURING AUTUMN AND WINTER

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Keywords

autumn and winter,
biorhythms,
wild rabbit.

Abstract

The main objective of this work is to assess the activity biorhythms of the European rabbit, under semi-freedom conditions between September and March.

The study was carried out in a property located in the north of the County of Valladolid (Spain). Nine wild adult animals, 2 males and 7 females, were used. They were marked individually with a microchip (AVID®). These animals were lodged in a 0.5 ha. enclosure. It was composed of two areas, one smaller where burrows were located and a bigger area, in which animals had fresh food and water. Both areas were separated by a metallic net provided of two passageways, in which, two microchips readers were placed to register animal activity. Each register indicated date, hour and code of the animal that had gone through the passageway.

An activity rate was determined as the number of times that the total of the animals went through all the passageways, per hour of each day of the study. A monthly index of activity was also determined by the average of the daily activity rates during each month.

It was observed that wild rabbits present a pronounced twilight and night-time activity, with two activity peaks which coincide with the sunrise and sunset. It was also determined that the activity of the animals in central hours of the day was practically null in both sexes. The activity pattern was changing, gradually, in function of the hour of sunrise and sunset on each month of the study. The activity index increased from September on, reaching a maximum peak during December, and decreased gradually until February when this index increased slightly until the finalization of the study on March. This pattern can be associated with the reproductive rhythms of the wild rabbit in the study area, during this period.

Introduction

The wild rabbit (*Oryctolagus cuniculus*, L. 1758) is one of most emblematic cynegetic species in the Iberian Peninsula [1]. Its importance is based in social, economic and mainly ecological aspects, because it is located at the base of the trofic chain, being the main prey for remarkable species such as the Iberian lynx (*Linx pardinus*) or the Iberian imperial eagle (*Aquila adalberti*).

Nowadays, the Wild rabbit populations undoubtedly constitute a problematic issue. The most important causes of their marked decline, which led to local extinctions in some cases include predation rates, diseases and habitat disturbances [2]. Two virical diseases, Myxomatosis (M) since 1952 and Haemorrhagic Viral Disease (HVD) since 1984 [3], acquired an increased importance considering the high mortality rates they produced in natural populations. On the other hand, agricultural intensive

techniques with well-known negative impacts on wild rabbits' habitat [4,5], the constant increase of game pressure and the increment of opportunist predators [6], has led to the reduction and, in some areas, to the disappearance of the wild populations. All these factors have, frequently, led wildlife managers to resort to reintroduction actions although, in many occasions, they were carried out in an incorrect way, using animals of doubtful quality, in genetic, sanitary and mainly ethologic terms, culminating in the failure of this practice [7].

This study aims at determining the European rabbit activity biorhythm, thus contributing to increase the knowledge about some important aspects of wild rabbit biology by obtaining data in which to base population management actions in order to improve their present situation.

Methods

The work was carried out between September and March when wild rabbits develop their main reproduction activity considering the climatic conditions of the study area (pers. obs.).

Study area

The study was carried out in a hunting game reserve located in the northern part of the county of Valladolid (Spain). The animals were maintained in an 0.5 ha. enclosure which was divided in two separate areas. The bigger area acted as a feeding area and the smaller one where four semi natural burrows were built. In the feeding area, cereals (*Hordeum vulgare* and *Triticum aestivum*) and pulses (*Medicago sativa*) were sowed. Both areas were separated by a metallic net of 1.5 m. height and buried 50 cm. This net had two passageways between both areas.

Animals used

Nine adult wild rabbits (2 males and 7 females), captured in the study area were used. Previously to their introduction in the enclosures, all animals were vaccinated against M and HVD and individually marked using a microchip (American Veterinary Identification Devices, AVID®), with a different alpha-numeric code for each animal.

Methodology

In each of the two exits, between feeding area and burrow area, a microchip reader was placed (AVID) connected to a computer which registered all readings. Each record was composed of: code of the animal, date, hour and exit number.

Data analysis

To study wild rabbit daily activity, an activity rate was assumed as the number of times all animals went through both exits, per hour and day.

A monthly activity index was determined, adding all daily activity rates per month and calculating its medium value.

On one hand, a global analysis was carried out, with the purpose of establishing a generic pattern of activity of the wild rabbit. On the other hand, the data were

considered in function of sex with the purpose of studying the possible variation in the activity of males and females during the reproductive period.

Statistical analysis, ANOVA and Student-Newman-Keuls test, were performed with SPSS v.11®.

Results

Activity rates per hour

Significant differences were found in the activity rates recorded for each hour ($F_{(23,167)} = 18,05$, $p < 0,001$). Largest distances were recorded between 8-18 h and 19-7 h.

It was observed that wild rabbits have an increased activity during twilight and night with two maximum peaks coincident with sunrise and sunset, during the study period, around 7 h and 19 h, respectively. It was also observed that the activity of the animals in the central hours of the day (9-17 h) presented values near zero (Fig. 1). When activity values were analysed according to sex, a similar pattern of twilight and night activity ($t_{(1,333)} = -0,042$) was detected during the whole study period, and it was also possible to detect a highly significant positive correlation between both sexes every month ($r = 0,855$, $p < 0,01$).

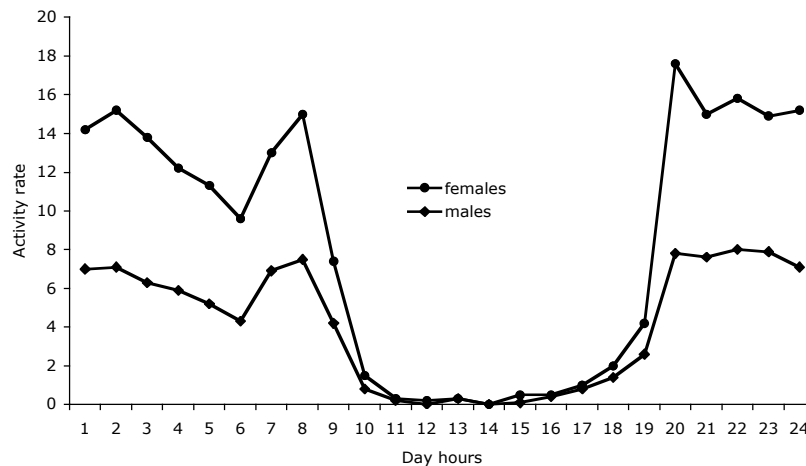


Fig. 1. Daily activity rate per hour in both sexes.

Activity index per month

A monthly activity rate was calculated as described previously.

There were significant differences between the seven considered month ($F_{(6,57)} = 19,173$, $p < 0,001$). Three groups were defined according to this index. The first group includes September, January, February and March, which presented the minimum values, the second group includes October and November, and the third one refers to December when values reached the maximum level.

We observed that, the activity index increased (Fig. 2) from September on, reaching

a maximum peak during December, followed by a descending activity pattern. When data was analysed according to sex similar patterns were observed although, for males the activity reduction presented after December was not so severe as for females. Furthermore, males increase their activity levels during March, reaching higher values than the initial values recorded. However, no significant differences were found between males and females ($t_{(1,61)} = 0,266$) and both groups were found to be highly correlated ($r = 0,798$, $p < 0,01$).

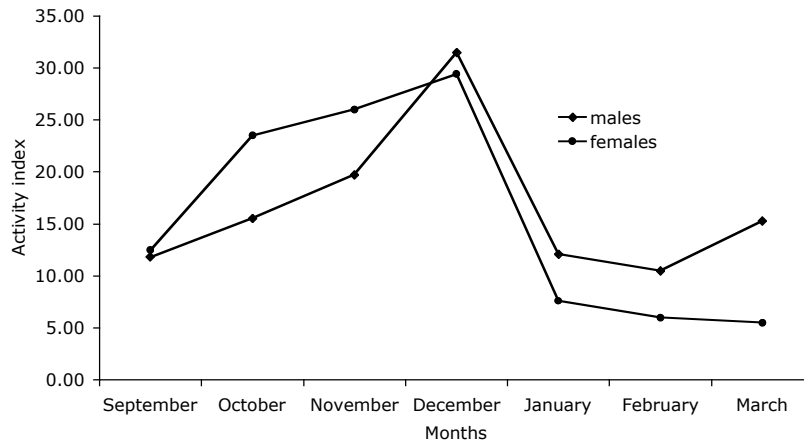


Fig. 2. Activity index per month in both sexes.

Discussion

Activity rate per hour

Wild rabbit main activity periods are the twilight and night. In fact, similar data was published by other authors [8,9,10,11], who indicate that daily activity begins at dusk, significantly decreases until dawn and, frequently, no activity or very low levels are detected during the central hours of the day.

This pattern of activity has been widely described for rabbits, other mammals and birds [12,13,14].

The presence of several activity peaks, during different periods of dusk and night, demonstrate that rabbits move several times during 24h periods to the feeding area, as described by [15], who indicates that animals present several cycles of emergence from the burrows.

The high correlation levels between sexes could be due to the intense social character present in this species [16,17]. Also, according to [6,18], it could be associated with an anti-predator strategy. These authors observed that, animals which come out to feeding areas in groups of three or more individuals, distance themselves farther away from burrow areas, because animals carry out surveillance activities together, being able to recognize the presence of predators in the environment in a more effective way.

Activity index per month

The increasing activity rate in both sexes found between September and December can be explained by the beginning of the reproductive season in the study area. Male higher activity peak during December (Fig. 2) is in accordance with [19] and it can be justified keeping in mind that the study was carried out during the reproductive season, when males start to divert more energy into mating behavior [20]. Also, it should be considered that animals are establishing their hierarchical order, which is much more intense in males than in females [20,21,22,23].

In the period between December and March, females present a clearly descending activity pattern although males present an activity increase during March, when females present another estrus period after the first litters have emerged. In this way, [24] dominant females choose dominant and residents males. However, according to [15] referring to a northern Europe study the wild rabbit activity is smaller between November and February than during the rest of the year, indicating that, this rate is increased in a remarkable way starting from March. This difference may be due to the different location of the study areas what would suppose a delay in reproductive season at this latitude.

Acknowledgements

We would like to thank the “Excma. Diputación Provincial de Valladolid (Spain)”, for financial support and permission to work on its land “Finca Coto Bajo Matallana”, in a common project with our University Department entitled “Autochthonous Cynegetic Species Reproduction”.

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