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Autor: Degiorgis, M.-P. / Frey, J. / Nicolet, J.

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An outbreak of infectious keratoconjunctivitis in Alpine chamois (*Rupicapra r. rupicapra*) in Simmental-Gruyères, Switzerland*

M.-P. Degiorgis[1], J. Frey[2], J. Nicolet[2], E.-M. Abdo[2], R. Fatzer[3], Y. Schlatter[2], S. Reist[4], M. Janovsky[1], M. Giacometti[5]

[1]Institute of Animal Pathology, [2]Institute for Veterinary Bacteriology and [3]Institute of Veterinary Neurology, University of Berne, [4]Department IV, Swiss Federal Institute of Technology, Zurich, [5]Wildvet Projects, Schüpfen

Abstract

An outbreak of infectious keratoconjunctivitis (IKC) in chamois (*Rupicapra r. rupicapra*) which occurred in the Simmental-Gruyères region (Switzerland) from August 1997 to February 1999 is described. The spatio-temporal progression of the outbreak was analysed, the characteristics in the group of animals found which died of the consequences of the disease assessed, and the mortality estimated. The infection spread along the Kaiseregg mountain chain southwestwards and northeastwards and progressed at an average speed of 15 km/year. Concerning the mortality, the IKC outbreak was characterised by a 3-peaked epidemic curve, but the occurrence could not be associated with a particular season. The game-keepers found 420 animals which had died of the consequences of IKC. Most of recorded chamois (76%) had perished, 21.4% were killed by state game-keepers because of irreversible blindness, injuries or emaciation, and 11 (2.6%) blind animals were predated by lynx (*Lynx lynx*). Young animals (especially kids) and adult females were particularly affected and the estimated cumulative mortality was 27%. The positive results of PCR analysis in 12 out of 15 animals sampled (80%) and the presence of specific antibodies in three chamois investigated showed that *Mycoplasma conjunctivae* was involved in the etiology of the disease. We suggest further epidemiological and immunological studies be carried out in order to develop tools that could lead to the control of *M. conjunctivae* infections in domestic sheep and wild Caprinae.

Key words: Infectious keratoconjunctivitis – *Mycoplasma conjunctivae* – Outbreak – Alpine chamois – *Rupicapra rupicapra* – Switzerland

Eine Epidemie der infektiösen Keratokonjunktivitis bei der Gemse (*Rupicapra r. rupicapra*) in der Simmental-Gruyères-Region, Schweiz

In der Gemspopulation der Region Simmental-Gruyères (Schweiz) ereignete sich in den Jahren 1997 bis 1999 eine Epidemie der infektiösen Keratokonjunktivitis (IKK). Vorgestellt werden eine Analyse der räumlich-zeitlichen Ausbreitung der Epidemie, die Beschreibung der Gruppe von Tieren, die an den Folgen der IKK gestorben und gefunden worden sind, sowie die geschätzte Mortalität. Die Epidemie breitete sich entlang der Kaiseregg-Bergkette nach Südwesten und Nordosten aus und sie kam mit einer mittleren Geschwindigkeit von 15 km/Jahr voran. Die zeitliche Verteilung des Auftretens von Todesfällen ist durch eine drei-gipflige Kurve charakterisiert, wobei diese mit keiner bestimmten Jahreszeit assoziiert werden konnte. Im beschriebenen Zeitraum wurden insgesamt 420 Gemsen erfasst, die an den Folgen der IKK eingegangen waren. Der Grossteil der erfassten Gemsen (76%) verendete spontan an den indirekten Folgen der Augenerkrankung und 21,4% wurden von der Wildhut wegen irreversibler Augenläsionen, Verletzungen und/oder schlechter körperlicher Verfassung erlegt; schliesslich konnten 11 erblindete Gemsen (2,6%) erfasst werden, die vom Luchs (*Lynx lynx*) gerissen wurden. Besonders betroffen waren die juvenilen Tiere (v.a. im ersten Lebensjahr) und die adulten Geissen. Die geschätzte Mortalität betrug 27%. Die positiven Ergebnisse der PCR-Analysen in 12 von 15 untersuchten Fällen (80%) und der Nachweis von spezifischen Antikörpern in drei untersuchten Tieren zeigten, dass *Mycoplasma conjunctivae* als Infektionserreger involviert war. Weitere epidemiologische und immunologische Untersuchungen sind notwendig, um Instrumente zu liefern, die zur Kontrolle von *M. conjunctivae*-Infektionen bei den kleinen Hauswiederkäuern und bei wilden Caprinae führen könnten.

Schlüsselwörter: Infektiöse Keratokonjunktivitis – *Mycoplasma conjunctivae* – Epidemie – Gemse – *Rupicapra rupicapra* – Schweiz

* den Wildhütern der Kantone Bern und Fribourg gewidmet – dédié aux surveillants de la faune des Cantons de Berne et de Fribourg

Introduction

Infectious keratoconjunctivitis (IKC) is an ocular disease which commonly affects domestic ruminants as well as free-ranging Alpine ibex (*Capra i. ibex*) and chamois (*Rupicapra r. rupicapra*) (Jones, 1991; Giacometti et al., 1997a). *Mycoplasma conjunctivae* has been implicated as etiological agent of IKC in domestic sheep and wild Caprinae by several authors (Barile et al., 1972; Nicolet and Freundt, 1975; Mayer et al., 1996; Giacometti et al., 1998), and an interrelationship between these susceptible Caprinae species has been postulated on alpine meadows (Daniel and Christie, 1963; Nicolet and Freundt, 1975; Degiorgis, 1998). Mycoplasmal IKC is highly contagious in a herd (Baas et al., 1977), and an interspecific transmission of *M. conjunctivae* by flies has been considered (Degiorgis et al., 1999). Mortality in chamois varies considerably from outbreak to outbreak, but only seldom exceeds 25% (Catusse, 1982; Lanfranchi et al., 1985; Gauthier, 1991).

In chamois, several outbreaks of IKC have been reported in the European Alps (Bouvier et al., 1958; Gauthier, 1994; Grattarola et al., 1999) as well as in the Pyrenees (Catusse, 1982) and in New Zealand (Daniel and Christie, 1963). However, the origin of such outbreaks remains unclear in most cases, and description of disease progression is usually incomplete due to the difficulty of recognising mild IKC symptoms in remote segments of the habitat. Furthermore, habitats of wild Caprinae populations are often politically subdivided (Giacometti et al., 1997b), and collaboration among administrative units at the population level, essential for complete IKC records, is not common yet.

The first reported outbreak of an "apparently infectious eye-disease in chamois" in Switzerland dates from 1926 (Anonymous, 1927) and occurred in the Simmental-Gruyères region, on a mountain chain in the north-western Swiss Alps. In August 1997, a severe outbreak of IKC in chamois started precisely in this area and the disease spread along the mountain range. This was an opportunity to study in detail an IKC outbreak in a free-ranging chamois population.

Our objectives were to describe the spatio-temporal progression of an IKC outbreak in chamois and to assess mortality and characteristics in the group of animals found which died of the consequences of the disease. New diagnostic tools were tested to evaluate suitability of methods to detect *M. conjunctivae* infections from clinical material. Furthermore, brains of some blind chamois presenting circling movements were investigated to find out whether abnormal behaviour in animals affected by IKC was associated with cerebral lesions.

Animals, Material and Methods

Study area

From 1997 to 1999, dead chamois affected by IKC were collected by game-keepers in a region of the north-western Swiss Alps (46°30' to 46°50'N, 7°10' to 7°35'E), in the cantons of Berne and Fribourg (Figure1). The mountain chain is bordered by the lake of Thun in the east, the rivers Gürbe and Sense in the north, Le Javro in the west, and La Jogne and Simme in the south. The area is characterised by rock faces and debris, alpine meadows, and wooded slopes. Prominent peaks are the Gantrisch (2175 m), the Schibe (2151 m), the Kaiseregg (2185 m) and the Schopfenspitz (2104 m, 3 km south-west of the Euschelspass). At the beginning of the outbreak, the local chamois population was estimated at approximately 1900 individuals. The region is subdivided into three subpopulation units: Simmefluhe (counting approximately 50 chamois), Stockhorn-Kaiseregg (1350 chamois), and Schopfenspitz (450 chamois). In some parts of the area, the chamois population is submitted to hunting every autumn. Other free-ranging wild species such as roe deer (Capreolus capreolus) and Eurasian lynx (*Lynx lynx*) are present in this region. Domestic sheep partially use this area during the summer grazing period.

Collection of animals and data analysis

In the course of an interregional collaboration, nine state game-keepers observed the countryside with binoculars and telescopes for chamois affected by IKC. Individuals either presenting ocular lesions regarded to be irreversible or being in poor general condition and/or injured were shot. Furthermore, all animals found dead were systematically recorded. The game-keepers were using trained bloodhounds and watched the behaviour of necrophageous birds in order to increase the chance of finding chamois carcasses. Animals were considered to be affected by IKC if at least one of the pathognomonic lesions was detected (Mayer et al., 1997): bilateral serous or mucopurulent ocular effusion, bilateral corneal opacity and/or perforation. The animals were aged by counting horn rings (Habermehl, 1985), and age-classes were established according to the sexual maturity and social behaviour. Considering data by Knaus and Schröder (1983), animals < 4-years old were classified as juveniles, and ≥ 4-years old as adults. Three causes of death were distinguished in chamois affected by IKC: (i) perished, (ii) shot, and (iii) predated by lynx. Lynx predation was ascertained by judging typical throat bite and prey utilisation pattern (Jobin, 1998).

Selected chamois affected by IKC were sampled in the field by the authors for microbiological, immunological, and pathological examination. Conjunctival swabs taken from behind the third eyelid were dipped in tubes without transport medium and stored at –18° C until analysis. A nested PCR based on the 16S rRNA gene for detection and identification of *M. conjunctivae* (Giacometti et al., 1999) was used. Immunoblot technique was utilised to detect specific antibodies against *M. conjunctivae* in sera and in ocular washes using whole cell antigen of *M. conjunctivae* strain HRC/581^T separated by SDS-PAGE 5–15% gradient gels (Degiorgis et al., 2000). Furthermore, the brains of individuals presenting circling movements were fixed in 4% $NaPO_4$-buffered formalin. Fixed organ samples were embedded in paraffin and histological sections stained with hematoxilin and eosin.

Results

Geographic and temporal distribution

On August 5, 1997, five chamois affected by IKC were found dead and another one was shot in the region of Schönenboden, approximately 3 km north of Oberwil/BE (Figure 1). From here, the outbreak spread along the mountain chain in both directions, south-westwards and north-eastwards. The IKC epidemic progressed at an average speed of 15 km/year and reached the Gantrisch mountain in the north-east and later the Jogne river in the south-west. Most cases were recorded in the regions of Kaiseregg and Schopfenspitz. An 11-year old male affected by IKC was shot on November 11, 1998, approximately 1 km south of the Jaunpass (outside the study area defined above). The last recorded chamois (a 5-years old male) was shot on February 15, 1999, 22 km away from the point of origin of the outbreak.

Dead chamois were found during a period of 18 months. Considering the mortality, IKC occurrence in chamois was characterised by a 3-peaked epidemic curve (Figure 2). A first peak was registered at the beginning of the outbreak in August 1997 with 19 cases. Two further peaks were particularly evident in February-March 1998 and August-November 1998. The highest monthly record of dead

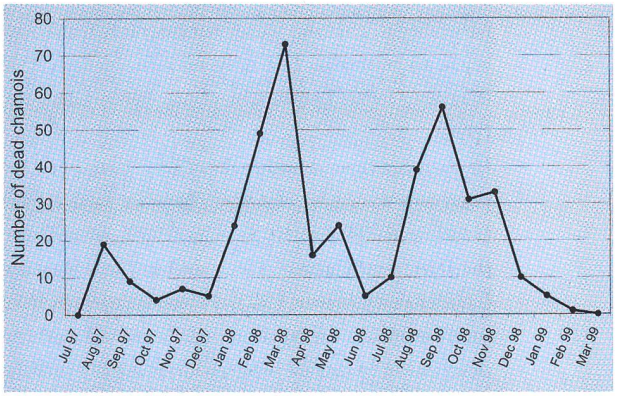

Figure 2: The infectious keratoconjunctivitis outbreak in chamois in the Simmental-Gruyères region, Switzerland, in 1997–99: number of recorded dead chamois per month.

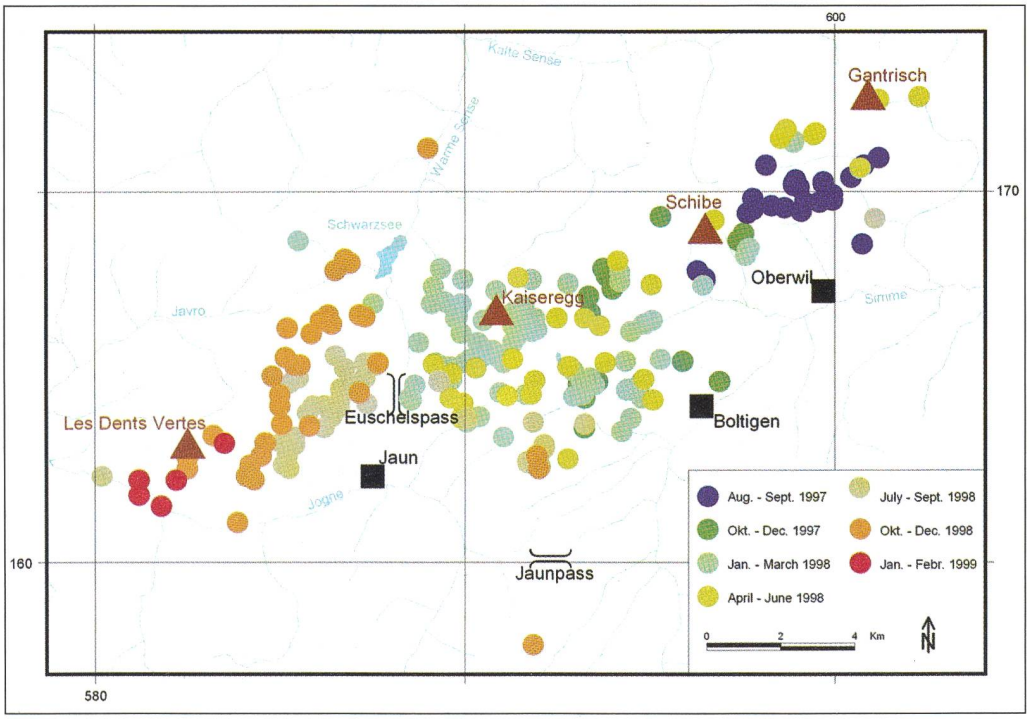

Figure 1: The Simmental-Gruyères region in the north-western Swiss Alps. The points show the 420 chamois which died of the consequences of infectious keratoconjunctivitis in 1997–99 using different colours for 3-months periods (except for the first and the last time period which lasted two months each only). Brown triangles represent mountain peaks, black quadrates represent villages, and rivers are shown in pale blue. Numbers outside the frame indicate the Swiss coordinates.

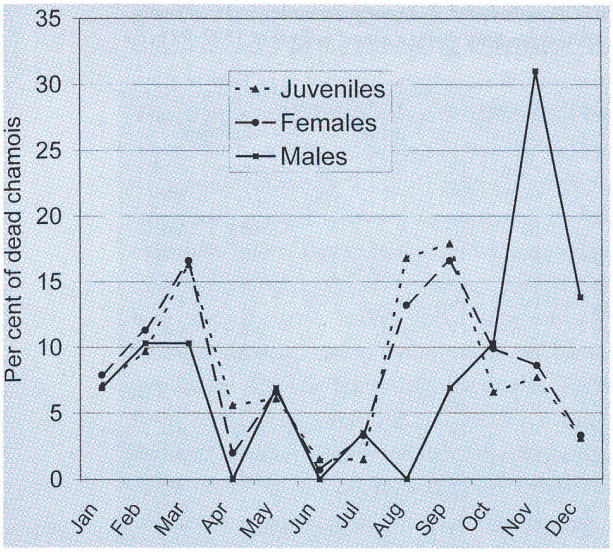

Figure 3: Time trend graph depicting the seasonal occurrence of infectious keratoconjunctivitis in chamois (animals whose death was associated with the disease) in the Simmental-Gruyères region from 1997–99.

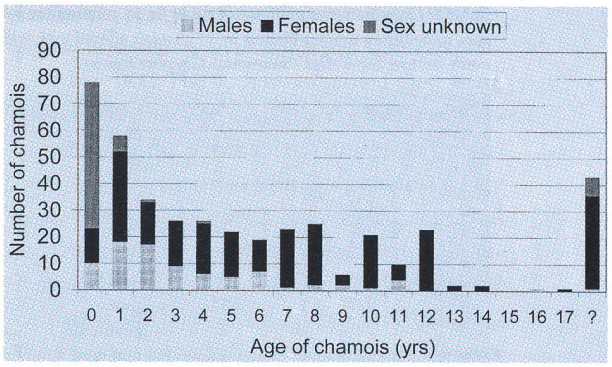

Figure 4: Sex and age of chamois which died of the consequences of infectious keratoconjunctivitis in the Simmental-Gruyères region from 1997–99.

chamois was registered in March 1998 (n = 73), followed by September 1998 (n = 56). Since only a relatively low number of males was found, the seasonal occurrence was essentially characterised by the curves of juveniles and females (Figure 3) showing two distinct peaks, one in February-March and one in August-September. Interestingly, a particularly high proportion of adult males (55%) died in October-December.

Characteristics in the group of chamois found which died of the consequences of IKC

From August 1997 to February 1999, the gamekeepers found 420 chamois which died of the consequences of IKC. Most recorded chamois (76.0%) had perished (Table 1). In these animals, death was associated with injuries caused by falls from rocks or steep slopes, starvation and/or pneumonia. The state game-keepers shot 90 (21.4%) animals because of irreversible blindness, injuries or emaciation. Finally, 11 (2.6%) blind chamois were predated by lynx. Age and sex of the affected chamois are represented in Figure 4. Juveniles (n = 170, 45.1%), particularly kids (n = 78, 20.7%), were mostly represented among the animals which died of IKC.

In contrast, only 29 adult males were recorded, which represents 7.7% of the total number of recorded chamois. The sex could not be determined in 70 (16.7%) animals, especially in kids, because in these cases carcasses were incomplete. Overall, more females than males died of IKC (266 females versus 84 males). This was particularly obvious in adult chamois: 48.1% of recorded animals with known sex and age were adult females, whereas only 9.2% were adult males. The estimated cumulative mortality associated with IKC in the affected regions (the western part of the Stockhorn-Kaiseregg subpopulation unit as well as the Schopfenspitz subpopulation unit, counting 1100 and 450 chamois, respectively) was 27%.

Microbiology and histopathology

M. conjunctivae was detected by means of nested PCR in 12 out of 15 animals (80%) affected by IKC (Table 2). Results were positive in 11 out of 12 swabs (92%) from shot chamois (including nine animals with perforated corneas), and in 1 out of 3 chamois found dead showing severe corneal lesions. Immunoblots performed with sera and ocular washes of three affected chamois reacted with 5–15 different protein bands, in particular to 68 and 60 kDa antigens, which were shown to be specific for *M. conjunctivae* (Degiorgis et al., 2000). Histopathological examination of the brains of two affected chamois showing circling movements did not reveal any lesions.

Table 1: Causes of death in chamois affected with infectious keratoconjunctivitis during a natural outbreak in 1997–99 in the northwestern Swiss Alps (Simmental-Gruyères region).

	perished		shot		predated by lynx		total	
	n	%	n	%	n	%	n	%
juveniles	152	47.6	40	44.5	4	36.4	196	46.7
adults	125	39.2	50	55.5	6	54.5	181	43.1
age unknown	42	13.2	0	0	1	9.1	43	10.2
total	319	100	90	100	11	100	420	100

Table 2: Examination of conjunctival swabs for M. conjunctivae by nested PCR methods, and of sera and ocular washes for M. conjunctivae-antibodies by western-blotting in 15 chamois affected with infectious keratoconjunctivitis during a natural outbreak in 1997–99 in the north-western Swiss Alps (Simmental-Gruyères region).

No[a]	Date	Sex[b]	Age[c]	Cause of death	Local place	Lesion[d]		*M. conjunctivae* agent[e]		antibodies[f]	
						right eye	left eye	right eye	left eye	serum	ocular wash
1	9.2.98	f	10	shot	Rippa	III	III	+	+	n.d.[g]	n.d.
2	11.2.98	f	2	shot	Kaiseregg	IV	IV	+	+	n.d.	n.d.
3	11.2.98	f	5	shot	Kaiseregg	IV	IV	+	+	+	+
4	11.2.98	f	11	shot	Kaiseregg	IV	IV	+	+	+	+
5	11.2.98	m	2	perished	Kaiseregg	e.m.[h]	IV	n.d.	-	n.d.	n.d.
6	23.2.98	f	12	perished	Tubental	IV	IV	+	+	n.d.	n.d.
7	25.2.98	f	2	shot	Riggisalp	III	III	+	+	+	+
8	25.2.98	f	12	shot	Riggisalp	n.d.	III	+	+	n.d.	n.d.
9	4.3.98	f	2	shot	Kaiseregg	III	IV	+	+	n.d.	n.d.
10	4.3.98	f	8	shot	Kaiseregg	IV	IV	-	+	n.d.	n.d.
11	4.3.98	f	2	perished	Kaiseregg	e.m.	IV	n.d.	-	n.d.	n.d.
12	10.3.98	f	2	shot	Riggisalp	IV	IV	+	+	n.d.	n.d.
13	11.3.98	m	8	shot	Euschels	IV	IV	-	-	n.d.	n.d.
16	18.3.98	m	2	shot	Riggisalp	IV	IV	+	+	n.d.	n.d.
17	23.3.98	f	5	shot	Kaiseregg	IV	IV	+	+	n.d.	n.d.

[a] Animal number
[b] f: female; m: male
[c] Fully completed years
[d] Stage of lesions. III: corneal dulling and neovascularisation; IV: corneal perforation (according to Mayer et al., 1997)
[e] As found by nested PCR based on the 16S rRNA gene (according to Giacometti et al., 1999)
[f] As found by western blotting using whole cell antigen of M. conjunctivae strain HRC/581T (according to Degiorgis et al., 2000)
[g] Not done
[h] Eye missing

Discussion

The outbreak of IKC in the Simmental-Gruyères region in 1997–1999 was analysed considering the chamois whose death was associated with the disease. In contrast to other studies, game-keepers systematically searched for perished chamois all year round, on population level. However, morbidity as studied by Hars and Gauthier (1984) was not investigated. A total of 420 dead chamois was recorded from August 1997 to February 1999, which is the highest number reported in an IKC outbreak since 1919, when the first epidemic in chamois was described in the Alps by Stroh (1919). In most reports, less than 100 dead chamois were recorded during the course of IKC epidemics; exceptions were IKC outbreaks in the Gran Paradiso (Italy) and Vanoise (France) National Parks in 1981–83 (Lanfranchi et al., 1985; Gauthier, 1991), and in Valpelline (Aosta Valley, Italy) in 1998 (Grattarola et al., 1999). The estimated cumulative mortality in the present study is comparable with the highest numbers previously reported for IKC outbreaks in chamois (Stroh, 1919; Catusse, 1982; Lanfranchi et al., 1985; Gauthier, 1991). However, the impact on the population was not as dramatic as reported for sarcoptic mange outbreaks with mortality rates > 80% (Rossi et al., 1995). In the IKC outbreak reported here, > 75% of the documented chamois had perished, and the impact of lynx predation on chamois mortality was very low. Since most individuals shot by game-keepers would have died spontaneously some days or weeks later, the bias due to killing in the mortality rate can be considered as negligible.

Cases of death associated with IKC were recorded especially in females and juveniles, which corresponds to earlier observations (Ratti, 1967; Catusse, 1982; Gauthier, 1994). Only a low number of affected adult males was registered, possibly reflecting a lower percentage of this sex/age-class within the chamois population. This would not be surprising, since in some parts of Switzerland the number of old male chamois hunted is often disproportionately high compared to other sex/age-classes (Giacometti, 1997). Furthermore, a lower probability for adult males to be infected with *M. conjunctivae* could be due to sexual segregation and solitary living during most time of the year (Schnidrig-Petrig and Salm, 1998). This is emphasised by the fact that > 50% of the recorded adult males died during the rutting season (Figure 3), when male and female chamois congregate (Sägesser and Krapp, 1986). In contrast, there was a large degree of correspondence of seasonal occurrence in juveniles and adult females, thus supporting the importance of social behaviour as a determinant factor in intraspecific transmission of IKC (Baas et al., 1977).

The observed disease occurrence can be classified as short-termed and, considering the recorded dead animals, it was characterised by three peaks. Regressions in the number of deaths were observed in autumn 1997, spring 1998, and winter 1998/99 (Fi-

gure 2), which were supposed to be associated with a local decrease in the number of susceptible chamois as well as a decrease of intraspecific contacts. The latter may be particularly true for spring 1998, when the Euschelspass (which represents the western border of the Stockhorn-Kaiseregg-subpopulation unit) seemed to stop the progress of the IKC epidemic. Interestingly, the disease did not progress from the Gantrisch region eastwards, although there is no natural barrier which could have prevented intraspecific transmission within the local chamois population. Disease transmission seems to be influenced by social behaviour, and contacts between different herds most likely influence the progression of an epidemic. Therefore, a lack of intraspecific contacts between chamois herds in this area might explain why the IKC epidemic did not progress in that direction. The single affected old male shot during the rutting season outside the defined study area probably represents a further example of the importance of social contacts in disease transmission. The disease did not progress southwards, suggesting that the animal did not infect any susceptible chamois in this area. The IKC epidemic progressed at an average speed of 15 km/year, which is 3–4 times faster than the progression reported for sarcoptic mange in chamois in the eastern Italian Alps (Rossi et al., 1995). This may be associated with differences in host density, social organisation and habitat morphology, but the highly contagious character of IKC may play the most important role in its faster progression. In contrast to sarcoptic mange outbreaks with peaks of mortality occurring in winter and spring (Rossi et al., 1995), the occurrence of deaths due to IKC could not be associated with any particular season. A high mortality was observed in winter as well as in summer and autumn, indicating a transmission of *M. conjunctivae* throughout the year in free-ranging Caprinae.

The results of PCR analysis and immunoblotting show that *M. conjunctivae* was involved in the IKC outbreak in the Simmental-Gruyères region. Thus, *M. conjunctivae* was again detected in chamois affected by IKC, as previously reported in Switzerland (Nicolet and Freundt, 1975; Giacometti et al., 1997a), Austria (Giacometti et al., 1999) and Italy (Grattarola et al., 1999) supporting the role of *M. conjunctivae* as an etiological agent of IKC in wild Caprinae (Nicolet and Freundt, 1975; Mayer et al., 1996; Giacometti et al., 1998). *M. conjunctivae* was detected from the eyes in 80% of the chamois sampled by means of nested PCR, including in one dead animal. This represents a high diagnostic performance considering the advanced stages of lesions and might be explained by the sensitivity of nested PCR analysis reported to be higher than the sensitivity of mycoplasmal culture (Giacometti et al., 1998).

Lanfranchi et al. (1985) and Bassano et al. (1994) reported brain lesions in chamois and Alpine ibex affected by IKC. The authors associated these brain lesions with the eye disease and made them responsible for the unnatural movements of the animals. However, in the present study, histopathology of the brains of two blind chamois did not reveal any lesion which could have explained their abnormal behaviour. The absence of pathological changes in the brain of a blind ibex presenting circling movements has already been reported (Mayer et al., 1997), and these findings suggest that in wild Caprinae affected by IKC, changes in behaviour are not necessarily a consequence of cerebral lesions, but might simply be due to disorientation and stress in totally blind animals.

The origin of the IKC-outbreak in chamois in 1997 near Oberwil remains equivocal. In this region, IKC has not been reported in chamois since 1982 (Schwendimann, pers. commun. 1999). Because the beginning of the IKC outbreak coincided with the presence of domestic sheep grazing on summer pastures, the introduction of *M. conjunctivae* by susceptible hosts other than chamois has to be considered. IKC is a very common ocular disease in domestic sheep in some parts of the Swiss Alps (Nicolet et al., 1974; Giacometti et al., 1997a), and interspecific transmission of *M. conjunctivae* probably occurs on alpine meadows: Encounters between different species of Caprinae, domestic and wild, are not uncommon events in the Alps (Degiorgis, 1998) and flies are considered as possible vectors of *M. conjunctivae* (Degiorgis et al., 1999). However, we have no microbiological data concerning the health status of the sheep herd in the Oberwil area in early summer 1997.

Loison et al. (1996) suggested to cope with IKC of chamois rather than to prevent the disease. Because mortality following an outbreak of infectious keratoconjunctivitis can reach almost 30% in wild Caprinae, and because blind chamois and ibex face particularly treacherous circumstances in steep rocky areas, we however suggest further epidemiological and immunological studies be carried out in order to develop tools that could lead to the control of *M. conjunctivae* infections in domestic sheep and wild Caprinae.

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Une épidémie de kératoconjonctivite infectieuse chez le chamois (*Rupicapra r. rupicapra*) dans la région Simmental-Gruyères (Suisse)

L'épidémie de kératoconjonctivite infectieuse (KCI) qui a sévi chez le chamois dans la région Simmental-Gruyères (Suisse) d'août 1997 à février 1999 est décrite. L'analyse comprend la progression spatio-temporelle de l'épidémie, les caractéristiques du groupe de chamois trouvés morts des suites de la maladie et l'estimation de la mortalité. L'épidémie s'est propagée le long de la chaîne montagneuse du Kaiseregg dans deux directions et elle a progressé à une vitesse moyenne de 15 km par année. Considérant les chamois trouvés morts, cette épidémie est caractérisée par une courbe à trois pics, mais l'occurence n'a pu être mise en relation avec aucune saison particulière. Les gardes-faune ont compté 420 chamois morts des suites de la maladie. La plupart des chamois trouvés (76%) avaient péri, 21.4% furent abattus par les gardes-faune à cause de lésions oculaires irréversibles, de blessures ou d'amaigrissement, et 11 chamois aveugles (2.6%) furent tués par le lynx (*Lynx lynx*). Les jeunes animaux (en particuliers les cabris) et les femelles adultes furent particulièrement touchés, et la mortalité cumulative est estimée à 27%. Les résultats positifs de l'analyse PCR chez 12 des 15 animaux testés (80%) et la présence d'anticorps spécifiques dans trois chamois analysés montrèrent que *Mycoplasma conjunctivae* était impliqué dans l'étiologie de la maladie. Nous suggérons de mener des études épidémiologiques et immunologiques supplémentaires afin de développer des instruments qui pourraient conduire au contrôle des infections à *M. conjunctivae* chez les moutons domestiques et les Caprinae sauvages.

Un'epidemia di cheratocongiuntivite infettiva (CCI) nel camoscio (*Rupicapra r. rupicapra*) nello Simmental-Gruyères (Svizzera)

Un'epidemia di cheratocongiuntivite infettiva (CCI) ha colpito una popolazione di camoscio nella regione del Simmental-Gruyères (Svizzera) negli anni 1997–1999. Vengono presentati un'analisi della diffusione spazio-temporale del focolaio, una descrizione del gruppo di camosci trovati morti in seguito alla malattia nonché una valutazione della mortalità. L'epidemia ha rapidamente interessato a macchia d'olio la cresta di montagna del Kaiseregg, diffondendosi verso sud-ovest e nord-est ad una velocità di 15 km/anno. Considerando i camosci periti, l'epidemia di CCI era caratterizzata da una curva a tre punte, la quale non ha però permesso di associare l'occorrenza della malattia ad una particolare stagione. Il corpo di sorveglianza ha recuperato cadaveri di 420 camosci morti in seguito alla CCI. Riguardo le cause di morte, la maggioranza degli animali (76%) sono periti e il 21.4% sono stati abbattuti a causa delle lesioni agli occhi ritenute irreversibili, di ferite da cadute oppure di decadenza fisica. Infine, 11 camosci (2.6%) affetti da CCI sono stati uccisi dalla lince (*Lynx lynx*). In rapporto all'età ed al sesso, le classi più colpite sono risultate i giovani, specialmente i capretti, e le femmine adulte. La mortalità è stata valutata al 27%. *Mycoplasma conjunctivae* è stato identificato nell'80% dei camosci analizzati (nested PCR), e inoltre, in 3 casi, sono stati identificati degli anticorpi specifici tramite immunoblotting. Si propone di proseguire gli studi mirati a migliorare le conoscenze sull'epidemiologia e l'immunologia della CCI. Questi lavori potrebbero portare a degli strumenti che permetterebbero di controllare infezioni da *M. conjunctivae* nei piccoli ruminanti domestici nonché nel camoscio e nello stambecco.

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Korrespondenzadresse

Dr. Marco Giacometti, Wildvet Projects, CH-3054 Schüpfen
(e-mail: info@wildvet-projects.ch; www.wildvet-projects.ch)

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