Reports

Studies on the Snake Mite, Ophionyssus natricis, in Nature

Ophionyssus natricis (Gervais, 1844) (Acarina: Dermanyssidae), the most serious parasite of snakes in zoological gardens throughout the world, has never been authenticated as occurring in wild reptile populations. Verbal reports of this mite in nature are either based on observations that have been made after hosts have been placed near captive reptiles, or else they refer to other forms such as pterygosomids, chiggers, or ticks. One recorded instance in which the mite was taken from a wild rat in Brazil is of little significance because of the proximity of a large reptile house to the collecting locality (*1*). The suggestion has been proffered that this mite may have evolved on reptiles in captivity, since the very behavior patterns that allow it to survive and prosper in this habitat were believed to preclude its existence on small snakes in wild situations (*2*). Recent collections in Giza Province, Egypt, however, reveal that *O. natricis* can and does exist in nature.

Eighty-two snakes representing eleven species were examined between January and May 1956 at various localities in this area. The mite was recovered from the following species: *Coluber florulentus* Jeoffrey, 1809, in Abu Ghalib, Abu Rawash, Kafr Hakim, Kirdasa, Minshat el Bakkari (Markaz Imbaba), and Zawyet Abu Musallam (Markaz Giza); *Psammophis sibilans* (Linnaeus, 1766) in Abu Rawash and Minshat el Bakkari; *Psammophis schokari* (Forskal, 1775) in El Mansuriya (Markaz Imbaba) and at the Giza Pyramids (Markaz Giza); *Spalerosophis cliffordi* (Schlegel, 1837) in Kirdasa and Zawyet Abu Musallam; *Naja haje* (Linnaeus, 1762) in Abu Ghalib; and *Telescopus dhara obtusus* Reuss, 1834, in Abu Rawash.

It was also found during the course of this study that large numbers of lizards, *Acanthodactylus boskianus* (Daudin, 1803) from the Lower Nile Valley, and *Acanthodactylus pardalis* (Lichtenstein, 1823) from Mersa Matruh (Markaz Matruh, Western Desert Governorate), harbored protonymphal mites that were indistinguishable from protonymphs of *Ophionyssus natricis*. However, lacertid lizards are known to be the hosts of species of *Sauronyssus* Sambon, 1928 (=*Neoliponyssus* Ewing, 1929), and the similarity (and possible synonymy) of the two genera prevent placement of these forms at this time.

Protonymphs also predominated on the afore-mentioned snakes, and it was necessary to rear them in order to obtain identifiable stages. Rearing was accomplished by placing the hosts in glass battery jars that contained a layer of moist sand and that were suspended over moats of water and detergent. The adult mites were recovered from the hosts or sand after the immature forms had molted. The afore-mentioned host records, however, are all supported by the subsequent finding of adult *Ophionyssus natricis* on all species concerned, with the exception of *Telescopus dhara obtusus.*

The most consistently and heavily parasitized host species was *Coluber florulentus,* only one out of 31 of which was free from mites. The density of infestation ranged from 14 to 109 mites, with an average of 39 per host. The mites were usually in the eye sockets and beneath the head, neck, and chin scales. Although mites were found on the body in heavy infestations, they were usually actively running about and not lodged beneath body scales. Of 18 *Psammophis sibilans* and 13 *P. schokari* examined, six of the former and four of the latter were positive, and none showed more than 15 mites per host. Again on these hosts, the mites were lodged anterior to the neck or were running freely over body scales. A single Egyptian cobra, *Naja haje,* harbored 50 mites in the left eye socket and beneath the posterior supralabial scales; elsewhere its body was free from infestation. Of five infested specimens of *Spalerosophis cliffordi,* out of six examined, one contained three female mites and seven freshly laid eggs in its right eye socket. An average of 22 protonymphs each were found on the other four *S. cliffordi;* all were lodged under the temporal scales or anterior to them. The only specimen of *Telescopus dhara obtusus* that was collected yielded a small number of protonymphal mites.

Although the occurrence of *Ophionyssus natricis* on certain snakes of this study may not necessarily indicate normal host-parasite relationships (it is possible that these reptiles had recently preyed upon one of the other hosts or had passed through an area that served as a focal point for hungry mites), these observations tend to indicate only slight host preference of this mite among different genera of snakes. Camin, studying the relationships of *O. natricis* to reptilian hemorrhagic septicemia, was able to utilize four genera of snakes, representing 11 different species or subspecies, as experimental hosts (*3*). This low degree of host specificity is in accordance with Bedford's observation that temporary parasites are generally less particular in their selection of hosts than are permanent parasites (*4*).

The intensity of infestation and the selection of feeding areas on the hosts in nature are interesting and should be compared with observations on populations in zoos and captive collections. On confined reptiles, mite populations sometimes approach thousands of individuals per cage and cause death of the host in 3 to 4 weeks. In light infestations, the mites are confined to the eye sockets and under the scales of the head, but as the population increases, they feed readily under the body scales of the snakes (*5*). In nature the most heavily parasitized snake harbored only slightly over 100 mites, and the choice feeding areas were observed to be in the eye sockets and beneath the scales anterior to the neck. The heavy mite population on captive reptiles is due to constant availability of hosts aided by utilization of larger feeding areas by the mites. Feeding from the large areas of distensible skin that generally underlie the body scales constitutes some danger to the parasite on more active, wild snakes. In contrast, the scales anterior to the neck, while imbricate, are nevertheless rigid enough to prevent dislodgement of the mite while the snake is in motion.

In addition to the afore-mentioned factors, certain other factors undoubtedly play a part in deterring such heavy infestation in nature. The "nest-parasite" existence of *Ophionyssus natricis,* typical of members of the family Dermanyssidae, was shown by Camin (*2*). He observed that the egg-laden female, larva, replete protonymph, and deutonymph remained in dark, humid places, where oviposition and molting occurred, whereas the newly molted protonymphs and adults lived on the host. The finding of only protonymphs and adults (with one exception) on the snakes examined in the present study would suggest that the life history in nature is similar in this respect. Not only, then, must the parasite twice seek and find a host, but it must also twice find suitable conditions in which to molt and oviposit. The low surface humidity prevalent throughout most of Egypt does not meliorate such activity. Furthermore, only a small number of eggs are deposited by females, and the parasite is discarded with the sloughed skin each time the host molts. Clearly, further comparison between wild and domestic populations is desirable to determine ecological factors that influence host-parasite relationships under each of these widely divergent situations.

In view of these facts, it may be postulated that the sustaining hosts of *Ophionyssus natricis* in nature are reptiles that repeatedly visit areas that are compatible with the ecological requirements of the nonfeeding stages of the mites. Only those reptiles with small home ranges that are either abundant or gregarious will satisfy these conditions.

With the discovery of *Ophionyssus natricis* in nature, the opportunity is also presented to investigate the natural ecology of hemorrhagic septicemia in snakes, a disease entity that, like *O. natricis,* has heretofore been studied only in the laboratory (*5*).

CONRAD E. YUNKER

Department of Medical Zoology, U.S. Naval Medical Research Unit No. 3, Cairo, Egypt, and

Department of Zoology, University of Maryland, College Park

References and Notes

1. F. da Fonseca, *Proc. Zool. Soc. London* 118, 249 (1948).
2. J. H. Camin, *Chicago Acad. Sci. Spec. Publ. No. 10* (1953).
3. ———, *J. Parasitol.* 34, 345 (1948).
4. G. A. H. Bedford, *Rept. Director Vet. Services Animal Ind. Onderstepoort* 18, 223 (1932).
5. This investigation was supported by the Microbiology Branch of the Office of the Naval Research under contract No. NONR-1809(00). The opinions and assertions contained herein are mine and are not to be construed as official or reflecting the views of the Navy Department or the naval service at large. I am grateful to Harry Hoogstraal, head of the department of medical zoology, NAMRU-3, for advice and facilities; to G. W. Wharton, head of the department of zoology, University of Maryland, for help and advice; to J. H. Camin, curator of invertebrates, Chicago Academy of Sciences, for active interest and suggestions during the course of this work; and to Hymen Marx, Chicago Natural History Museum, for identification of hosts.

23 August 1956

Action of Guinea Pig Serum and Human Gamma Globulin on the Growth of a Rat Tumor

The growth of the fibrosarcoma ACMCA2 that was transplanted into the AxC9935 strain of the Irish gray rat was found to be inhibited by repeated intraperitoneal injections of normal guinea pig serum following tumor transplantation. This inhibition is enhanced by a single injection of heterologous gamma globulin given at the time of implantation.

Preliminary experiments have shown

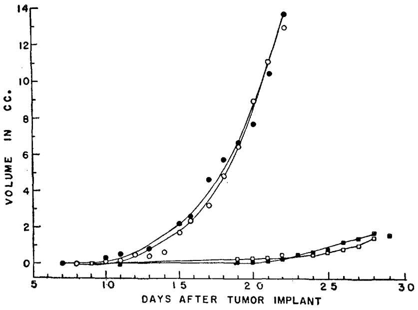

Fig. 1. Growth curves of the tumor in treated and untreated animals. Injections: ○ 5 ml of Ringer's solution daily; ● single injection of 28 mg of human gamma globulin plus daily injections of 5 ml of Ringer's solution; ■ 5 ml of guinea pig serum daily; □ single injection of 28 mg human gamma globulin plus daily injections of 5 ml of guinea pig serum.

that for this tumor, unlike other tumors that have been studied (*1*), multiple injections of guinea pig serum, rather than single or short-term injections, are required to produce the maximum inhibition. Treatment was therefore continued for 20 to 25 days (*2*).

Three series of experiments, with a total of 82 animals, were carried out (*3*). Thirty-two control animals were each given daily injections of 5 ml of Ringer's solution. Twenty-six animals were treated with daily injections of 5 ml of pooled guinea pig serum. Nineteen animals were given a single injection of 28 mg of human gamma globulin intramuscularly in the thigh in addition to the daily injections of guinea pig serum. Five animals were given a single intramuscular injection of 28 mg of human gamma globulin and daily injections of 5 ml of Ringer's solution. The animals were grouped so that litter mates were distributed in the different groups. The guinea pig serum was obtained commercially from heterogeneous colonies and stored in a Deepfreeze for 5 to 30 days. Human gamma globulin was obtained from Hyland Laboratories and dissolved in Ringer's solution with a concentration of 140 mg/ml.

In the first two series of experiments, the tumor was cut into pieces of weight 1.0 to 2.0 mg and implanted by trochar. In the third series, the Bernfeld and Homburger (*4*) modification of Snell's (*5*) cytosieve procedure was employed, and 0.1 ml of a 15-percent suspension was injected. In all cases the tumor was implanted subcutaneously in the back. Daily measurements were made in three dimensions with a vernier caliper during the course of treatment and for a short time afterward. The volumes were calculated from these data.

The results of the three series were combined, and the treated and untreated animals were compared using three criteria: (i) the positive or negative "take" of the tumor at the end of 65 days; (ii) the latent period, as determined by the time after implantation when a palpable tumor was first discernible; (iii) the time necessary for the tumor to reach a volume of 0.2 cm^3, at which time it was well into the logarithmic phase of growth.

The growth curves of the four groups are compared in Fig. 1. It will be seen that the treatment not only approximately doubled the time before the tumor entered the logarithmic phase of growth but also induced a slower rate of growth of the tumor.

The most significant finding is that the tumors in seven of the 19 animals that received guinea pig serum plus gamma globulin showed no growth at the end of the 65-day period. Two of these seven animals, however, had shown a small tumor which then regressed; one of these reappeared subsequently and again regressed. One of the 24 animals that was given guinea pig serum alone was also negative. One of the control animals was negative after implantation, and it remained refractory on subsequent implants.

The negative animals were reimplanted after 65 days (that is, 40 days after cessation of treatment), and all the tumors but one grew at a normal rate. The one grew to a volume of about 5 cm^3 and then regressed.

The effect on the latent period is graphically represented in Fig. 2. The appearance of the tumors is plotted on a probability scale. The lowest curve shows that the appearance of the normal tumor is a linear function of time. However, the curves of the treated animals deviate not only in the time of appearance, but in the rate of appearance as well.

When the time necessary for the tumor

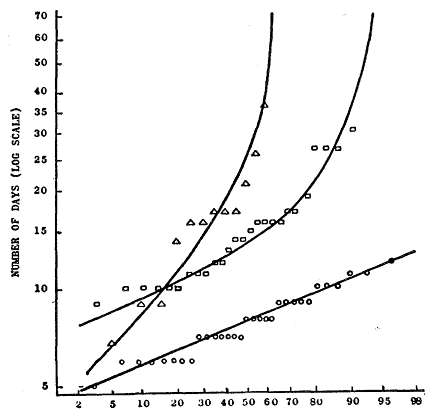

Fig. 2. Effect of treatment on the latent period of the tumor. The percentages of tumors are plotted on a probability scale. Injections: ○ 5 ml of Ringer's solution daily; □ 5 ml of guinea pig serum daily; △ 28 mg of human gamma globulin plus 5 ml of guinea pig serum daily.