

DEMOGRAPHIC PATTERNS DURING AN EPIZOOTIC OF SARCOPTIC MANGE IN A CANTABRIAN CHAMOIS (*RUPICAPRA PYRENAICA PARVA*) POPULATION

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ABSTRACT.— We studied a chamois population affected by an epidemic of sarcoptic mange in Asturias in the North West of Spain in 1991-2002. The study area was 813 km² and population was estimated at 6200 individuals before the epidemic. In 2002 the number of chamois are 2200. The front line of the epidemic has advanced between 1.6 and 7.6 km year. The number of animals showing apparent clinical signs in relation to the number of recorded animals (prevalence) is highest in spring and lowest in summer and autumn. The disease affects more the adult males than to the other groups of sex and age, so the sex ratio has moved towards the females. The relation between the females and kids in July did not change.

RÉSUMÉ.— La population d'isards affectée par une épidémie de gale a été étudiée dans les Asturies (NW de l'Espagne) en 1991-92. La zone d'étude comprenait 813 km² et la population était estimée à 6200 individus avant la maladie. En 2002, le nombre d'isards avait chuté à 2200. Le front de l'épidémie a avancé d'une distance comprise entre 1,6 et 7,6 km par an. La prévalence, c'est-à-dire le nombre d'animaux ayant de signes cliniques visibles par rapport au nombre d'animaux observés, est apparue comme haute au printemps et basse en été et en automne. La maladie affecte surtout les mâles adultes et par conséquent la sex-ratio s'est déplacée en faveur des femelles. Cependant, le rapport entre les femelles et les chevreaux en juillet n'a pas été altéré.

RESUMEN.— Desde 1991 a 2002 se estudió en Asturias (noroeste de España) una población de rebeco afectada por una epidemia de sarna sarcóptica. El área de estudio abarca 813 km² y la población de rebeco se estimaba en 6.200 individuos antes de la epidemia. En 2002 el número de rebecos era de 2.200. El frente de la epidemia avanzó entre 1,6 y 7,6 km al año. El número de animales que muestran signos clínicos aparentes, en relación con el número de animales observados (prevalencia), es máximo en

primavera y mínimo en verano y otoño. La enfermedad afecta más a los machos adultos que al resto de las clases de edad o sexo, con lo que la sex ratio está desplazada a favor de las hembras. La proporción entre hembras y cabritos en julio no cambió.

Key-words: Cantabrian Chamois (*Rupicapra pyrenaica parva*), sarcoptic mange (*Sarcoptes scabiei*), population, Spain.

1. Introduction

Sarcoptic mange is a highly contagious, mite-caused skin disease, which has already been described in various eastern alpine chamois population (MILLER, 1985; ONDERSCHEKA, 1982; ROSSI, *et al.*, 1995). This illness has recently affected the Cantabrian chamois sub-species (BENITO *et al.*, 1994).

The typical pattern of the evolution of sarcoptic mange outbreak in the chamois and other species consists in the apparition of epizootic periodic waves consisting in high rates of mortality followed by periods of latent state (KUTZER & ONDERSCHEKA, 1966; ONDERSCHEKA, 1992; MILLER, 1985; ROSSI *et al.*, 1995). Due to the fact that this is a species of high hunting interest, the study of this epidemic illness is evidently very important.

Periodic censuses of the chamois *Rupicapra pyrenaica parva* population have been organised by the Government of Asturias since 1989 (FERNÁNDEZ GIL, 1989; SOLANO *et al.*, 1991, 1997). Apart from that since in 1993 the first episode of sarcoptic mange was detected, the environmental department of the Asturian Government has been financing a series of studies with the purpose of knowing the evolution of the disease and its effects on the population. (BENITO *et al.*, 1994; GONZÁLEZ-QUIRÓS *et al.*, 2001).

2. Study Area

The chamois population is distributed on both sides of the Cantabrian Mountains in the North of Spain, but the study area (81,300 hectares) is limited to its northern side belonging to the Asturian county, outside the borders of the National Park "Picos de Europa". Altitude varies between 400 and 2000 meters.

The vegetal landscape is the typical of the Orocantabrian regions corresponding to the bioclimatic belt of land: deciduous woods, mainly beech *Fagus sylvatica*, heather *Erica* spp., *Calluna vulgaris* and broom shrubs *Genista* spp., *Cytisus* spp. and mountain grazing land.

The chamois living in the study area are a part of the cantabrian population. The geographical area of distribution of Cantabrian chamois population

is situated over 500 m, although this species lives mainly over 1200 m high. Sharing the area with the chamois, populations of roe deer *Capreolus capreolus*, deer *Cervus elaphus* and wild boar *Sus scrofa*, apart from domestic cows and horses from March to October, and some domestic sheep and goats.

When mange appeared the number of hunted chamois per year were about 200 individuals, only adults were hunted (5% of the censuses of the previous year). The hunted pressure was dissuade to female, because the sex-ratio was 1.4 in 1991 and 1.8 in 1995. Afterwards the decrease of the population cause a gradually prohibition of hunt.

3. Methods

During the period of 1991-2002 annual censuses have been done in the whole study area to estimate the chamois population –except 1992 when no census was done and 1994 when the census was only partially done–. The censuses were done always in the same time of the year, that is between the end of June and first two weeks of July, when the chamois live in the highest open areas and so can be easily detected. The distribution area of chamois was divided in various zones so each one could be sampled in one day through various itineraries simultaneously. The individuals observed we are arranged according to their age and sex and taking into account the external skin lesion which could have been produced by the mange.

The defined age and sex classes are the following: over two years old males (MAD), over two years old females (FAD), youngs between 1 and 2 years –subadults– (J), kids of the year (CR), adult individuals of no specified sex (IAD), no kids individuals of unidentified sex and age (INC) and no sex nor age identified individuals (It). The mange affected chamois have been divided in four classes (I to IV) according to the extension and distribution of the apparent skin lesions. Class I: Individuals affected by lesions in less than the 25% of their bodies (mainly in the neck area); Class II: lesions taking from 25 to 50% of their bodies; Class III: lesions taking between 50 and 75%; Class IV: lesions that take more than 75%.

In addition to the yearly censuses in June-July, since 1994 more than 180 annual itineraries, including those of the census, have been done in the whole study area, monthly distributed. We have also collected the information provided by the rural agents about ill and death animals -due to the mange or other causes. Skin samples collected from shoted affected animals and from those chamois found dead were subject to biopsy. Examination of the mites was by direct observation under microscope, subsequent to preparation in 40% KOH.

The minimum convex polygon has been used to work out the area affected by the mange every year, considering the more external points in which reliable information of ill animals has been collected every year.

The maximum distance covered every year by the advancing epidemic front has been calculated as the maximum perpendicular distance between the perimeters of the polygons which define the affected areas corresponding to consecutive years.

In 1997, 22 individuals were marked with radio-tracking or coloured collars in a non infected area at that moment, and were checked since then every 2 weeks, which also helped to observe the evolution of the disease.

Table 1. Epidemic advance of mange in each focus between 1993-1997, and in the later union of both focus (1998-2001), reported in the mange area of asturian mountains.

	Years	Affected Area (ha)	Surface Increase	Front's Highest Annual Advance (km)
Focus 1	1993	400	-	1,60
	1994	5.440	x 13,6	5,75
	1995	14.030	x 2,6	6,25
	1996	24.300	x 1,7	4,90
	1997	34.200	x 1,4	3,65
Focus 2	1994	200	-	2,00
	1995	6.480	x 32,4	7,65
	1996	8.200	x 1,3	1,30
	1997	12.750	x 1,5	2,25
Union focus 1 & 2	1998	54.650	x 1,2	2,00
	1999	67.130	x 1,2	6,75
	2000	83.495	x 1,2	3,00
	2001	85.500	x 1,02	2,20

4. Results and Discussions

The censuses and the itineraries have allowed to describe the spread pattern of the epidemic of sarcoptic mange. The first recorded case of the illness dates from May 1993, found in the most western zone of the study area. Between 1993 and 1997 the disease spread until it covered 34200 ha (Table 1). Independently, a different focus appeared in 1994 (FERNÁNDEZ MORÁN *et al.*, 1997), 21 km far from the first one. The second focus spread until it covered 12750 ha in 1997. In 1998 both focus joined and the epidemic spread towards east until it covered the whole study area in 2000. In December 2001 it took up 85500 ha and in 2002 it goes on growing to the east, inside The National Park "Picos de Europa". The annual advancing speed and direction of the epidemic front vary each year (Table 1, Figure 1) and among other factors it depends on the chamois distribution and the existence of topographic barriers which could influence their movements. In the places where the disease began, some

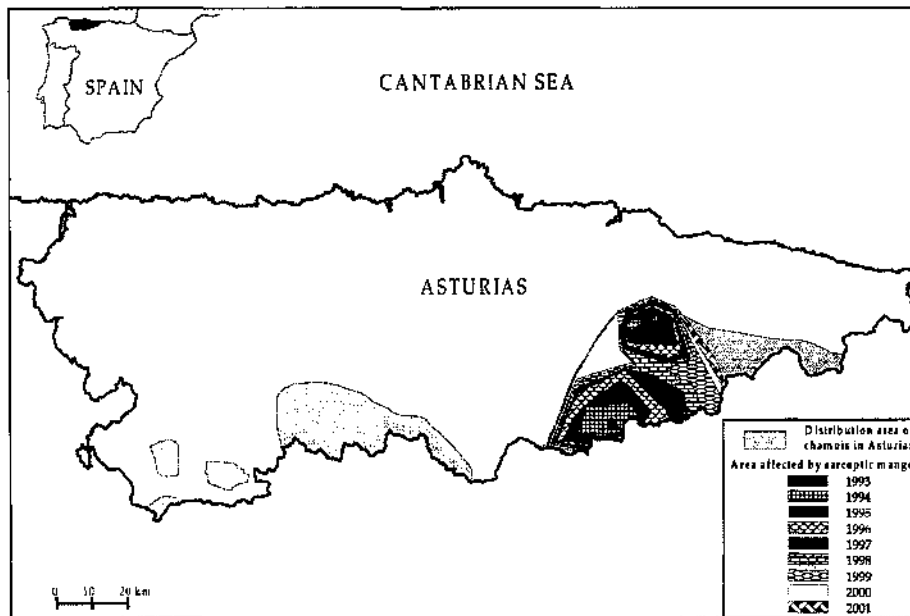


Figure 1. Progress of the sarcoptic mange epidemic in Asturias (North of Spain) in 1993-2001 from its origin to the rest of the region.

cases of domestic goats with the disease have been reported, but this was difficult to prove through laboratory analyse because the animals disappeared.

In many occasions the annual propagation speed was clearly higher than 3.4 and 2.4 km, as described in two chamois population affected by mange in the eastern Italian Alps (ROSSI *et al.*, 1995).

The progression of the outbreak of mange is a consequence of the chamois movements, mainly due to the movements of the males in rut period and seasonal movements. ROSSI *et al.* (1995) stated that the average annual advance of mange in the Italian Alps matches the distance walked by males in rut and by the females and the young between the areas occupied in summer and winter.

The number of the individuals clinically affected with mange in relation to all the animals seen varied along the year (Figure 2). Highest prevalence was reported during the end of winter and spring and minimum during the summer and autumn. This seasonal pattern matches up the one found in other sarcoptic epidemic and particularly in the mange outbreak of the chamois in the eastern Alps (ROSSI *et al.*, 1995). In any of the months the average value of this rate is superior to 6%.

The optimal environmental conditions for the *Sarcoptes scabiei* is characterised by the combination of low temperature and high levels of humidity.

ty (ARLIAN *et al.*, 1989). Besides, the situation is improved because at the end of winter and the beginning of spring the chamois have the worst body condition due to the scarce food during winter and to the serious energetic cost in the rut season for the males and the pregnancy for the females (BARBERÍA, 1994).

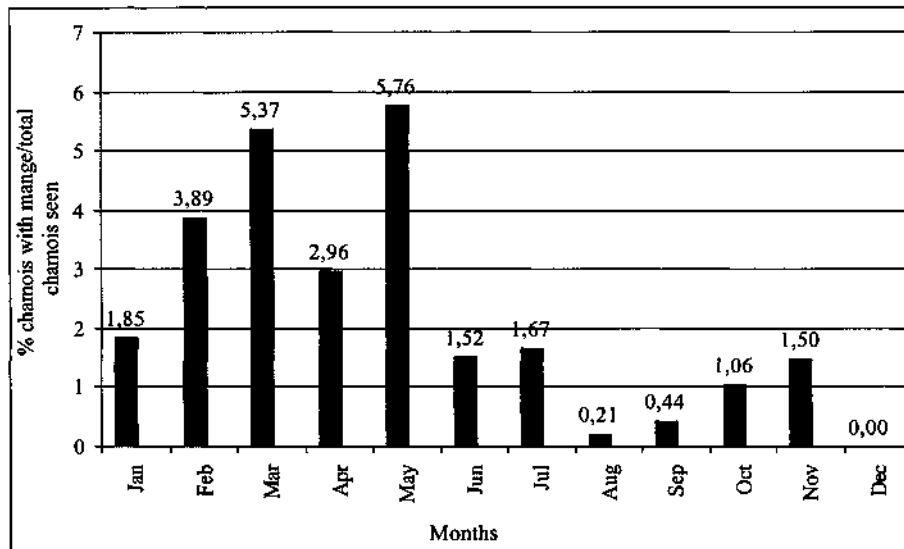


Figure 2. Prevalence of chamois population with mange reported by month in 1993-2001 in Asturias.

The sex-ratio in 1991, before the apparition of the mange, was 1.4 females for each male, then has been moving towards the females (Figure 3), in such a way that the value worked out with the results obtained in the census of 2001 is 4.0 females for each male.

The males observed with mange in the field showed higher morbidity than their status in the age class obtained in censuses (See Table 2). Skin lesions can be seen in all sex and age, although the adult males -older than 2 years- are the most affected by the disease and the kids are the less affected (Figure 4). This event has already been noticed by other authors in the Alpine population of chamois (ONDERSCHEKA, 1982; ROSSI *et al.*, 1995). It is considered to be strange as the kids are expected to be more easily affected by the disease. Along a number of years we can appreciate that on the one hand the proportion of male infected by mange grows respect to the total of the animal seen and on the other hand the total number of male seen decreases. Both facts explain the movement of the sex-ratio to the females.

DEMOGRAPHY DURING AN EPIZOOTIC IN CANTABRIAN CHAMOIS (*RUPICAPRA...*)

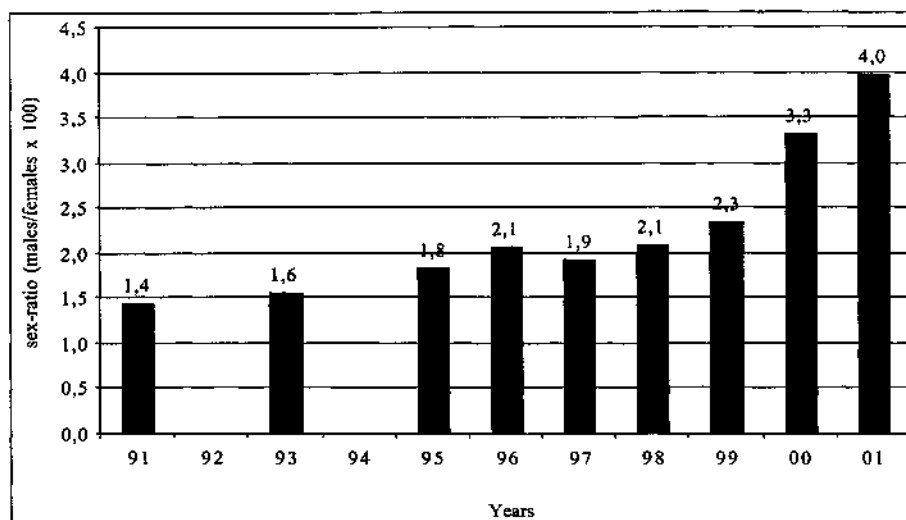


Figure 3. Sex-ratio evolution 1991-2001 in the area affected by mange.

Table 2. Comparison between affected (total different affected chamois observed) and non-affected chamois (population censuses) in all the area according to sex and age categories.

Year	Males %		Females %		Yearling		Kids %	
	Affected Chamois	Total population	Affected Chamois	Total population	Affected Chamois	Total population	Affected Chamois	Total population
1995	28.1	22.6	45.1	41.5	17.5	11.8	11.2	24.1
1996	42.7	20.4	38.9	42.3	12.1	12.2	6.3	25.2
1997	33.2	21.1	41.2	40.9	14.2	12.3	11.3	25.8
1998	42.6	19.7	35.1	41.0	18.3	15.2	4.0	24.1
1999	40.9	18.9	38.6	44.1	18.2	12.0	2.3	25.0
2000	41.1	14.2	38.4	47.0	17.8	12.4	2.7	26.1
2001	49.0	12.0	27.5	47.5	17.6	14.3	5.9	26.2

We did not find differences of the population trends, between the sectors in which the hunting pressure was increased in the initial states and the others, but in all the cases hunting was gradually forbidden, and only the very affected animals were shot by the rural agents.

According to the results of the annual census for the whole nucleus, the rate between the kids of year and adult females, worked out in July, has kept between 55.2-59.6 kid/100 females –except the value of 49.0 kids/100 females corresponding to 1993–, very similar values observed before the apparition of mange –56.0 kids/100 females in 1991– (Figure 5).

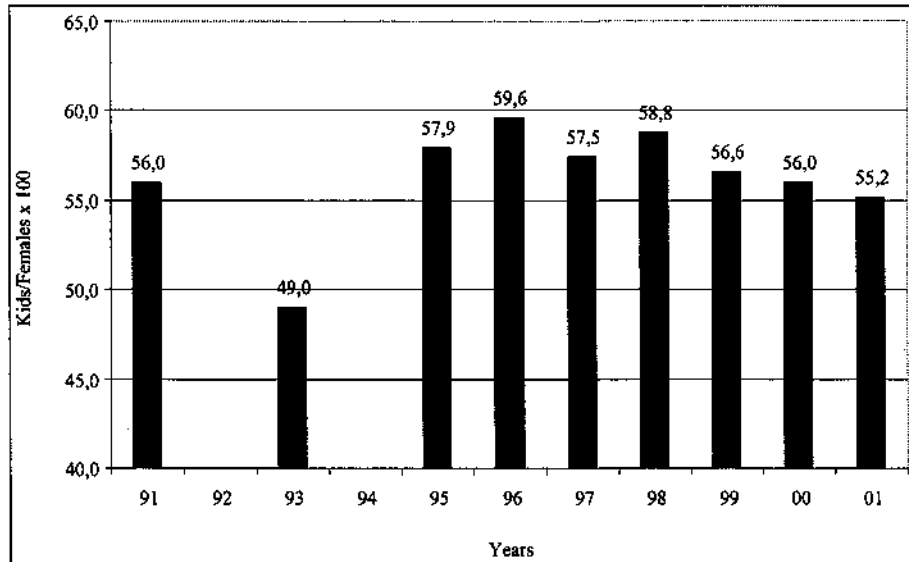


Figure 4. Rate of specimens with mange in each sex and age classes, in the area affected by mange in 1995-2001 in Asturias.

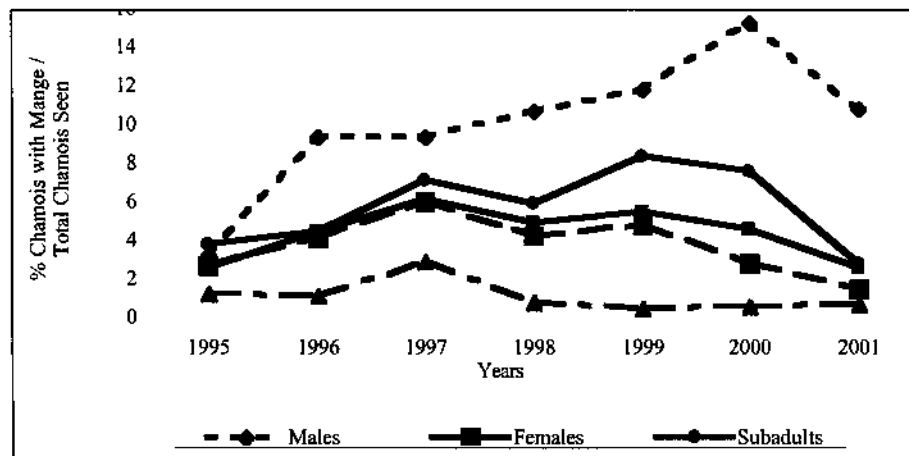


Figure 5. Birth Rate Evolution 1991-2001 (kids/female x 100) in the area affected by mange.

The biggest number of death chamois found belong to class IV, which makes us think that a serious development of the disease is needed to cause death to the animals. In the field chamois with easily seen lesion

belong to all the classes although the are more which belong to the classes I and II (Figure 6). Since 1993-2001 we reported 1432 different chamois infected by mange, 988 observed with telescopes in field, 229 found dead and 215 shoted.

From the 22 healthy individuals marked between August 1997 and August 1998, only two were still alive in December 2001. All the market males have died (n=9), most of them by mange, while two from the 13 branded females (15.4%) were alive in December 2001. The average monitoring time from August 1997 to the disappearance of each individual is 24.1 months for the males and 33.7 months for the 11 death females. In 11 cases mange was diagnosed in death animals, frequently with type IV lesion. In the 9 left cases the bodies of the animals couldn't be found or the remains located could not be analysed.

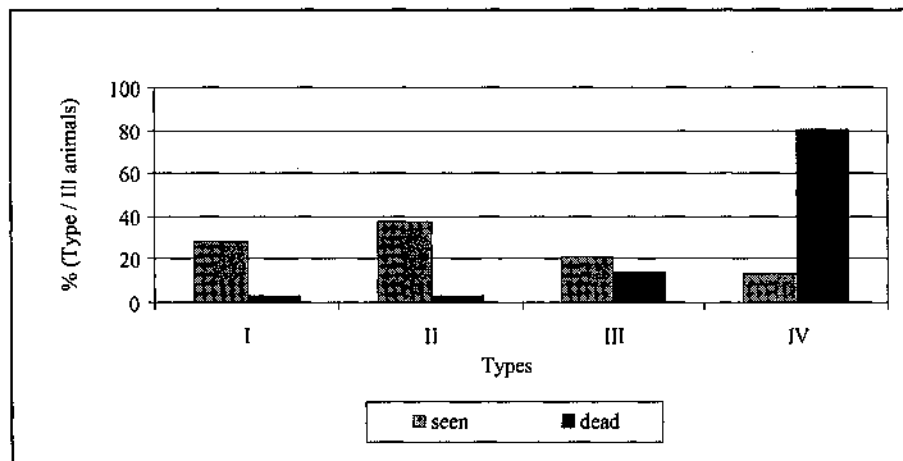


Figure 6. Type distribution affected animals seen in the field and found dead in the area with mange in 1995-2001 in Asturias.

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