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TRANSMISSION OF PSOROPTIC MITES FROM BIGHORN SHEEP (*Ovis canadensis mexicana*) TO DOMESTIC SHEEP, CATTLE AND RABBITS [□]

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Abstract: Psoroptic mites, thought to be *Psoroptes ovis* (Hering) and collected from bighorn sheep (*Ovis canadensis mexicana*) in southern New Mexico, were transferred to domestic sheep, rabbits and cattle. These mites established infestations in the ears of 5 of 6 rabbits but failed to establish lasting infestations on sheep. Reproducing colonies of mites were established with difficulty on cattle (3 of 11). The studies indicate that these mites are not adapted to cattle or domestic sheep.

INTRODUCTION

In the fall of 1978 psoroptic scabies was discovered on bighorn sheep (*Ovis canadensis mexicana*) taken during an organized hunt in the San Andres National Wildlife Refuge in southern New Mexico.² Specimens of these mites were tentatively identified as *Psoroptes ovis* (Hering) based on the length of the outer opisthosomal setae (OOS) of adult males.⁵ The next year, only about half of the sheep counted in 1978 were located. It was assumed that many of the animals had died because of the severity of the scabies, from predation, or possibly during migration to a new location. This scabies outbreak may have been the result of the mites transferring to bighorn from domestic stock² and, if so, these mites might be transferrable back to domestic stock under controlled conditions. Therefore, the objective of this study was to determine if psoroptic mites collected from bighorn sheep could infest domestic sheep, rabbits and cattle. Since domestic sheep and cattle are the primary hosts for *P. ovis*, the establishment of reproductive colonies of psoroptic mites from bighorn sheep on these

animals could be used as additional evidence to identify these mites as *P. ovis*.

MATERIALS AND METHODS

Bighorn sheep captured from the San Andres National Wildlife Refuge in October and November of 1979 and bighorn sheep in northern Arizona were the source of psoroptic mites.^{4,7} Several of these sheep were held in captivity at New Mexico State University. Samples of mites were collected in October, November and December, 1979, and in March and May, 1980. Mites in adequate numbers to establish reproductive colonies, were transferred to test animals within 48 h after collection.

Cattle and domestic sheep were obtained from local auctions, and domestic rabbits were from laboratory-maintained flock of rabbits that were free of *P. cuniculi* (Delafond), the ear canker mite.

Domestic Sheep Trials

Trial 1, October, 1979. Two domestic sheep were restrained in stanchions

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designed to restrict grooming. They were infested by placing pieces of scab containing live mites on the withers near the skin after parting the wool. The wool was pulled together and held in place with a rubber band, forming a pyramid of wool over the scabs. These sheep were checked weekly for evidence of lesions.

Trial 2, November, 1979. The ears of 7 sheep (four were restrained in stanchions and three were loose in a pen) were infested with pieces of scab containing live mites. The ears were held shut with paper tape to allow the mites time to leave the scabs; the tape was removed after 24 to 48 h. The ears of the sheep were examined weekly for lesions and live mites.

Rabbit Trials

Trial 1, October, 1979. The ears of 4 young rabbits (2-3 months old) were infested in the manner described for sheep in Trial 2. These rabbits were fitted with plastic collars to restrict grooming. The ears of the rabbits were examined weekly for lesions and live mites.

Trial 2, November, 1979. The ears of 2 adult rabbits were infested as mentioned above. These rabbits were examined weekly.

Trial 3, November, 1979. One adult rabbit fitted with a plastic collar was infested, as described above, with psoroptic mites obtained from bighorn sheep from northwestern Arizona.

Cattle Trials

Psoroptes ovis control. In order to have *P. ovis* infestations on cattle for comparison of the development rate of scabies caused by psoroptic mites from bighorn sheep on cattle, we infested 5 calves with *P. ovis* from our laboratory herd of infested cattle. The infestation on these calves also served as a comparison for the expected distribution of all life stages of psoroptic mites in a reproductive colony.

Trial 1, October, 1979. Two 10-month-old calves were infested on the withers

with psoroptic mites from bighorn sheep as described for sheep in Trial 1. These calves remained in stanchions to restrict grooming for 5 weeks postexposure. The calves were examined every 2 weeks, and 2 to 4 samples of mites were collected from each animal by scraping 6.5 cm² affected areas near the site of exposure. All eggs, adult mites and immature mites were counted. The area of the body covered with lesions was determined by the method of Guillot.¹

Trial 2 — In November, 1979 Trial 1 was replicated with 2 animals.

Trial 3 — In March, 1980 Trial 1 was replicated with 2 animals.

Trial 4 — In May, 1980 Trial 1 was replicated with 3 animals.

Four of the animals (the 2 used in Trial 1 and the 2 used in Trial 2) did not develop scabies after exposure to psoroptic mites from bighorn sheep. To determine if these animals were refractory to *Psoroptes*, they were later infested with *P. ovis* obtained from our laboratory herd of infested cattle. The animals were infested, examined, and scraped as stated for Trial 1.

RESULTS

Domestic sheep trials: Neither of the 2 sheep infested with mites on their bodies developed any lesions. Of the 7 sheep infested in the ears, only one stanchioned animal developed scabies in one ear. This infestation appeared at 2 weeks postexposure but was completely gone after 4 weeks.

Rabbit trials: Five of the 6 rabbits infested with the mites obtained from bighorn sheep in New Mexico developed ear canker and had reproducing populations in their ears. The rabbit infested with the mites from bighorn sheep in Arizona developed severe ear canker within 4 to 6 weeks.

Cattle trials: Cattle that served as *P. ovis* controls developed lesions over 18% of their bodies and harbored a reproduc-

ing population of mites, as indicated by the presence of all life stages, including eggs, at 2-3 weeks after exposure (Table 1). The quantity of scabies lesions and the mite population continued to increase during the first 9 weeks post-exposure. The number of eggs/sample also increased at each sampling period, indicating that oviposition continued throughout colony establishment. Adult mites composed 41% of the total population at 2-3 weeks postexposure but had decreased to 26% at 8-9 weeks postexposure when the cattle were 90% covered with lesions (Table 1). The development rate of the scabies lesions and the population increase of these mites are typical of a reproducing *P. ovis* colony on cattle.

In the first three trials, transfer of psoroptic mites from bighorn sheep to cattle did not result in scabies or establishment of a reproducing colony of mites (Table 2), as described for the *P. ovis* controls. Lesions, when present, were found only at the immediate site of exposure and did not spread over the hosts as on the *P. ovis* controls. The number of mites decreased in the first two trials after 4 or 7 weeks, few eggs were found in the samples, and the adult population averaged less than 10%, except on one date when it was 20%. In Trial 3, 731 mites/sample were found at 7 weeks postexposure; however, adult pop-

ulations were as low as those in Trials 1 and 2, and few eggs were found during the 10-week postexposure period.

The results of the mite transfer from bighorn sheep to cattle in Trial 4 followed more closely the results of the *P. ovis* controls. The three recipient cattle developed lesions over 50% of their bodies in 9 weeks, and large numbers of mites were found in the samples. The adult population was higher in Trial 4 than in the first three trials, averaging 34% at 2 weeks and ca. 20% at 9 weeks postexposure. However, the adult population generally was lower in these samples than in those from the *P. ovis* controls. The number of eggs recovered in Trial 4 was higher than that in Trials 1 to 3 but considerably lower than the number recovered from the *P. ovis* controls (Table 1).

The 4 cattle in Trials 1 and 2 that did not develop scabies when exposed to the mites from bighorn sheep later developed scabies and harbored large reproducing populations of mites after exposure to *P. ovis* of cattle origin (Table 3).

DISCUSSION

The attempt to transmit psoroptic mites from bighorn sheep to domestic sheep was unsuccessful, but transmission to rabbits restricted from grooming

TABLE 1. Results of biweekly sampling and examination of five calves exposed to *Psoroptes ovis* from cattle.¹

Weeks Post- exposure	Average ²			Percent Body Involvement
	Mites/Sample	Eggs/Sample	Percent Adults ³	
2-3	62	30	41.3	18.5
4-5	360	267	35.8	30.8
6-7	636	454	31.7	79.3
8-9	2514	1442	25.7	90.5

¹The calves served as *P. ovis* controls.

²Calculated from 2 to 4 samples per calf.

³Samples with fewer than 10 mites were not used in the calculations to determine the percentage of adult mites per sample.

TABLE 2. Results of biweekly sampling and examination of calves exposed to psoroptic mites from bighorn sheep.

Trial No.	Weeks Post-exposure	Average ¹			
		Mites/Sample	Eggs/Sample	Percent Adults ²	Percent Body Involvement
1	3	53	1	8.7	0.6
	5 ³	57	1	3.1	1.4
	7	59	14	8.6	3.5
	9	1	1	—	2.1
	12	0	0	—	2.9
2	2	21	2	6.5	1.9
	4	23	0	20.0	0.4
	7	6	1	—	0.7
3	3	6	0	—	0.3
	5	55	0	5.9	1.8
	7	731	9	13.3	4.0
	8	119	0	8.8	7.1
	10	66	—	5.3	1.5
4	2	36	16	34.1	2.2
	4	281	33	27.1	11.4
	6	354	12	14.6	10.5
	8	162	9	21.2	55.4
	9	358	33	19.7	49.7

¹Calculated from 2 to 4 samples per calf.²Samples with fewer than 10 mites were not used in the calculations to determine the percentage of adult mites per sample.³These animals were removed from the stanchions at the 5-week sampling.

was easily accomplished. Meleney¹ successfully transferred *P. ovis* from a steer to a rabbit, and we routinely transfer *P. ovis* from cattle to rabbits at our laboratory.

The results of our attempts to establish colonies of bighorn sheep mites on cattle are ambiguous. Transfers in Trials 1 to 3 were not successful. Mites were found in samples for as long as 10 weeks after exposure, but small to no lesions developed from these transfers. Only a few eggs were found in samples during the first 10 weeks after exposure, and adults composed less than 10% of all but two samples, whereas adults composed more than 30% of the mite population on the *P. ovis* controls. These data suggest that the mites sampled in Trials 1 to 3 were mostly survivors from the scrapings used at the time of exposure rather than progeny of a reproducing

colony. The later successful production of scabies lesions and establishment of reproducing colonies of *P. ovis* mites from cattle on the 4 cattle from Trials 1 and 2 rules out the possibility that these cattle did not support colonies of mites from bighorn sheep because of host resistance to *Psoroptes*.

The results of Trial 4 agree with those of the first 3 trials only in the few eggs recovered in the samples; the cattle developed lesions typical of psoroptic scabies and had large numbers of mites, with an adult population that was at times as high as that found on the *P. ovis* controls.

The data from Trial 4 are not as easily interpreted as those from Trials 1 to 3. The number of eggs collected was too low to support the large number of mites found in the biweekly samples. This

TABLE 3. Results of biweekly sampling and examination of four calves exposed to *Psoroptes ovis* from Cattle.¹

Weeks Post- exposure	Average ²			Percent Body Involvement
	Mites/Sample	Eggs/Sample	Percent Adults ³	
2-3	266	310	43.5	23.3
4-5	999	476	30.0	18.1
6-7	249	125	28.8	16.8
9-11	549	695	34.2	50.3

¹These four calves were previously exposed to psoroptic mites from bighorn sheep (Trial 1 & 2).

²Calculated from 2 to 4 samples per calf.

³Samples with fewer than 10 mites were not used in the calculations to determine the percentage of adult mites per sample.

finding suggests that some of the mites were survivors, but that some were progeny of a slowly developing population.

These data indicate that psoroptic mites from bighorn sheep established infestations easily in the ears of rabbits restricted from grooming, established reproducing colonies on cattle with difficulty and more slowly than did *P. ovis*

of cattle origin, and did not establish infestation in ears or on the bodies of domestic sheep.

The length of the outer opisthosomal setae suggested that these psoroptic mites from bighorn sheep are *P. ovis*, but our transmission studies indicate that these mites are not adapted to cattle or domestic sheep and could transfer to cattle only with great difficulty.

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