EPIDEMIOLOGICAL SURVEY OF BOVINE ONCHOCERCOSIS IN SOUTHEASTERN FRANCE.

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SUMMARY: Bovine onchocerciasis prevalence in France, during two years study was 57%. Prevalence results are inferior in temperate countries than in tropical countries, it may be related to the seasonal nature of its transmission. Seasonal variations in prevalence and intensity of infestation were observed. Parasitism is more pronounced during the spring and summer considering the parameters set by McCALL& TREES (1993). Transmission of onchocerciasis in southwest France occurs from May to October. Seasonal fluctuation of parasitism may be explained as a function of the parasite's reproduction cycle in its definitive hosts. The age of cattle plays no vital role in determining infection. Its effects were not significant when computed separately from those of the season. On the other hand, the season of the year is shown to be a determining factor affecting filarial prevalence and intensity of infection.

KEY WORDS: Epidemiology, bovine onchocerciasis, prevalence, France.

INTRODUCTION

Bovine onchocercosis is caused by the parasitism with various species of the genus *Onchocerca,* Diesing, 1841. Adults live in connective tissue and their larvae, the microfilariae, are dermatotrophic. The diversity of described species, the difficulties for recovery of intact adult parasites for morphological studies, and the diverse localization in the host make difficult the identification and study of these helminths.

Bovine onchocercosis has worldwide distribution (BAIN & CHABAUD, 1986). However, there are differences in the parasitism between tropical and temperate climates. In France, one species, *Onchocerca gutturosa* was described (BAIN *et alii*, 1978a; b; POPESCU-BARAN, 1939), but in other European countries, the presence of *Onchocerca lienalis* was also reported (TREES *et alii*, 1987). The differences and consequences in the seasonal transmission which occurs in countries with temperate climate, in comparison to the perennial transmission that exists in tropical countries are still unanswered questions in epidemiological studies. The present work aimed at determining in France, and particularly in the Southeastern region (Midi-Pyrénées), the following epidemiological characteristics: prevalence, intensity, sex:intensity ratio, age:intensity ratio and main characteristics of the seasonal transmission of bovine onchocercosis.

MATERIALS AND METHODS

Animals

At weekly intervals, skin from the umbilical region of 727 cattle was collected in abattoirs. The survey was carried out from April 1990 to 1992. The animals proceeded from various regions of France, 62% of which from the Southeastern region. Of all animals, 688 were females and 39 males. The age distribution of the animals was: 11 aged 1 year, 43 aged 2 years, 103 aged 3 years, 80 aged 4 years, 90 aged 5 years, 100 aged 6 years, 77 aged 7 years, 72 aged 8 years and 151 more than 9 years-old. Each animal had a correspondent sanitary statement where the age was registered. The animals were fit for consumption. Predominant breeds were Gascogne, Limousin, Blonde D'Aquitaine and their crosses.

Experimental protocol

Skin samples of the umbilical region 1cm wide and 10cm long were collected during the slaughtering of the cattle. The skin samples were scraped and scarified with a scalpel, washed in water and placed into physiological saline (0,9% NaCl) at 37.°C inside an incubator. Eighteen hours later the solution was centrifuged at 2000rpm for 5 minutes. One drop of iodine was added to 300µl of the sediment, which were examined under the microscope and the microfilariae found were counted. When the number of microfilariae exceeded 1000, this value was considered as the maximum.

The animals were divided into four age groups: 1 to 3 years, 4 to 6 years, 7 to 9 years and over 9 years-old. The age groups were defined according to three categories: young animals (1 to 3 years: 157 animals), adults (4 to 8 years: 419 animals) and older animals (over 9 years old: 151 animals). These proportions approximately reflect what is found in beef cattle farms, that is, 2/3 of adult animals and 1/3 of young and old animals.

Four levels of infection were considered: no infection, low, moderate and high.

Meteorological data

Meteorological data (temperature, rainfall and insolation) were provided by Météo-France, from eight meteorological stations.

Statistical Analysis

The associations between prevalence and temperature (or rainfall or insolation) and animals of different age groups were analyzed by logarithmic regression. The associations between intensity and temperature (or rainfall or insolation) and animals of different age groups were analyzed by log linear regression.

The factorial analysis of correspondence was performed to assess the inter-relations: cattle, age, sex, microfilariae, year and month of the survey. The percentage in the axes represents the share of inertia (or of variance) explained by the axes. It is licit to interpret the proximity among the elements with the same. Two close points show neighboring profiles. The center of gravity G is the origin of the axes corresponding to the average profiles.

The analysis of segmentation was executed to split the samples into homogeneous groups, being each group significantly different from the other (ROUX, 1985).

RESULTS

Prevalence

From 727 examined animals, 414 (57%) harbored *Onchocerca* spp. microfilariae. The monthly prevalence varied from 19% (November 1991) to 100% (May 1990). In 1990, the peak prevalence occurred in May and, in 1991, in August. Table 1 shows the results of prevalence and intensity of parasitism during the two-year study. In the months of higher prevalence (May, June and July, 1990 and August and September, 1991), it was more intense in younger (1 to 3 years) than in older animals (more than 9 years).

Intensity of Infection

The mean total number of microfilariae for each bovine carrier was 103. The intensity was higher in June, 1990 (350 microfilariae) and August 1991 (292 microfilariae). The lowest intensity was observed in February, 1991: 8,5 microfilariae per animal and in January, 1992: 5 microfilariae. The distribution of parasites in the host population is overdispersed. The quotient of variance and monthly mean number of microfilariae varied from 622 to 316 in 1990, from 5 to 702 in 1991 and from 10 to 196 in 1992.

Relationships among prevalence, intensity and age

According to the regression analysis there is a significant variation of prevalence and intensity of parasitism, which are most intense in summer. These three factors, prevalence (or intensity), age and seasons are inseparable, because if the seasons are not taken into consideration, the variation of intensity and prevalence among animals of different age ranges are not significant.

Effects of climate on prevalence and intensity

By the calculation of the percentage dispersion (r^2), it is concluded that 60% of the variation in prevalence are followed by alterations in temperature; 56% by insolation; 7% by rainfall. The fluctuation intensity is influenced by season of year, (32%), by mean temperature (30%) and by rainfall (4%).

Results of multiple correspondence and segmentation analysis

Figure 1 presents the results of multiple correspondence. The age or microfilariae number classes are similar or equal sized. A13 = 157 animals 1 to 3 years old; A34 = 80 animals >3 to 4 years old; A45 = 90 animals >4 to 5 years old; A56 = 100 animals >5 to 6 years old; A68 = 49 animals >6 to 8 years old; A>8 = 157 animals more than 8 years old. The intensity of infection is divided into classes. The class 0mf corresponds to 313 negative animals, class 1mf = 1 to 2 microfilariae; 2mf = 3 to 9 microfilariae, 3mf = 10 to 32 microfilariae; 4mf = 33 to 206 microfilariae; 5mf = 207 to 1000 microfilariae. The classes 1mf to 5 mf are comprised by a comparable number of animals (81 to 86). The aim of multiple correspondence is to characterize the parameters under study: cattle and parasitism. The axes 1 and 2 are significant at 13%. This value is weak but may be explained by the size of the sample examined. The years 1990, 1991 and 1992 presented differences regarding the recruitment of the cattle, which also differed among seasons: in the summer of 1990 a large number of young cattle were examined; in the autumn and winter the animals are distinctively older, especially in 1991. The seasonal distribution of intensity may be affected by the recruitment of animals. The increase in filaremia (0mf to 5mf) corresponds to two events: change of season (from autumn to summer) and an increase in

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Table 1 - Epidemiological data of bovine onchocercosis in France from April, 1990 to April, 1992. (95% confidence interval).

Year	Month	Number of animals examined	Prevalence (%)	Mean intensity	Confidence interval
1990	April	9	89	268	0-602
	May	31	100	319	174-465
	June	118	82	346	263-428
	July	40	72	361	193-529
	August	11	45	87	0-269
	September	43	63	38	3-72
	October	53	48	38	4-49
	November	31	26	34	0-97
	December	23	42	62	0-170
1991	January	25	39	10	5-16
	February	9	44	8	0-18
	March	9	33	59	0-196
	April	28	36	20	0-44
	May	18	27	92	82-102
	June	27	37	13	2-25
	August	12	86	2	0-369
	September	27	78	204	45-363
	October	39	59	27	14-40
	November	36	19	4	1-8
	December	21	81	85	0-308
1992	January	26	27	5	0-9
	February	29	24	54	0-157
	March	40	35	59	2-117
	April	22	27	17	6-28
	Total	727			
	Média		57	92	0-186

the age of the animals (A12 to A68). There is no difference due to the sex of the cattle. However, the number of males examined was small, preventing any definitive conclusion.

The risk factors of bovine onchocercosis are the months of May, June, July and August; the year 1990 and animals from 1 to 3 years of age. These factors arranged hierarchically, month, year and age show effects on the intensity of infection.

DISCUSSION

The results of prevalence of bovine onchocercosis are comparable to those obtained by DOHNAL *et alii* (1990) in Germany (40%), by EICHLER & NELSON (1971) in Southern England (58%), and by SAFAR-HERMANN & SUPPERER (1983) in Austria (46%). On the other hand, they differ from those of TREES *et alii* (1987) in Northern Wales (28%) and of KOLSTRUP (1975) Denmark (9%).

The variation in prevalence depends in part on the abundance and period of activity of the vector. The period of activity of the vector depends mainly on temperature. The regions where the prevalence is lower, Northern Wales and Denmark, present lower mean temperatures than the studied region. McCALL & TREES (1993) stated that infection is not produced when mean temperatures are below 8°C. In Southeast France the mean lowest temperature is above 8°C from May and since October the mean lowest temperature varies from 6°C to 11°C. Then, transmission would be possible from May to October. The prevalence of bovine onchocercosis is higher in tropical climate (WAHL *et alii*, 1994; FERENC *et alii*, 1986). JAROVY *et alii* (1988) explain that in seasonal transmission, characteristic of temperate climates, where one single and large increase in the number of infective stages occurs in the parasite-vector-definitive host system, the prevalence is lower than in tropical climates where the infective stages are continuously available.

The variation in prevalence and intensity of infection are seasonal. Parasitism is more intense in summer. Summer in the

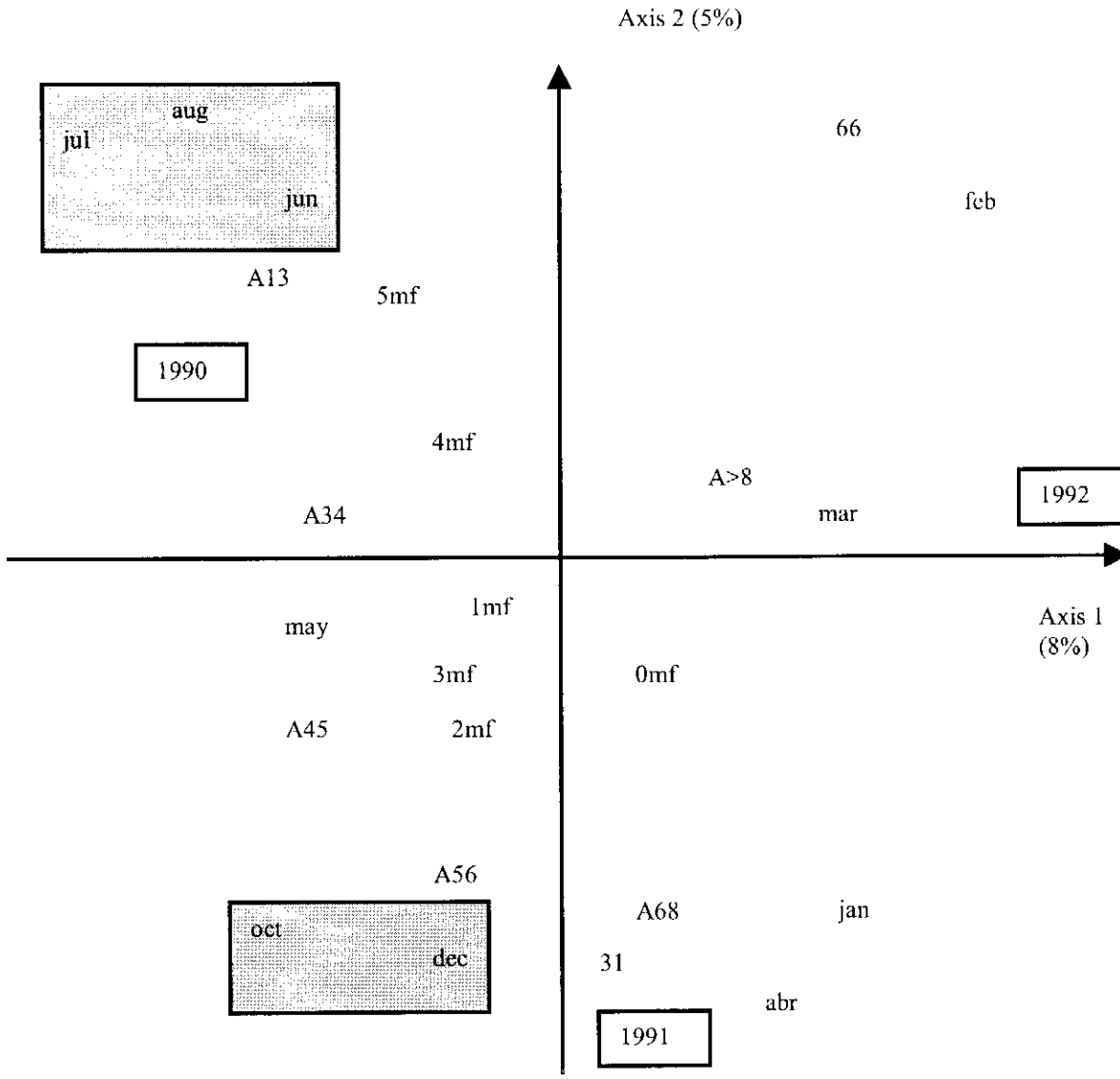

Figure 1 - Relationship among filarial infestation, origin, cattle age and sampling month. Multiple correspondence analysis.

region under study is characterized by higher temperatures, more intense insolation and weak rainfall. Seasonal variation was observed in tropical (HASIGUSHI *et alii*, 1981; FUGLSANG & ANDERSON, 1976; WAHL *et alii*, 1994) and temperate (EICHLER, 1973; FOIL *et alii*, 1987) climates for the genus *Onchocerca*. The various studies suggest a correlation between presence of the vector and elevated parasitism. In Southeast France, transmission is possible since May and probably ends in October. Then, the period of activity of the vector matches the observed variations.

Onchocercas possess two important features for the understanding of their biology: a long life span and the accumulation of microfilariae in the definitive host. Supposedly there is a correlation between release and loss of microfilariae. The density of microfilariae in the bovine host must be sufficient to ensure transmission and survival of the species. Female onchocercas behave as reservoirs. They produce from 2500 to 4000 microfilariae per day but only 700 to 1500 are released, the others accumulating in the uterus and degenerating (SCHULZ-KEY, 1990). Reproductive cycles of two to four months per year were proposed for the females of the genus *Onchocerca* (SCHULZ-KEY & KARAM, 1986). In temperate climates, the infective stages are inoculated in a single wave (spring/summer), demanding an adjustment between the infection of the definitive and intermediate hosts. These facts suggest that the reproductive life of the filariae regulates the intensity of infection so that the adequate period for transmission coincides with the rise in infection.

The pre-patent period of *O. gutturosa* is approximately seven months (IVASHKIN & GOLOVANOV, 1974), then the animals between one and two years of age are less likely to be infected. The prevalence studies according to the age of the animals yielded different results depending on the species investigated: for *O. gutturosa* the prevalence peaks in animals 3-4 years-old and decreases significantly in animals aged 7 years (WAHL *et alii*, 1994); for *O. lienalis*, the prevalence increases with age (BEVERIDGE, 1979). The results of the present work show that age is a significant factor when associated to seasons of the year.

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SUMÁRIO

A prevalência da onchocercose bovina na França, durante dois anos de estudos, foi de 57%. A prevalência nos países temperados é menos elevada do que em países tropicais provavelmente devido a transmissão sazonal. Foram observadas variações na prevalência e intensidade da infecção. O parasitismo foi mais elevado na primavera e verão. No sudoeste da França a transmissão da onchocercose se limita aos meses de maio a outubro de acordo com os parâmetros estabelecidos por McCALL & TREES (1993). As flutuações do parasitismo são explicadas pelo ciclo reprodutivo do parasito no hospedeiro definitivo. A idade dos bovinos não tem papel predominante na determinação da infecção porque seu efeito só é significativo quando associado às estações. Por outro lado, as estações são um fator determinante na prevalência e intensidade da infecção filariana.

PALAVRAS-CHAVE: epidemiologia, onchocercose bovina, prevalência, França.

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