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**Echinococcus vogeli sp. n. (Cestoda: Taeniidae)
from the Bush Dog, *Speothos venaticus* (Lund)**

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Education, and Welfare, Fairbanks, Alaska,
Los Angeles Zoo, Los Angeles, California**Summary**

Echinococcus vogeli sp. n., from a bush dog, *Speothos venaticus* (Lund), captured in the Province of Esmeraldas, Ecuador, differs morphologically from the three species of *Echinococcus* recognized as valid. *E. vogeli* sp. n. is distinguished from *E. granulosus* (Batsch 1786) by its larger rostellar hooks, different proportions of the strobila, tubular, sac-like gravid uterus, and different arrangement of the female genital ducts, from *E. multilocularis* Leuckart 1863 by its larger rostellar hooks, different proportions of the strobila, position of genital pore, and greater number of testes; from *E. oligarthus* (Diesing 1863) by different proportions of the strobila, position of genital pore, and greater number of testes. Characters that separate *E. vogeli* sp. n. from *E. granulosus* and *E. oligarthus* differentiate it respectively from two species of uncertain status, *E. patagonicus* Szidat 1960 and *E. pampeanus* Szidat 1967.

Echinococcus vogeli, sp. n. (Cestoda: Taeniidae) aus dem Waldhund, *Speothos venaticus* (Lund)

Aus einem Waldhunde, *Speothos venaticus* (Lund), der in der Provinz Esmeraldas, Ecuador, gefangen worden war, wird *Echinococcus vogeli* sp. n. beschrieben. Die neue Art unterscheidet sich durch mehrere morphologische Merkmale von den drei *Echinococcus*-Arten, die zur Zeit als valid anerkannt sind. Unter anderem unterscheidet sich *E. vogeli* sp. n. von *E. granulosus* (Batsch 1786) durch größere Rostellarhaken, Form und Größenverhältnisse der Glieder und verschiedene Strukturen (ohne Ausbuchtungen) des graviden Uterus; von *E. multilocularis* Leuckart 1863 durch größere Rostellarhaken, Form und Größenverhältnisse der Glieder, Lage des Genitalporus und größere Anzahl der Hoden; von *E. oligarthus* (Diesing 1863) durch Form und Größenverhältnisse der Glieder, Lage des Genitalporus und Zahl und Anordnung der Hoden. Die Merkmale, die *E. vogeli* sp. n. von *E. granulosus* und *E. oligarthus* unterscheiden, gelten bzw. für *E. patagonicus* Szidat 1960 und *E. pampeanus* Szidat 1967, deren taxonomische Selbständigkeit noch zu bestätigen ist.

An adult male bush dog, *Speothos venaticus* (Lund), captured in late 1969 or early 1970 in the Province of Esmeraldas, Ecuador, was received at the Los Angeles Zoo on 11 February 1970. After a routine fecal examination (by Bernstein) revealed eggs of at least four species of nematodes as well as what appeared to be a segment of a small cestode, treatment of the animal with dicroarbil (arecoline-acetarson) on 16 February resulted in the expulsion of numerous cestodes of the genus *Echinococcus* Rudolphi 1801. The specimens were examined by Dr. Calvin W. Schwabe, School of Veterinary Medicine, University of California, Davis, who upon finding unusual morphological characteristics, suggested that we study them. Our findings have shown that they differ from recognized species of *Echinococcus* in several significant characters.

In recognition of the contributions to the understanding of the taxonomy of *Echinococcus* species made by Professor Dr. Hans Vogel, Bernhard-Nocht-Institut für Schiffs-

und Tropenkrankheiten, Hamburg, the name *Echinococcus vogeli* sp. n. is proposed for this cestode.

Materials and Methods

The cestodes were relaxed in tapwater and fixed in hot 10% formalin solution. Most of the 99 specimens obtained were stained in Semichon's acetic carmine or Ehrlich's acid hematoxylin and mounted entire. To examine rostellar hooks, the rostellum was detached and mounted separately, with sufficient pressure on the cover-glass to cause the hooks to lie flat. Transverse or frontal sections, at 0.010 and 0.015 mm, were made of the anterior portions of seven paraffin-embedded strobilae and stained in hematoxylin-eosin. Since subsequent anthelmintic treatment of the animal produced no additional specimens, we obtained no infective embryophores for establishing experimental infections.

Results

The following description is based upon entire and sectioned specimens. All measurements are in millimeters.

Description. Strobila slender, 3.94 to 5.58 long, of similar width throughout, and composed of 3 segments, all longer than wide. Scolex relatively large, 0.345 to 0.577 long by 0.262 to 0.322 wide. Rostellum massive, 0.103 to 0.134 long by 0.154 to 0.188 wide, with 28 to 36 hooks arranged in 2 rows. Large hooks 0.049 to 0.057 long (av. 0.053); small hooks 0.030 to 0.047 long (av. 0.043). Suckers oval, with long axis directed anteromedial, 0.115 to 0.134 in greatest diameter. Length of neck, 0.157 to 0.300, greater than that of first segment. Mature (second) segment 0.420 to 0.742 long by 0.232 to 0.285 in maximum width. Gravid segments slender, with almost parallel margins, and nearly round in cross-section; 2.94 to 4.2 long by 0.285 to 0.330 in maximum width. Ratio of length of anterior portion of strobila (scolex and first 2 segments) to length of gravid segment 1:2.2 to 1:3.1. Genital pores unilateral or alternating, slightly posterior to middle in mature segments, and in gravid segments 0.60 to 0.63 of length from anterior margin. *Anlage* of ovary sometimes visible in posterior portion of neck. Dorsal longitudinal excretory canal 0.002 to 0.007 in diameter; ventral canal about 0.004 to 0.007 in diameter. Fibers of internal layer of longitudinal muscle large, but few and widely separated. Cirrus sac subspherical to piriform, 0.107 to 0.135 long by 0.058 to 0.069 in diameter, at center of segment, often extending aporal beyond midline; cirrus sac usually directed anteromedial, often slightly ventrad, in mature segments. Walls of cirrus sac 0.005 to 0.008 thick, enclosing coiled ejaculatory duct. Vas deferens, 0.006 to 0.008 in diameter, forming numerous coils aporal and posterior to cirrus sac. Cirrus minutely spined, 0.066 to 0.085 long by 0.010 to 0.014 in diameter when extruded. Cirrus sac persisting in gravid segments. Subspherical to spherical testes 0.031 to 0.047 in diameter; 50 to 67 in number (av. ca. 56), distributed in mature segment between and slightly overlapping longitudinal excretory canals from near posterior margin of vitelline gland anterior to level of distal end of uterus; majority of testes (ca. 2/3) anterior to level of genital pore. Thick-walled vagina, 0.016 to 0.018 in greatest diameter, running medial from genital atrium, turning posteriad near midline, and enlarging near level of anterior margin of ovary to form thin-walled seminal receptacle. Vaginal lumen with maximum diameter of about 0.011, narrowing to about 0.003 at junction with seminal receptacle; lined with slender spine-like projections throughout save for portion just anterior to seminal receptacle. Sperm-filled seminal

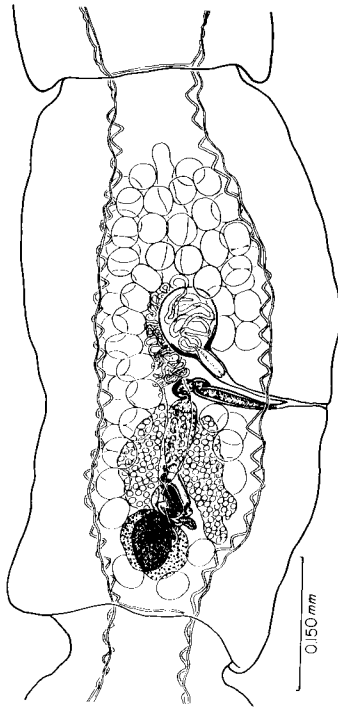


Fig. 1. Mature segment of *Echinococcus vogeli* sp. n. (dorsal view).

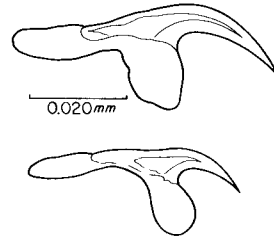


Fig. 2. Rostellar hooks of *Echinococcus vogeli* sp.n.

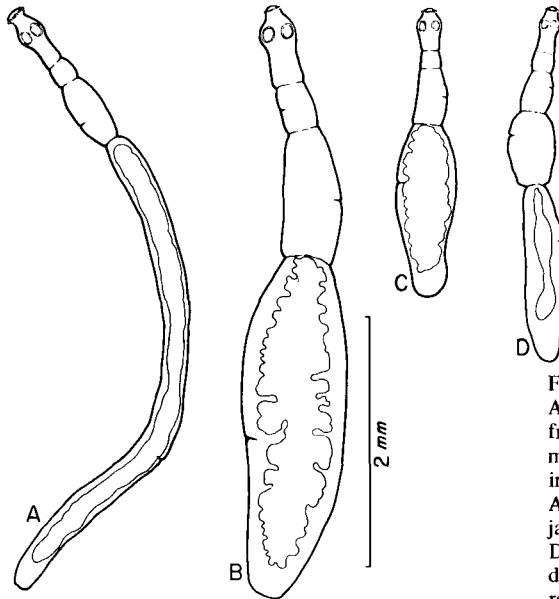


Fig. 3. Strobilae of *Echinococcus* species. A - *E. vogeli* sp. n. B - *E. granulosus*, from dog (beagle) 67 days after experimental infection with larva from wild reindeer, *Rangifer tarandus* Linnaeus (north Alaskan origin). C - *E. oligarthrus*, from jaguarundi, natural infection (London Zoo). D - *E. multilocularis*, from arctic fox 37 days after experimental infection (St. Lawrence Island strain).

receptacle ovoid to piriform, variable in size, on midline dorsally, partially enclosed by ovarian lobes. Thick-walled seminal duct arising at posterior end of seminal receptacle, running posteriad and joining oviduct near level of anterior margin of Mehlis' gland. Mehlis' gland rounded in dorsoventral view, 0.039 to 0.061 in diameter, near midline between ovary and vitelline gland. Ootype 0.006 to 0.010 in diameter. Weakly lobed ovary 0.057 to 0.144 long by 0.107 to 0.160 wide, lying ventrally in posterior 1/3 of segment, and occupying most or all of central field between longitudinal excretory canals. Ova ca. 0.009 by 0.008 in diameter. Oviduct, with well defined oocapt, arising ventrally, running posteriad to point of junction with seminal duct, then turning dorsad, forming three or more loops, and entering Mehlis' gland. Anteriorly, oviduct ca. 0.006 in diameter, thin-walled; enlarging to diameter of ca. 0.020, walls thickening, and lined with thin but stout projections. Vitelline gland bilobed in dorsoventral view, 0.057 to 0.069 long by 0.057 to 0.107 wide, posterior to ovary on midline; vitelline duct up to 0.013 in diameter. Uterus in mature segments thin-walled, tubular, arising from Mehlis' gland at anterior margin and extending antieriad across dorsal surface of ovary, thereafter passing ventrad and lying ventral to male genital ducts and testes in anterior portion of segment. Gravid uterus sac-like, tubular, extending nearly through length of gravid segment. Eggs abundant. Embryophores 0.032 to 0.042 by 0.029 to 0.040 (av. 0.037 by 0.033).

Type host: Bush dog, *Speothos venaticus* (Lund).

Type locality: Near the Rivers Bua and Mache (tributaries of the Quinindé), Province of Esmeraldas, Ecuador.

Holotype: U.S. National Museum Helminthological Collection, No. 72 140; Paratype No. 72 141.

Discussion

Of the 12 species that have been described (from the strobilar stage) in the genus *Echinococcus*, three are accepted as valid: *E. granulatus* (Batsch 1786); *E. multilocularis* Leuckart 1863; and *E. oligarthrus* (Diesing 1863). *E. patagonicus* Szidat 1960, and *E. pampeanus* Szidat 1967, described respectively from a canid, *Dusicyon culpaesus* (Molina), and from a cat, *Felis colocolo* (Molina) in Argentina are of uncertain taxonomic status. *E. patagonicus* is morphologically most similar to *E. granulatus* (see Rausch and Nelson 1963). *E. pampeanus* is most similar to *E. oligarthrus*, from which it was distinguished by its smaller strobila (up to 1.1 mm), fewer segments (2), fewer testes (10 to 14), and different form of the rostellar hooks (Szidat 1967). The original description and figures suggest that the specimens studied were relatively young. The taxonomic characters that distinguish *E. vogeli* sp. n. from *E. granulatus* and *E. oligarthrus* serve respectively to distinguish it also from *E. patagonicus* and *E. pampeanus*.

Morphological and biological characteristics in both the strobilar and larval stages differentiate the three species of *Echinococcus* (Thatcher and Sousa 1966, Rausch 1968, Sousa and Thatcher 1969). Variation in morphological characters that might have value as taxonomic discriminants in the strobilar stage has been a subject of much discussion (Rausch 1953, Vogel 1957, Verster 1965). When used in combination, the taxonomic criteria include form of strobila, position of genital pore in mature and gravid segments, size of rostellar hooks, number and distribution of testes, and form of gravid uterus.

Comparative Material

Cestodes, in most cases large series, from the following hosts and localities were selected for comparison.

E. granulosus. (Natural infections) Domestic dog: south-central Alaska; Old Crow, Yukon Territory, Canada; Pretoria, South Africa; Turkana region, Kenya. Wolf, *Canis lupus Linnaeus*: arctic Alaska. Black-backed jackal, *Canis mesomelas Schreber*: Turkana region, Kenya. Hunting dog, *Lycaon pictus Temminck*: South Africa (paratypes of *E. lycaontis Ortlepp* 1934). Red fox, *Vulpes vulpes* Linnaeus: England (paratypes of *E. cameroni Ortlepp* 1934). Lion, *Panthera leo Linnaeus*: South Africa (paratypes of *E. felidis Ortlepp* 1937). (Experimental infections) Domestic dog: Argentina; New Zealand (60 days' duration); Alaska (313 days).

E. multilocularis. (Natural infections) Domestic dog: Hokkaido, Japan. Arctic fox, *Alopex lagopus Linnaeus*: Pribilof Islands, Bering Sea; St. Lawrence Island, Bering Sea. Red fox: Nunivak Island, Bering Sea; North Dakota, U.S.A. (Experimental infections) Domestic dog: Alaska (49 and 98 days). Wolf: Alaska (32 days). Coyote, *Canis latrans Say*: Alaska (41 days). Arctic fox: Alaska (130 days). Domestic cat: Alaska (51 days).

E. oligarthrus. (Natural infection) Jaguarundi, *Felis yagouaroundi Geoffroy*: London Zoo, England (22 specimens of the series studied by *Cameron* 1926).

Taxonomic Comparisons

Strobila. Consistent differences in the characteristics of the strobila are seen in each species of the genus *Echinococcus*, including *E. vogeli* sp. n. (Fig. 3).

The reported ranges in the length of the strobila for the respective species are: *E. granulosus*, 2 to 7 mm (*Verster* 1965); *E. oligarthrus*, 2.2 to 2.9 mm (*Thatcher and Sousa* 1966); *E. multilocularis*, 1.2 to 3.7 mm (*Rausch* 1968). Strobilae of *E. multilocularis* (St. Lawrence Island strain) from an experimentally infected dog (beagle), 49 days after exposure, have been found to range up to 4.5 mm (*Rausch*, unpublished). Thus, with a length of 3.9 to 5.6 mm, the strobila of *E. vogeli* sp. n. is exceeded in size only by that of *E. granulosus*.

The numbers of segments making up the strobila are variable: *E. granulosus* usually has three (sometimes four, rarely five or six) (*Vogel* 1957, *Verster* 1965); *E. oligarthrus*, three (*Cameron* 1926; *Thatcher and Sousa* 1966); *E. multilocularis*, two to five (occasionally six) (*Vogel* 1957; *Rausch*, unpublished). Strobilae of *E. vogeli* sp. n. were made up of three segments.

In fully developed strobilae (i.e., those with a gravid segment containing ostensibly infective eggs), the relative position of the mature segment is consistent for each species. The penultimate segment (second or third) is mature in *E. granulosus* (*Vogel* 1957, *Verster* 1965) and in *E. oligarthrus* (*Cameron* 1926, *Thatcher and Sousa* 1966). In *E. multilocularis* the antepenultimate segment is characteristically mature (*Vogel* 1957), although when six segments are present, the third is sometimes mature (*Rausch*, unpublished). The second (penultimate) segment was mature in the specimens of *E. vogeli* sp. n.

Maximum width of the strobila is attained in the gravid segment, usually near the middle, in *E. granulatus* and *E. oligarthrus*. In *E. multilocularis* the gravid segment is usually the widest, but the penultimate (pre-gravid) is often as wide, or wider. The gravid segment of *E. vogeli* sp. n. is long, slender, and only slightly wider than the mature segment.

Differences in the ratios of the length of the anterior portion of the strobila (scolex through penultimate segment) to the length of the gravid segment seem to have value as a taxonomic discriminant at the specific level. This ratio ranged, in *E. granulatus*, from about 1:0.86 to 1:1.3, being lowest in strobilae of four or more segments; in the small series of *E. oligarthrus* studied, from 1:0.96 to 1:1.1; and in *E. multilocularis* from 1:0.31 to 1:0.8, varying inversely with number of segments. The ratios for *E. vogeli* sp. n. were the highest observed, from 1:1.9 to 1:3. These values further demonstrate the great relative length of the gravid segment of the latter species.

Position of Genital Pore. The location of the genital pore relative to the length of the segment is a reliable character for distinguishing *E. granulatus* and *E. multilocularis* (Vogel 1957). The position of the pore in mature and gravid segments, respectively, in the four species is: *E. granulatus*, near (usually posterior to) the middle, and posterior to the middle; *E. multilocularis*, anterior to the middle in both; *E. oligarthrus*, anterior to the middle, and approximately at the middle (Thatcher and Sousa 1966); *E. vogeli* sp. n., posterior to the middle in both, located in the gravid segment about 60% of its length from the anterior segmental margin. In a few, apparently anomalous specimens of the latter, the genital atrium opened on the ventral surface of the mature segment. *E. vogeli* sp. n. most closely resembles *E. granulatus* in the relative position of the genital pore.

Rostellar Hooks. The lengths of the rostellar hooks have taxonomic value but must be considered in combination with other characters, for all species of *Echinococcus* exhibit intraspecific variation in size and shape of hooks.

Verster's data (1965, Tables 4, 6 and 8) derived from seven isolates of *E. granulatus* in South Africa, indicated ranges in lengths of large and small hooks to be 0.031 to 0.049 mm and 0.022 to 0.039 mm, respectively; average lengths of hooks for the different isolates ranged from 0.0375 to 0.0421 mm and from 0.0288 to 0.034 mm, respectively. The measurements reported by Vogel (1957, Table 6) for specimens of European origin fell within these limits. Similar ranges were obtained for *E. granulatus* from other regions (Kenya, Alaska, Argentina, Australia) (Nelson and Rausch 1963).

For *E. multilocularis* of central European origin, Vogel (1957, Table 6) reported ranges of 0.0276 to 0.0343 mm and 0.0227 to 0.031 mm, for large and small hooks, respectively, with averages (five isolates) of 0.0309 and 0.0269 mm. Vogel found that the hooks of cestodes of St. Lawrence Island origin were slightly smaller (averages of 0.0268 and 0.0229 mm) than those of European specimens. However, the study of additional series of cestodes from various regions has shown that length of the rostellar hooks is somewhat more variable than had been observed. For 18 series of *E. multilocularis* from Alaska, Japan, North Dakota, and Germany, obtained from several species of carnivores, average lengths of hooks ranged from 0.0249 to 0.0328 mm (large) and from 0.0204 to 0.0260 mm (small) (Rausch and Richards 1971, Table 1) with the maximum in specimens from a naturally infected dog in Hokkaido, Japan. In one of nine series of cestodes of the strain from St. Lawrence Island, the lengths of hooks

equaled those of cestodes from southern Germany. Consistently, the average lengths of rostellar hooks of *E. multilocularis* have been significantly less than those recorded for *E. granulosus*.

The rostellum of *E. oligarthrus* was described as being unarmed by *Diesing* (1850, p. 519), but restudy of the original material by *Lühe* (1910) revealed large and small hooks, 0.047 and 0.032, respectively. Measurements by *Cameron* (1926) were 0.045 and 0.032 mm, and by *Rausch* (1953), 0.046 to 0.050 mm and 0.036 to 0.039 mm, with averages of 0.049 and 0.038 mm, for the large and small hooks, respectively. *Thatcher and Sousa* (1966, p. 408) for 50 hooks of each type obtained ranges of 0.043 to 0.060 mm and 0.028 to 0.045 mm, with averages of 0.052 and 0.039 mm. The rostellar hooks of *E. oligarthrus* have significantly greater average lengths than do those of *E. granulosus*.

The rostellar hooks of *E. vogeli* sp. n. averaged slightly longer than those of *E. oligarthrus*. For 120 large hooks, length ranged from 0.049 to 0.057 mm, with an average of 0.053 mm; for 80 small hooks, the range was 0.030 to 0.047 mm, with an average of 0.0426 mm. These data indicate also that the small hooks of *E. vogeli* sp. n. are relatively longer than are the small hooks of *E. oligarthrus*.

Number and Distribution of Testes. *Verster* (1965) concluded that, in *E. granulosus*, the number of testes is not influenced by species of final host. Numbers of testes reported for this species are: cestodes of European origin (*Vogel* 1957, Table 14), a range of 38 to 52, with an average of 44; specimens from dogs and wolves in Siberia, 32 to 40 testes (*Petrov and Chertkova* 1959); material of Australian origin (*Yamashita et al.* 1956), a range of 45 to 65, with an average of about 56; numbers from 45 to 59 (incorrectly printed as 45 to 49), with an average of 53, in cestodes from various species of carnivores in Kenya (*Nelson and Rausch* 1963). In the study of seven isolates of *E. granulosus* in South Africa (*Verster* 1965, Table 21), a range of 25 to 80 testes was observed, although the numbers varied within relatively narrow limits for any given isolate. The average numbers for these isolates were from 32 to 68.

The testes in *E. granulosus* may be about equally distributed anterior and posterior to the level of the genital pore, or the greater number may be anterior (*Verster* 1965). *Verster* concluded (p. 62) that "... the testes distribution remains constant for any given strain; it is neither affected by host-species nor by successive generations, and shows only a slight dependency on the degree of development. Thus it is a reliable character for both species and subspecies differentiation."

E. multilocularis has fewer testes of more restricted distribution, as compared with *E. granulosus*. In cestodes from St. Lawrence Island, *Rausch* (1953) observed 17 to 26 testes, with an average of 22. Specimens from southern Germany had 14 to 31, with an average of 22 (*Vogel* 1957). *Petrov and Chertkova* (1959) observed 16 to 24 in material from Siberia. A recent study (*Rausch and Richards* 1971, Table 1) has shown that the number of testes varies within wider limits in *E. multilocularis*; the range was 16 to 35, with mean numbers of 18 to 26, based upon 18 series of cestodes. Few testes lie anterior to the level of the genital pore in the mature segment of *E. multilocularis*.

Compared with *E. granulosus* and *E. multilocularis*, the number of testes in *E. oligarthrus* is intermediate. In the type material, *Lühe* (1910) observed 25 to 30, and *Cameron* (1926) and *Rausch* (1953) reported 20 to 24 and 23 to 29, respectively. In 50

specimens of *E. oligarthus* studied by *Thatcher and Sousa* (1966), the range was 15 to 46, with an average of about 29. The distribution of testes in *E. oligarthus* is most similar to that in *E. multilocularis*. As noted by *Thatcher and Sousa* (1966), the statement by *Rausch and Nelson* (1963), concerning distribution of testes in this species, is misleading; while the majority is distributed posterior to the level of the genital pore, some are to be found also in the anterior half of the segment (*Cameron* 1926, Fig. 1; *Rausch* 1953, p. 241). *Thatcher and Sousa* observed 3 to 14 (av. 9) anterior to the level of the genital pore in their material.

With a range of 50-67 testes (av. of 14 was 56), *E. vogeli* sp. n. resembles only *E. granulosis* in this character. The greater number was in the anterior half of the segment.

Form of Gravid Uterus. The gravid uterus of *E. granulosis* is characterized by well developed lateral sacculations and branches, in which point *Verster* (1965) observed no variation. In *E. multilocularis* and *E. oligarthus*, the gravid uterus is sac-like.

Lateral branches or sacculations were not present on the gravid uterus of *E. vogeli* sp. n., and the uterus of this species is further distinguished by its relatively long, tubular form. Eggs numbered 400 to 500. The dimensions of the embryophore ranged in 150 from 0.032 to 0.042 mm by 0.029 to 0.040 mm, with an average of 0.0369 by 0.0355 mm. The embryophores are of larger average size than those of *E. multilocularis* and *E. oligarthus*, but similar to those of *E. granulosis* (cf. *Verster* 1965, Table 23).

Other Differential Characters. With regard to the constancy of the arrangement of the female genital organs in *E. granulosis* (*Verster* 1965, p. 66) concluded that "The structure of the female genitalia in the present experiments does not differ in parasites showing other morphological differences. Variations in the structure of the female genitalia would therefore be of taxonomic significance."

Comparisons of the female genital ducts in *E. vogeli* sp. n. with those of *E. granulosis* have demonstrated some consistent, well defined differences (Figs. 4 and 5). The vagina in *E. vogeli* is relatively shorter, while the oviduct is relatively longer, forming at least three loops between the oocapt and the point of entry into Mehlis' gland. The seminal duct is also longer in *E. vogeli*, entering the oviduct near the middle of the latter structure. The arrangement of these ducts in *E. oligarthus* and in *E. multilocularis* (see *Vogel* 1957, Fig. 18) is similar to that in *E. granulosis*.

E. vogeli thus is seen to possess a combination of morphologic characters that distinguishes it from its congeners. Its larval stage may also be found to exhibit distinctive characters.

Host Specificity and Zoogeographic Considerations

The occurrence of indigenous species of *Echinococcus* in carnivores of the family Canidae in South America has not been previously confirmed. Although *E. granulosis* is a common parasite of domestic dogs and is found in wild canids of the genus *Dusicyon*, this species is thought to have been introduced from the northern hemisphere (*Rausch* 1967).

The genus *Speothos* was included, with the genera *Cuon* and *Lycaon*, in the subfamily Simocyoninae by *Simpson* (1945), while the other species of canids indigenous in

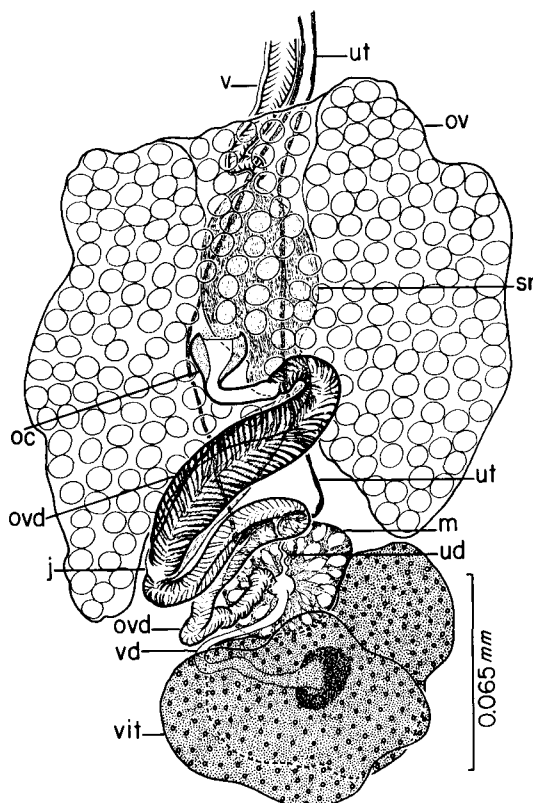


Fig. 4. *Echinococcus vogeli* sp. n. Details of female genital ducts. V - vagina; OC - oo-capt; OVD - oviduct; J - junction of seminal duct with oviduct; VD - vitelline duct; VIT - vitelline gland; UD - uterine duct; M - Mehlis' gland; UT - uterus; SR - seminal receptacle; OV - ovary.

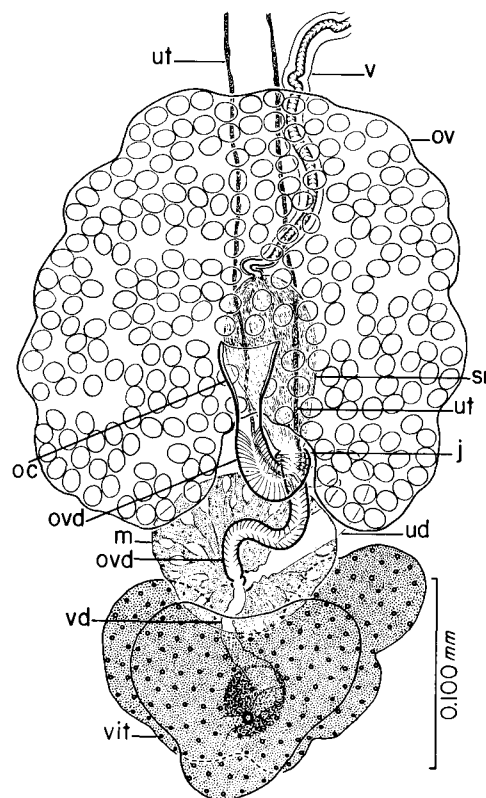


Fig. 5. *Echinococcus granulosis*. Details of female genital ducts. Labeled as in Fig. 4.

South America were placed in the subfamily Caninae. Whether the bush dog is sufficiently divergent to harbor a host-specific species of *Echinococcus* remains to be determined by means of attempts to infect canids of other species experimentally. That this cestode has not been found in other South American canids might be attributable to ecological, rather than phylogenetic, factors.

The bush dog, little known biologically, has an extensive geographic range (western and central South America, from Panama south to Paraguay). *Cabrera and Yepes* (1960, p. 133) describe these canids as hunting in packs, preying mainly upon large rodents, including pacas (*Cuniculus*) and capybaras (*Hydrochoerus*) which they pursue in rivers as well as on land. The larval stage of *E. vogeli* might be expected to occur in such mammals. Other rodents (*Dasyprocta* spp.) serve as intermediate host of *E.*

oligarthus in South America (Sousa and Thatcher 1969). *E. oligarthus* has not been recorded from other than feline hosts, and findings in two dogs experimentally exposed to infection (Sousa and Thatcher 1969) indicated that such animals are not suitable hosts for this cestode.

Acknowledgments

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