

## NASAL ACARIASIS IN THE CHACMA BABOON, *PAPIO URSINUS* KERR, 1792\*

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### ABSTRACT

McCONNELL, E. E., BASSON, P. A. and DE VOS, V., 1971. Nasal acariasis in the chacma baboon, *Papio ursinus* Kerr, 1792. *Onderstepoort J. vet. Res.* 38 (3), 207-214 (1971).

Mature specimens of *Rhinophaga papionis* Fain, 1955 were observed exclusively in the maxillary recesses of 29 of 31 chacma baboons (93.6%). They stimulated the formation of inflammatory polyps, which in some cases almost completely filled the recesses. The polyps were composed of a myxomatous core infiltrated with varying numbers of plasma cells and eosinophiles. Hyperplastic epithelium with localized areas of stratified squamous metaplasia covered the polyps. *R. elongata* Coffee, van Aswegen, McConnell & Basson, 1971 (elongated nasal mite) was found in 3 of 44 baboons (6.8%). This remarkably long mite (5 to 6 mm) was located in the apex of small nodules which were randomly distributed throughout the nasal cavity. The anterior third of the mite was deeply embedded in the mucosa and in some cases even in the subjacent bone. These mites also tended to cause plugging of the mucosal glands which became markedly dilated. It is probable that both mites have a direct life cycle, with spread by way of immature forms.

### INTRODUCTION

During a recent survey of the spontaneous diseases of the chacma baboon, *Papio ursinus* Kerr, 1792, two different *Rhinophaga* spp. were observed in the nasal cavities of several animals. The finding of *Rhinophaga papionis* Fain, 1955 in the maxillary recesses is the first record of this mite in the chacma baboon, whereas the other mite, *Rhinophaga elongata* Coffee, van Aswegen, McConnell & Basson, 1971 proved to be a new species. This paper gives the results of a study of the lesions caused by these two mites. With the exception of an earlier brief description of the lesions of an unidentified mite (Kim & Bang, 1970) this is the first report on the pathogenesis of specific nasal acariasis.

### MATERIALS AND METHODS

Sixty chacma baboons were captured from different localities in the Kruger National Park. They were either directly immobilized with phencyclidine hydrochloride (Sernylan†) or captured in cages before immobilization and immediately transported to the Veterinary Investigation Centre, Skukuza, where they were exsanguinated while still anaesthetized and necropsied. After the initial discovery of the nasal mites the nasal cavities of 44 animals were specifically examined for the presence of *R. elongata* and 31 for *R. papionis*.

Parasites from affected animals were collected and preserved in 70% ethanol to which 3% glycerin had been added. Pathological specimens were preserved in 10% buffered formalin within 1 hour of death. After fixation the specimens containing bone were decalcified by immersion in 8% formic acid solution, which was changed daily until decalcification was complete. Sections were prepared from paraffin embedded tissue and stained with haematoxylin and eosin (HE). Special stains included Berlin blue (BB), Gomori's methenamine

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\*This work was supported in part by a research grant, Project Number 3A061102B71Q from the Medical Research and Development Command, U.S. Army, Washington, D.C.

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Received on 8 June 1971. - Editor

silver (GMS), Hotchkiss's periodic acid-Schiff (PAS), Schmorl's method for lipofuscin and Pickworth's method for haemoglobin.

### RESULTS

#### *R. papionis*

Twenty-nine of 31 baboons (93.6%) were infested with *R. papionis*. This group included 12 females and 19 males of different ages and weighing from 1.7 to 30.9 kg. The two non-parasitized animals were both adult males. Several troops of baboons were involved, some affected ones being from areas as far apart as 232 km. The habitat of these animals varied from typical bushveld to thickly wooded riverine areas with an average annual rainfall of approximately 450 mm.

*Location:* Adult *R. papionis* were found only in the maxillary recesses but the larvae were also recovered from other areas of the nasal cavity. Because of this specific localization of the adult mites [Plates 1 (1,2 and 3) and 2(7, 8, 9, 10 and 11)] and also since the nasal cavity of the baboon has been inadequately described a detailed description of this area is warranted.

To locate the recess the skull is bisected longitudinally through the midline. After removal of the medial part of the vomer and the nasal septum, the underlying conchae (turbinates) are readily visible [Plate 2(7)]. The superior concha is a poorly developed small bony ridge which is covered with and extended by mucous membrane. It lies almost vertically immediately posterior to the better developed triangular middle concha. Incidentally, the superior and middle conchae, arise from the vomer in the baboon. Removal of the middle concha reveals a nearly horizontal narrow semilunar hiatus (about 2 cm along its long axis) [Plate 2(8)]. It is comparable to the maxillary hiatus of man inasmuch as it opens laterally into the maxillary recess [Plates 1(1) and 2(9)]. The recess, which is simple in appearance, is complex in its formation. The major part of the superior

and lateral posterior wall is formed by the lacrimal bone, which houses the relatively wide lacrimal canal superior to the recess. The more medial portion of the posterior wall is composed of a curved portion of the middle concha where it attaches to the vomer. The largest part of the lateral wall is formed by the maxillary bone, although more posteriorly, the anterior tine of the perpendicular part of the palatine bone is present. The anterior portion of the recess is formed by the curved reflection of the inferior concha towards the maxillary bone. The recess is lined with respiratory epithelium, which is reflected from the superior and inferior walls to line the maxillary hiatus.

*Macroscopic findings:* The adult mites [Plate 2(9)] were usually found to be hidden by, close to, or on a myxomatous plug which either partially or almost completely filled the maxillary recess [Plates 1 (1 and 2) and 2(11)]. This material later proved to be polypoid growths of the mucosa lining the recesses. Occasionally they contained free blood or evidence of old haemorrhage. The mites were usually found bilaterally and varied from 1 to 15 in each recess. They appeared to be lying free on the mucosa [Plate 2(9)] but at times were loosely embedded between the folds of the polyp. The larvae of the mites were found in all areas of the nasal cavity but more frequently in the vicinity of the maxillary recess. They were easily identified by their smaller size, the absence of the characteristic black dorsal shield of the adult [Plate 2(9)] and by their greater mobility in contrast to the relatively slower movements of the adults.

*Microscopic findings:* The mildest lesions consisted of oedema and infiltration of lymphocytes, plasma cells and to a lesser degree eosinophiles into the lamina propria of the parasitized maxillary recess. Slightly more severe involvement was indicated by progressive hyperplastic changes of the epithelium characterized by an increase in both the number and the height of the cells. Concomitantly there appeared to be hyperplasia of the mucosal glands with dilatation by mucous and cellular debris [Plate 3(15)]. Occasional lymphoid follicles were observed in the mucosa.

The more advanced lesions consisted of inflammatory polyps that often filled a large portion of the recess [Plates 2 (11 and 12) and 3(15)]. These polyps were composed of a myxomatous fibrovascular stroma [Plates 2(12) and 3(15)] covered with intact hyperplastic epithelium which, in places, showed marked stratified squamous metaplasia [Plate 3(13 and 14)]. The epithelial basement membrane was unevenly thickened, but this could have been a normal variation. Mild haemorrhages in the lamina propria and blood on the surface of the epithelium were observed in some of the more severe cases. The myxomatous stroma was mildly to moderately infiltrated with plasma cells and a significant number of lymphocytes and eosinophiles. Many plasma cells showed the formation of Russell bodies. A small number of macrophages having a brown granular BB-positive pigment was also present. The mucosal glands did not play a significant role in the formation of the polyp [Plates 2(12) and 3(15)] having been involved in only one of the cases examined.

The underlying periosteum was affected in only the most advanced cases in which a mild fibrous proliferation was noticed. New bone growth was not observed in any of the cases.

The mites were found exclusively on the surface of the epithelium with no evidence of invasion of the mucosa [Plate 3(13)]. They were often enmeshed in

mucopurulent debris and at times were covered with free blood.

#### *R. elongata*

The nasal cavities of three of 44 baboons (6.8%) contained *R. elongata*. Two of these three were also infested with *R. papionis*. These animals were all large adult males from different troops mainly from riverine areas. Two of these troops were found within 15 km of each other, but the third was from an area more than 200 km from the others.

*Location and macroscopic findings:* The mites were invariably found attached to small nodules (2 to 10 mm in diameter) in the respiratory mucosa [Plate 1(4 and 5)]. These nodules varied in number from 3 to 7 in each nasal fossa and were found from the anterior respiratory region to the area of the superior concha, but never in the maxillary recess and vestibular region. The lesions were mainly in the respiratory mucosa, but the olfactory mucosa was also involved in one case. Each nodule contained from 1 to 3 mites, each of which had its anterior portion firmly embedded in the mucosa. The remainder of the mite was fairly rigid and either lying on the surface of the nodule or projecting into the lumen of the nasal cavity, apparently immobile. These features, coupled with their unusual length (5 to 6 mm), gave them the appearance of either nematodes or small awns.

The nodules could be easily scraped off from the underlying bone, which did not show evidence of exostosis. A small haemorrhagic zone was noticed in some of the lesions where the mite had penetrated.

*Microscopic findings:* The anterior portion of the mite was embedded deep in the mucosa and even in the underlying bone [Plates 1(6), 3(16, 17 and 18) and 4(19)] where an associated mild neuritis and perineuritis were observed. Some multinucleated giant cells were present immediately adjacent to the parasite [Plate 4(20)] and next to this there was a substantial inflammatory response composed of both mononuclear and granulocytic cells. The mononuclear cells were mainly plasma cells and lymphocytes, but several macrophages were also found containing either a refractile brown granular BB-positive or a light greyish-brown Schmorl's-positive pigment. A small number of Russell bodies was noticed throughout the lesion. Eosinophiles were scarce in some lesions, but predominated in others. A prominent amount of fibrovascular proliferation and a mild oedema were present, but no evidence of haemorrhage was observed other than the pigment described above. Several cholesterol clefts were observed within the reactive lesion [Plate 3(18)]. The nodules were covered by hyperplastic epithelium which was devoid of goblet cells adjacent to the parasite [Plate 3(18)]. There was, however, no evidence of squamous metaplasia. A thick, prominent epithelial basement membrane was again observed [Plate 4(21)]. Occasional areas of the stratum germinativum contained lymphocytes.

The mucosal glands were not hyperplastic but various degrees of cystic dilatation were noticed. In some cases, the large polypoid lesions consisted mainly of several cystic glands filled with a seromucinous secretion and catarrhal and inflammatory exudate [Plate 4(22)]. Several cells of the glandular epithelium were very eosinophilic and evidently necrotic.

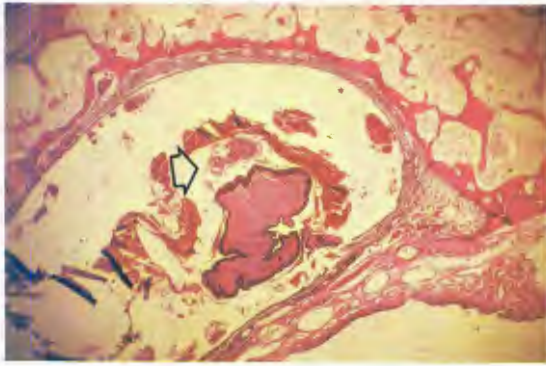
Purulo-haemorrhagic debris surrounded the mite on the epithelial surface [Plate 3(18)]. Erythrocytes were clearly visible within the digestive tracts of some parasites, and Pickworth's stain revealed some of these



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2



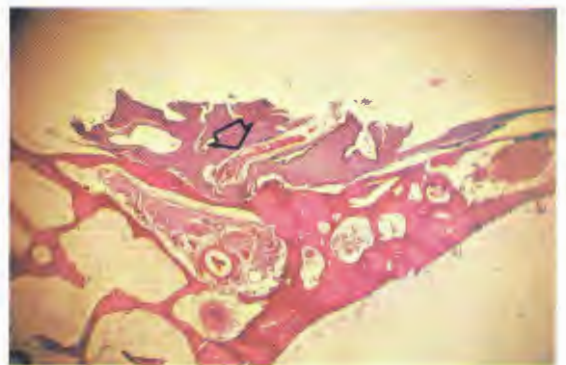
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PLATE 1

1. Bisected anterior portion of a baboon skull showing an exposed maxillary recess which contains a small myxomatous polyp and several *R. papionis* (arrow)
2. Another exposed maxillary recess almost completely filled with a myxomatous polyp (arrow). Formalin fixed specimen
3. Photomicrograph of a maxillary recess containing a polyp and one mite (arrow). HE
4. Nasal cavity showing nodules in the respiratory mucosa caused by *R. elongata* (arrow)
5. Closer view of the parasitic nodules of *R. elongata*. The free portions of four elongated mites are prominent
6. Photomicrograph of *R. elongata* embedded in the nasal mucosa (arrow). HE

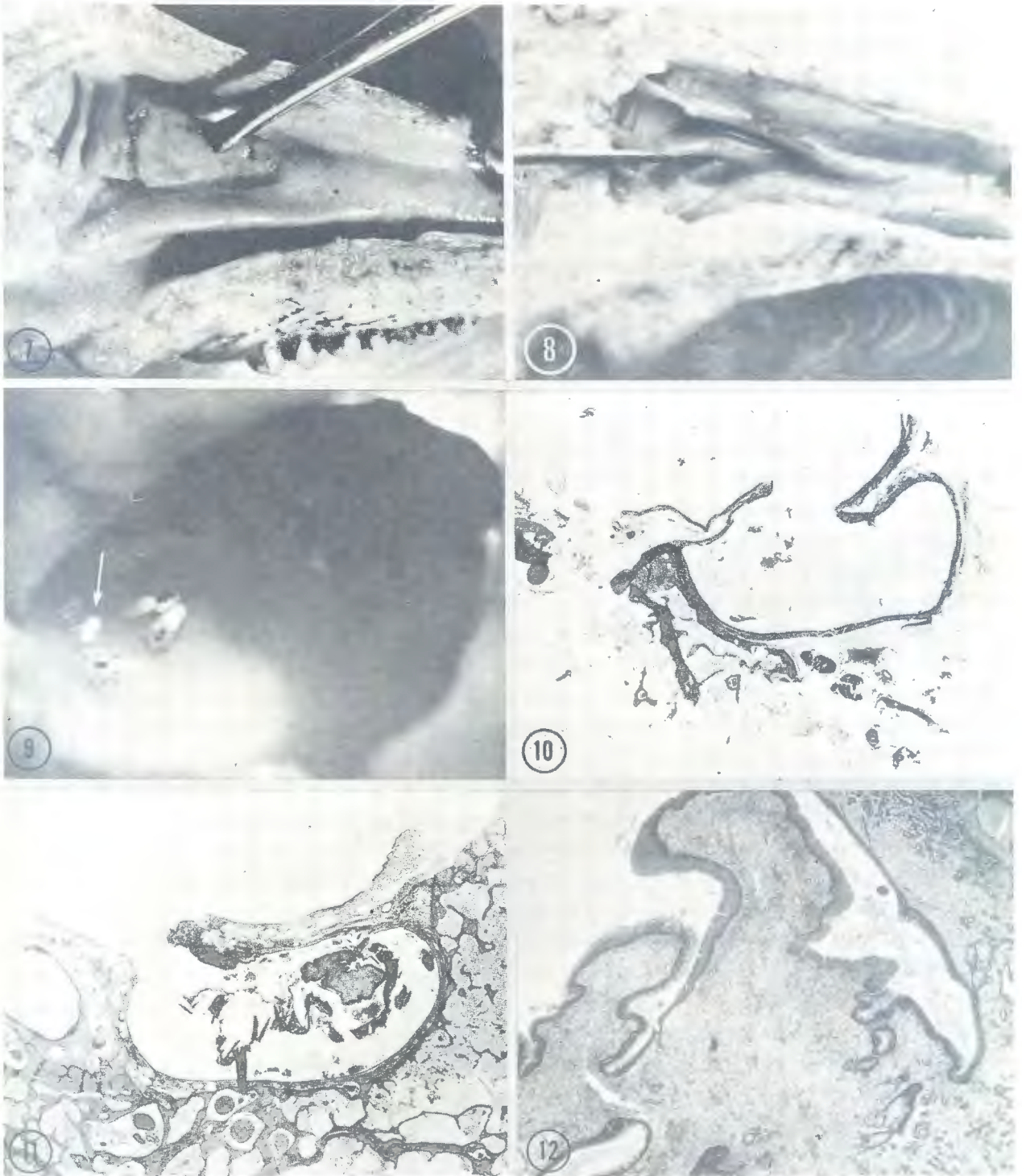


PLATE 2

7. Illustration of the procedure for locating the maxillary recess: nasal cavity after removal of the medial septum. Forceps is attached to the middle concha
8. The middle concha has been removed revealing the maxillary hiatus (probe)
9. Opened maxillary recess containing three adult and one larva (arrow) of *R. papionis*.  $\times 3$
10. Vertical section through a normal maxillary recess. The dorsal opening is the maxillary hiatus. HE  $\times 2,5$
11. Maxillary recess containing a polyp and debris. HE  $\times 2,5$
12. Early polypoid lesion in maxillary recess. HE  $\times 80$

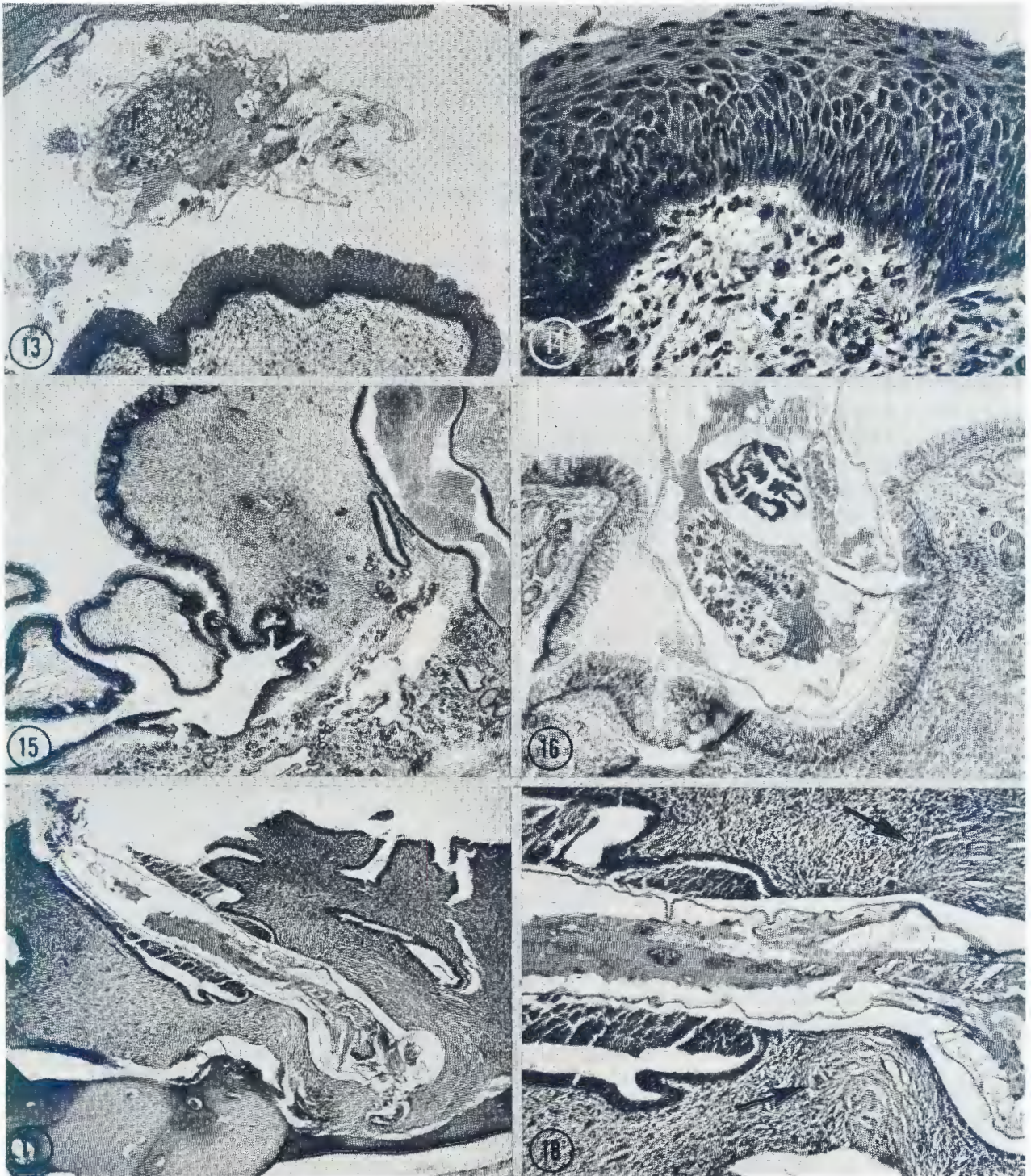


PLATE 3

13. Edge of polyp with *R. papionis* on surface and overlying haemorrhagic debris. HE  $\times$  165
14. Higher magnification of the epithelium illustrated above showing stratified squamous metaplasia. HE  $\times$  375
15. Polypoid growth with cystic glands near the base. HE  $\times$  80
16. *R. elongata* invading the respiratory mucosa. HE  $\times$  165
17. Fibrous hyperplastic nodule with *R. elongata* imbedded deep in the mucosa. HE  $\times$  30
18. Higher magnification of the above lesion showing the point of penetration of the mite and some cholesterol clefts (arrows). HE  $\times$  80

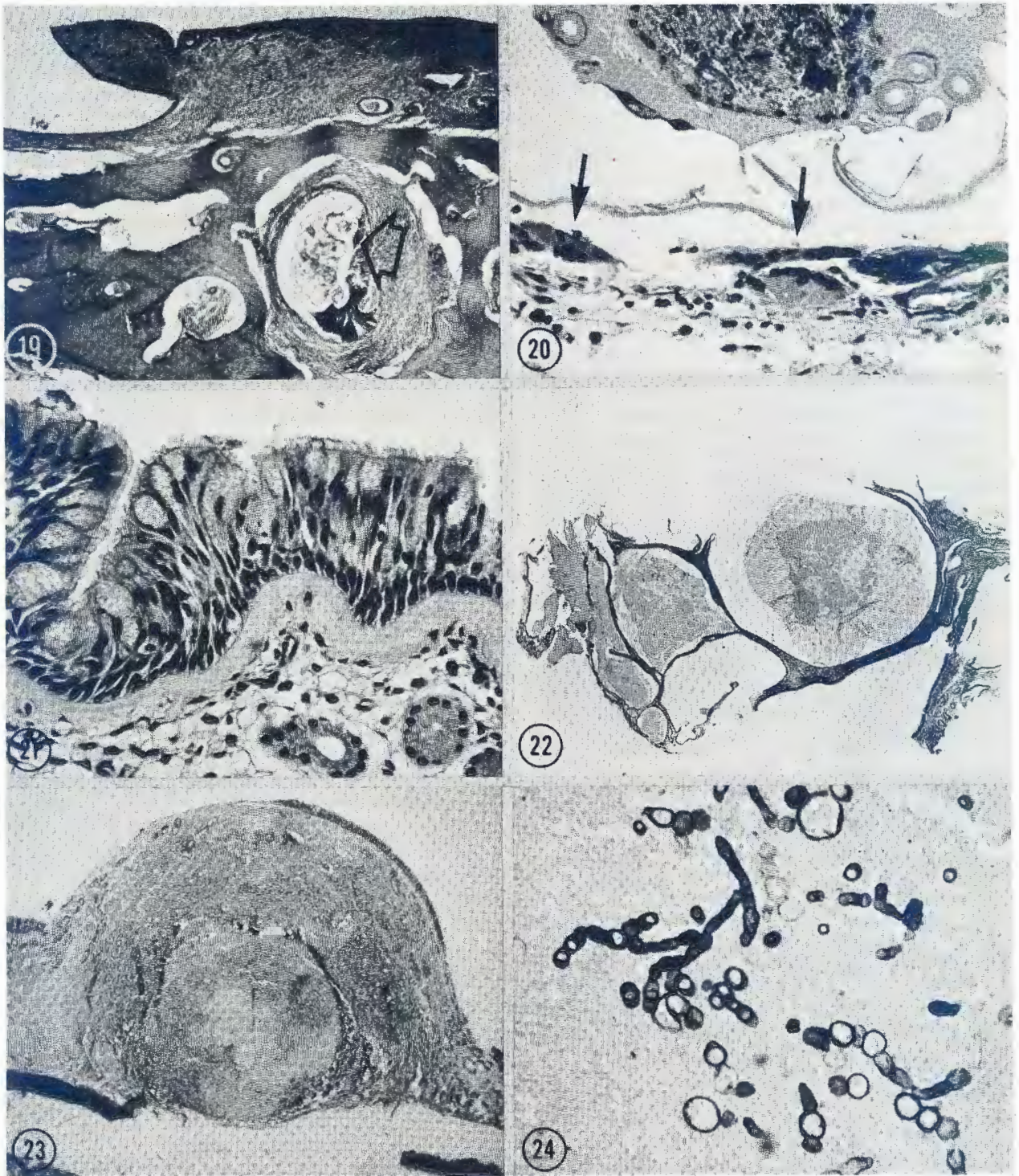


PLATE 4

19. Cross section of *R. elongata* (arrow) deep in the bone. The mite is surrounded by a prominent granulomatous reaction. HE  $\times$  30
20. Multinucleated giant cells adjacent to the mite (arrows). HE  $\times$  375
21. Thick basement membrane, presumably a normal feature. HE  $\times$  375
22. Cystic mucosal glands in a lesion caused by *R. elongata*. HE  $\times$  5
23. Mycotic granuloma secondary to invasion of *R. elongata* lesion. HE  $\times$  30
24. Higher magnification of the above lesion demonstrating numerous hyphae in centre of lesion. GMS  $\times$  375

ingested erythrocytes to be mildly positive for haemoglobin.

A secondary mycotic infection was observed in one parasitic nodule. The fungus had short septate hyphae that appeared to be branching, but specific identification could not be made [Plate 4(23 and 24)].

#### DISCUSSION

Because of the difference in location and feeding habits of the two mites, a variation was encountered in the type of lesion produced. With the exception of the maxillary recess *R. elongata* may be located anywhere in the respiratory and olfactory region of the nasal cavity. Their method of firm attachment insures survival and prevents expulsion by the sneezing efforts of the host. They burrow deeply into the submucosa and even into the cavities of the spongy bone where they cause considerable trauma and moderate to severe inflammation including granulomatous reactions. This creates suitable conditions for secondary infection such as the mycotic lesion encountered. The presence of erythrocytes in their digestive tracts indicates that apart from other tissues and or fluids the mites are feeding on blood. The mildly positive reaction to Pickworth's stain for haemoglobin was ascribed to partial digestion.

*R. papionis*, on the contrary, is located in the well-protected maxillary recess and consequently has no need for such firm attachment. It evidently does not penetrate the mucosa and possibly feeds on mucosal secretions, lymph and inflammatory exudate. The inflammatory infiltrate is therefore milder and the deeper layers of the submucosa are only occasionally involved. The irritation caused by the continuous presence of the mites, their movements and possibly even their excretions on the surface of the mucosa, however, lead to more pronounced polypoid hyperplasia, as well as squamous metaplasia. The latter is not a feature of the lesion caused by *R. elongata*. The more prolific myxomatous and friable polypoid response to *R. papionis* could also result from the more protected surroundings of the maxillary recess.

The method by which these mites spread among baboons is a matter of conjecture at this point. The high infestation rate by *R. papionis*, including very young animals, however, suggests that parasitization probably occurs soon after birth. The relative immobility of the adult mite and its restricted environment lead one to believe that spread should be by the more mobile immature forms. Therefore, it seems plausible that *R. papionis* is spread from the mother to her young by way of the larvae soon after birth possibly during nursing, grooming or other such activities. The spread of *R. elongata* should also be by way of immature forms since the burrowing nature of the adult and its almost com-

plete immobility would not allow for easy transmission at this stage.

It is believed that routine quarantine and deworming procedures would have no effect on the presence of these mites and that imported chacma baboons would suffer from nasal acariasis. This was shown in the United States by Kim & Bang (1970) who described nasal mite lesions in baboons imported from Kenya. While they did not give the species of either the host or parasite concerned, the location of the mites and the microscopic findings were similar to those attributed to *R. elongata*. A routine treatment of baboons with acaricides may therefore be indicated before exportation and experimental use.

#### SUMMARY

The lesions caused by two nasal mites of the chacma baboon are described and discussed. *R. papionis* was found in a small restricted area of the nasal cavity only, i.e. the maxillary recess, whereas *R. elongata* was present in several areas of the respiratory and olfactory nasal mucosa, but never in the maxillary recess. *R. elongata* was conspicuous by its exceptional length (5 to 6 mm). Both mites provoked proliferation of the nasal mucosa, but it was more evident in the case of *R. papionis* infestation where large inflammatory polyps developed. *R. elongata* penetrated deep into the mucosa, submucosa and even into the bone where granulomatous reactions were produced, while *R. papionis* showed no evidence of penetration.

#### ACKNOWLEDGEMENTS

The authors wish to thank the National Parks Board for the opportunity to do this study; the Director, Veterinary Services, and the Director, Veterinary Research Institute, Onderstepoort for the facilities; the biological staff of the Kruger National Park, and Mr. C. A. W. J. van Niekerk of the Veterinary Investigation Centre, Skukuza, for their cooperation and assistance. We would also like to express our appreciation to Prof. H. P. A. de Boom, Department of Anatomy, Veterinary Faculty, University of Pretoria, Prof. R. Trevor-Jones and Prof. P. V. Tobias of the Anatomy Department, Witwatersrand University, Johannesburg, for their helpful assistance in delineating and describing the anatomical features of the baboon skull.

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