Survival of Adults and Developmental Stages of Sarcoptes scabiei var. canis when Off the Host

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ABSTRACT


All life-stages of Sarcoptes scabiei var. canis survive in the hosts' environment for several days to several weeks depending on r.h. and temperature. Survival of larvae was comparable to males; survival of nymphs was comparable to females. Females and nymphs generally survived longer than larvae and males.

Low temperature (10-15°C) and high r.h. prolonged survival of all life stages. At 10-15°C, females and nymphs survived 1-3 weeks at 97% r.h., 1-2 weeks at 75% r.h. and 5-8 days at 45% r.h. At 20-25°C, survival was significantly reduced but all life stages survived at least 2 days at 25% r.h. and 5-6 days at 75-100% r.h. Long survival off the host coupled with host-seeking behavior of these mites make it likely that environmental contamination is a source of scabies in domestic and wild mammals, and in humans.

INTRODUCTION

Indirect investigations have reported that the role of fomites in transmission of the scabies mite, Sarcoptes scabiei, was minimal (Orkin, 1971; Parlette, 1975; Shaw and Juranek, 1976; Orkin and Maibach, 1978a, b; Witkowski and Parish, 1978). Recent studies, however, directly sampled the home environments of scabietic patients. Many samples from those homes contained live and dead scabies mites (Arlian et al., 1984a, 1988b). The presence of scabies mites in the environment of scabietic patients raises questions concerning how long they may survive off the host, and the role of fomes in scabies transmission. All scabies life stages on a host leave the burrow and wander on the skin (Arlian and Vyszenski-Moher, 1988) and it is very likely many mites may fall or become dislodged from the host. A previous study investigated survival of adult S. scabiei var. canis and var. hominis mites (Arlian et al., 1984a). The purpose of this study was to determine systematically the survival of all life stages of
Sarcoptes scabiei var. canis in vitro, under environmental conditions that may exist in homes, barns and outdoor livestock enclosures and kennels.

METHODS

Sarcoptes scabiei var. canis were obtained from New Zealand white rabbits experimentally infested from naturally infested dogs (Arlian et al., 1984b, 1988a). Heavily infested skin crusts from parasitized rabbits were placed in petri dishes; mites were allowed to crawl from the crusts onto the dishes. With scabies' developmental life-stages, protonymphs that become either males or females after the tritonymphal stage and tritonymphs that become males are all small, making it difficult to distinguish between them when viewed with a stereomicroscope. By comparison, tritonymphs that become females are large and can be identified easily. Larvae, males and females could also be easily recognized. Therefore, for survival experiments, using a stereoscope, life-stages could only be sorted to larvae, small nymphs (protonymphs and tritonymphs that become males), large nymphs (tritonymphs that become females), males, and females. At least 19 mites of each type or life-stage were transferred to cylindrical glass cages (17x6 mm) and confined by sealing both ends with nylon mesh held in place by Teflon tubing plugs. Caged mites were placed in test environments consisting of all combinations of 4 specific relative humidities (r.h.) and 9 different temperatures. Aqueous glycerol solutions (100 ml) were used to maintain the desired test r.h. (Segur, 1953). The experimental environmental conditions were maintained in 200-ml glass jars covered with rubber stoppers with attached wire-mesh baskets. Caged mites were placed in the basket and suspended over the glycerol solution when the jar was closed. The atmosphere (100 ml) in the closed jars equilibrated to the desired r.h. within 15–30 min. Temperatures were maintained by BOD incubators. Caged mites were examined with a stereoscope, and the numbers of living and dead mites were determined at intervals of 24 h or less until all mites were dead. Mites exhibiting no external or esophageal movement were considered dead. To allow sufficient time to initiate movement at lower test temperatures, mites were equilibrated for 20 min at room temperature prior to determination.

RESULTS

Lower temperature and higher r.h. generally favored scabies mite survival. Except at the highest temperature, high humidities usually prolonged the survival of every life-stage.

Large nymphs (tritonymphs that become females) exhibited the longest single survival-time of any life-stage. At 10°C and 97% r.h. they exhibited 100% mortality in 21 days (Table 1). Large nymph survival ranged from 21 days to between 5 and 10 h (45°C), and they lived as long as or longer than