EXPERIMENTAL INFECTION OF RODENTS WITH LARVAE OF *METACUTEREBRA APICALIS*, A NEOTROPICAL CUTEREBRID.

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SUMMARY: Rodents bred in the laboratory - *Mus musculus, Rattus norvegicus*, and *Oryzomys subflavus* (a South American Cricetidae) - were infected with larvae of *Metacuterebra apicalis*. The rodents showed similar susceptibilities to infection , although all *M. musculus* died, before or after the larvae had left the host. For infection, the nasal route was more effective than the ocular route. However, no difference in the results was recorded between via nasal vs. the concomitant via ocular and via nasal infection. In the rodents, the localization of cutaneous lesions was mainly in the dorso-lumbar region, although they also occurred in the lateral and ventral regions. The larvae that left the hosts, except those from *M. musculus*, pupated and produced fertile adults.The results reveal a new optional model for different subjects of study, using a Neotropical bot fly and rodents maintained in the laboratory.

KEY WORDS: Rodentia, bot fly, *Metacuterebra apicalis*, Diptera, Cuterebridae

INTRODUCTION

Cuterebrid insects are New World dipterans whose larvae or maggots cause primary cutaneous myiasis in mammals, including man (CATTS, 1982). Adults of *Metacuterebra apicalis*, one of the more than 50 Neotropical bot fly species (GUIMARÃES, 1971; CATTS, 1982; GUIMARÃES *et alii*,1983; GUIMARÃES, 1984; SABROSKY, 1986), has been reported to occur from México to Argentina (AUSTEN, 1895; BAU, 1933). However its larvae have been found causing myiasis only in mammals from South America (GUIMARÃES *et alii*, 1983). Like the other Cuterebridae species (except *Dermatobia hominis* - whose infection process of the host is by a cutaneous route) the first instar larvae of *M. apicalis* enters its hosts through natural body openings and follows a migration route through the host, terminating in the subcutaneous tissues, to form a warble, as described for Neartic Cuterebridae (e. g. *Cuterebra fontinella*, GINGRICH, 1981). Under field conditions, *M. apicalis* larvae have been recorded in Muridae: *Rattus rattus* (EVERARD & AITKEN, 1972) and *R. norvegicus* (LED *et alii*, 1974-76); in Cricetidae: *Holochilus brasiliensi* (LUTZ, 1917), *Oryzomys nigripis* (FONSECA, 1938-39; MELLO, 1978), *O. flavescens* (HENRIKSEN, 1942), *Pseudoryzomys wavrini* (FORATTINI & LENKO,1959), *H. sciureus* (TWIGG, 1965), *Nectomys squamipes*, *Zigodontomys brevicauda* (EVERARD & AITKEN, 1972), *Calomys callosus* (MELLO, 1978), *Bolomys lasiurus* (GUIMARÃES *et alii*, 1983; VIEIRA, 1993), *O. subflavus* (LEITE, 1987, VIEIRA, 1993), *O. nitidus* (BOSSI & BERGALLO, 1992), *Thalpomys cerradensis* (VIEIRA, 1993); and in Marsupialia: *Metachirus nudicaudatus* (BOSSI & BERGALLO, 1992).

Under experimental conditions, attempts to infect laboratory rodents (*Ratttus* and *Cavia*) with *M. apicalis* larvae gave negative results or killed the hosts (D'ANDRETTA & JARDIM, 1954). When the life cycle of *M. apicalis* was described, *R. norvegicus* and *O. subflavus* were used as hosts (LEITE & WILLIAMS, 1988). The present work records the infection of *M. apicalis* larvae in three species of laboratory reared rodents.

MATERIALS AND METHODS

Swiss white mice *M. musculus*, Holtzoman white rats *R. norvegicus*, and *O. subflavus* - a Neotropicaal Cricetidae captured in woodlands situated on the campus of the

"Universidade Federal de Minas Gerais", Belo Horizonte - MG (19° 55' S; 43 56' W; alt: 852 m) were bred in the laboratory with commercial food (Testebom) and water *ad libitum*. The rodents were exposed to infection with first instar larvae of *M. apicalis* obtained as described by LEITE & WILLIAMS (1988). For infection, newly hatched larvae were collected with a paint brush and placed on the cornea or into the nose of each of the following adult male animals: 13 *M. musculus*, with one larva via ocular; 10 *R. norvegicus*, with two larvae via nasal; 10 *R. norvegicus*, with four larvae, two via ocular and two via nasal; 50 *R. norvegicus*, with two larvae via ocular; and six *O. subflavus*, with two larvae via nasal.

The third instar larvae that emerged from rodents were collected and transferred to glass cups containing moist sawdust. The cups were covered with nylon mesh and maintained in an incubator at 25°C with a relative humidity of 80-90% until the pupae formed and the imagoes emerged.

The results obtained were analyzed by the Student t and X^2 tests at a significance level of 0.05.

RESULTS

From the *M. musculus* group, six (46.15%) had been infected via ocular, but all the mice died: three during the infection, and the other three after the third instar larvae had left the hosts. Of the 10 *R. norvegicus* infected via nasal, and the other 10 white rats infected via ocular and via nasal, seven (70.0%) and 10 (100.0%) respectively, were positive for myiasis and supported complete larval development. In the group with 50 white rats, infected *via* ocular, 19 (38.0%) were positive for myiasis, and completed larval development. The infection and complete larval development in *O. subflavus* occurred in 5 animals (83.0%). Both white rats and *O. subflavus* appeared to be normal during and after infection. The cutaneous lesions in all *Rattus* and *Oryzomys* (Figs. 1, 2) healed one week after the bot had left the hosts.

The difference of susceptibility among *M. musculus*, *R. norvegicus* and *O. subflavus* to larval infection was not statistically significant. However, the *via* nasal infection showed a significant difference (p> 0.05) as compared to *via* ocular. No difference was observed between the use of *via* nasal compared with the concomitant infection using *via* ocular and *via* nasal. The *via* ocular in both *M. musculus* and *R. norvegicus* produced similar results of infection, a fact also registered between *Rattus* vs. *Oryzomys*, during via nasal infection. All bot flies that emerged were fertile, as shown by reproduction.

The number of the rodents infected, cutaneous lesions (warbles) localized in the hosts; third instar larvae the emerged, and the fertility *M. apicalis* adults obtained are shown in Table 1.

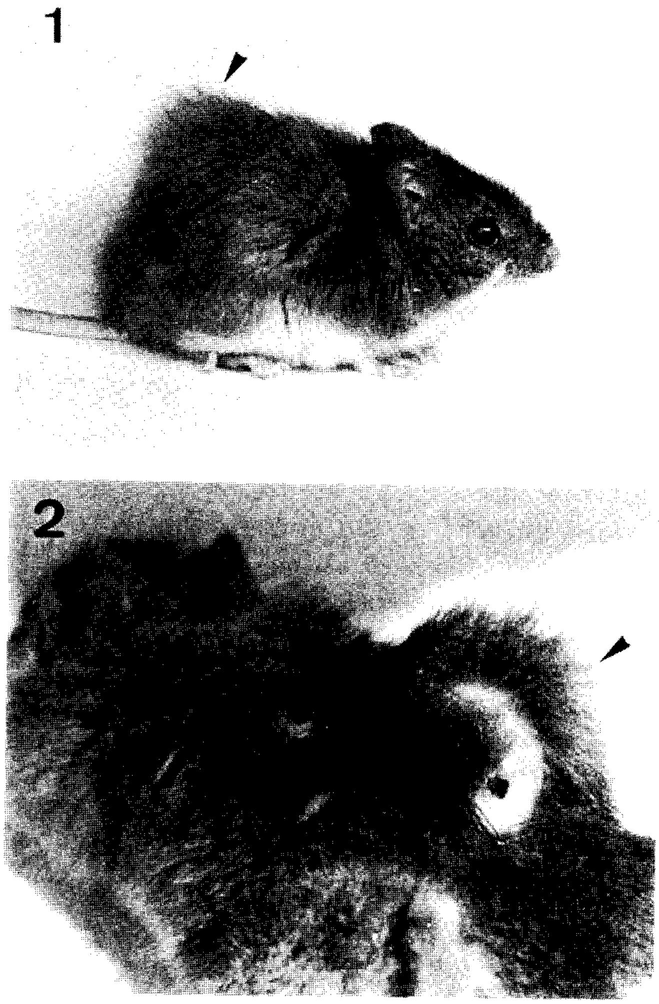

Fig. 1, 2 - *Oryzomys subflavus* with dorsal-lumbar warble of *Metacuterebra apicalis* (arrow head).

DISCUSSION

The susceptibility to infection by *M. apicalis* was similar in the three rodent species studied. *M. musculus* was not a good host because the animals died of infection; the few larvae that left the warble did not reach the adult stage. The limited utility of *M. musculus* as a host for *M. apicalis* has also been reported for other cuterebrids: *Cuterebra latrinfrons* (CATTS, 1965), *C. americana* (CAPELLE, 1970), *D. hominis* (CHAIA et alii, 1975), *C. fontinella* (GINGRICH & BARRETT, 1976), *C. approximata* (SMITH, 1977) and *C. tenebrosa* (BAIRD, 1979). For screening systemic insecticides and for immunological observations, the white mouse and cuterebrid combination has been used as a study model (GINGRICH *et alii*, 1972; OSTLIND et alii, 1979; PRUETT & BARRETT, 1983).

The susceptibility and tolerance of *R. norvegicus* to *M. apicalis* infection were determined by the development of the

Table 1: Data obtained from rodents submitted to artificial infection with *Metacuterebra apicalis*.

No. and rodent species (rodents fected)	Cutaneous lesions No.	Localization	No. emerged larvae	No. adults obtained
13 *M.musculus*[a] (6)	4	dorsal-lumbar	3	0
	1	lateral-right		
	1	anterior-ventral		
10 *R. rattus*[b] (7)	6	dorsal-lumbar	9	5
	2	lateral-left		
	1	posterior-ventral		
10 *R. rattus*[c] (10)	9	dorsal-lumbar	17	10
	4	lateral-left		
	1	lateral-right		
	1	anterior-ventral		
	2	posterior-ventral		
50 *R. rattus*[d] (19)	15	dorsal-lumbar	25	10
	4	lateral-left		
	3	Lateral-right		
	3	Posterior-ventral		
6 *O. subflavus*[e] (5)	7	Dorsal-lumbar	7	7

a - Three mice died before the larvae left the host; b - Two rats had two lesions; c - Seven rats had two lesions; d - six rats had two lesions; e - two larvae shared a common warble.

bot inside the host, followed by formation of the pupa and the fertility of adult flies that emerged. Similar results, although mortality of the host occurred, were obtained when white rats were infected with *C. tenebrosa* (GREGSON, 1950; BAIRD, 1979). On the other hand, a low level of infection for *C. latinfrons* was recorded in white rats (RADOVSKY & CATTS, 1960; CATTS, 1964; CATTS, 1965). Despite the fact that white rats shown a low infection level in *C. latinfrons*, whose bot occurs on native rodents *Neotoma fuscipes* (CATTS, 1965), the present results are in agreement with those of BAIRD (1979) who infected white rats with *C. tenebrosa*, a bot fly whose larval stages develop in the field rodent, *Neotoma cinera*. The white rat has already been shown to be a good host for *D. hominis* (CHAIA *et alii*, 1975), a Neotropical cuterebrid whose larvae cause cutaneous myiasis in various mammals, including man.

The experimental infection of *O. subflavus* reveals that it is a better host for *M. apicalis* than *R. norvegicus*; and that the *via* nasal is the best method for infecting both rodents. *O. subflavus*, a Cricetidae commonly found in the "cerrado" of the central Brazil (ALHO, 1982), can be reared in the laboratory (VILLELA & ALHO, 1983 and present results), but it may be difficult to establish laboratory colonies.

Under field and laboratory studies, different species of mammals can suffer parasitism from one or another distinct species of cuterebrid larvae. However, based on prevalence, multiple infection and larval localization, many Neartic rodents or lagomorphs are considered natural specific hosts of bot fly species (BENNETT, 1955; CATTS, 1965; CATTS, 1982).

Except for cosmopolitan species of the genus *Rattus*, introduced into the Americas, all the other hosts of *M. apicalis* larvae reported are autochthonous animals in South America (ALHO, 1982; HONACK *et alii*, 1982). The identification of multihost of *M. apicalis* is also reported to have occurred for other *Cuterebra* species and *D. hominis* (CATTS, 1982). The distinct localization of *M. apicalis* warbles on field hosts could be related to the route of infection enters (via natural body openings), as demonstrated in *Peromyscus leucopus*, a natural host of *C. fontinella* (GINGRICH, 1981).

From field observations (LEITE, 1987; VIEIRA, 1993) and in this present experimental study, *O. subflavus* may be considered the specific host of the bot fly *M. apicalis* in nature.

Ideally, *O. subflavus* would be the best rodent for studies on the host-parasite relationship of *M. apicalis* but the laboratory white rat is a suitable substitute for studies on the histopathology and immunology of the myiases.

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SUMÁRIO

Roedores criados em biotério - *Mus musculus, Rattus norvegicus e Oryzomys subflavus* (Cricetidae, sulamericano) - foram infectados experimentalmente com larvas de primeiro estágio de *Metacuterebra apicalis*. Os roedores mostraram similar susceptibilidade a infeção, embora *M. musculus* tenha morrido antes ou após a larva ter deixado o hospedeiro. Para infecção, a via nasal foi mais eficiente do que a via ocular, todavia nenhuma diferença significativa foi observada entre a via nasal versos a concomitância de infecção por vias ocular e nasal. Nos roedores, a localização das lesões cutâneas foi principalmente na região dorso-lombar, embora elas também tenham ocorrido nas regiões lateral e ventral dos hospedeiros. As larvas de terceiro estágio que deixaram os hospedeiros, exceto de *M. musculus*, puparam e deram adultos férties.

PALAVRAS-CHAVE: Roedores, *Metacuterebra opicalis*, Diptera, Cuterebridae.

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