**Habronema malani** sp. n. and **Habronema tomasi** sp. n. (Nematoda: Habronematidae) from the Burchell’s Zebras and Hartmann’s Mountain Zebras in Southern Africa

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**ABSTRACT:** *Habronema malani* sp. n. is described from the stomachs of 44 Burchell’s zebras, *Equus burchelli antiquorum*, in the Etosha and Kruger national parks and 6 Hartmann’s mountain zebras, *Equus zebra hartmannae*, from the Etosha National Park in southern Africa. *Habronema tomasi* sp. n. is described from the small intestines of 35 Burchell’s zebras in the Kruger National Park. *Habronema malani* is distinguished from other members of the genus by its deep buccal capsule with walls that are narrower anteriorly than posteriorly and have projections in the anterior end; spicule length ratio (right: left) ranging 1:2.3 to 1:3.7; a short, stout, and striated right spicule; and a long and slender left spicule with a pointed projection. *Habronema tomasi* is differentiated from other species by buccal capsule walls that are wider anteriorly than posteriorly; a distance between the anterior wall of the buccal capsule and the inner surface of the lateral lips that is almost equal to the buccal capsule depth; an ovejector with spiral-shaped muscles; and a spicule length ratio (right: left) ranging 1:1.5 to 1:2.95. The right spicule of *H. tomasi* is short and cross striated except at the distal fourth where the tip is flanged. The left spicule is long and cross striated in the first one-third and partially cross striated in the second one-third. A key to the equine *Habronema* species is also included.

**KEY WORDS:** taxonomy, Nematoda, *Equus burchelli*, *Equus zebra*, key to genera of equine *Habronema*, zebras, equids, southern Africa.

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Members of the nematode family Habronematidae parasitize the stomachs of mammals and birds. There are 6 species found in equids and these are frequently pathogenic. These include 5 belonging to the genus *Habronema* and 1 to the genus *Draschia* (Yamaguti, 1961). The larval stages develop in flies (e.g., *Musca domestica*), and if the infective larvae of some of these habronematids (e.g., *Draschia megastoma* (Rudolphi, 1819), *Habronema majus* (Creplin, 1849) Ransom, 1911, *Habronema muscae* (Carter, 1861) Diesing, 1861) are deposited in wounds, they cause “summer sores” (Lichtenfels, 1975; Arundel, 1978). The adults of *Draschia megastoma* (syn. *Habronema megastoma* (Rudolphi, 1819) Railliet, 1923) often form abscesses that can range in size from 2.5 to 10.0 cm in diameter and are found in both the glandular and non-glandular portions of the stomach in both domestic and wild equids (Lichtenfels, 1975; Scialdo-Krecek, 1984).

During parasitological investigations on Burchell’s zebras and Hartmann’s mountain zebras (Scialdo et al., 1982; Scialdo-Krecek, 1983; Scialdo-Krecek et al., 1983), 2 new species of *Habronema* were recovered. These are described below.

**Materials and Methods**

Adult worms were recovered from the stomachs and small intestines of 35 Burchell’s zebras (*Equus burchelli antiquorum* H. Smith, 1841) in the Kruger National Park (KNP), Republic of South Africa, and 9 Burchell’s zebras and 6 Hartmann’s mountain zebras (*Equus zebra hartmannae* Matschie, 1898) in the Etosha National Park, South West Africa/Namibia. These nematodes agree with the generic description of *Habronema* by Lichtenfels (1975), but they could not be assigned to known species.

The zebras were processed for parasitological studies and the nematodes were killed in Lugol’s iodine and fixed in 10% formalin (Malan et al., 1981a, b). The specimens were cleared in lactophenol and examined with a Nikon Optiphot light microscope fitted with disc interference contrast. The anterior end of some of the specimens was cut transversely in the region of the buccal capsule. This cut end was mounted en face, which enabled the structures of the head region to be examined.

For scanning electron microscopy (SEM) the formalinized nematodes were dehydrated in ethanol and critical point dried in liquid CO$_2$ (Humphreys, 1975). The dried nematodes were oriented onto a stub bearing adhesive and coated with gold/palladium. They were examined by SEM at 5-20 kV.

Specimens of *Habronema* from the United States National Museum Helminthological Collection (USNM Helm. Coll.), Beltsville, Maryland, U.S.A., which were borrowed and examined, included *H. majus* (USNM Helm. Coll. Nos. 31066, 31091), *H. muscae* (USNM...
**Habronema malani sp. n.**

(Figs. 1–7, Table 1)

**DESCRIPTION:** Dimensions given as range (mean in μm ± 1 standard deviation) unless otherwise indicated.

**MALES** (10 specimens): Length 17.8–24.6 (22 ± 2.0) mm. Width 305–492 (354 ± 56.0). Depth of buccal capsule 52–88 (67 ± 12.4). Width of buccal capsule 20–30 (26 ± 3.0). Base of buccal capsule to outer lip 80–112 (91 ± 10.4). Esophagus 2.8–3.9 (3 ± 0.3) mm long and 104–200 (156 ± 41.0) wide. Nerve ring 239–332 (294 ± 65.3) from base of stoma. Vagina short 72–104 (78 ± 15.2). Ovejector long 700–1,000 (887 ± 102.4). Vulva 8.7–12.6 (11.0 ± 1.2) mm from anterior extremity. Anus 240–340 (286 ± 38.2) from tip of tail. Egg 40–80 (66 ± 12.3) long and 4–16 (10 ± 4.1) wide.

**HOST RECORD INFORMATION:** Total burdens (3–1,244) of this species were recovered from the stomachs of both Hartmann’s mountain zebras and Burchell’s zebras in the KNP and Etosha National Park.

**TYPE SPECIMENS:** Three intact males and females (T-2169) in the Ondersteypoort Helminthological Collection, Veterinary Research Institute, Ondersteypoort, South Africa; 3 intact males and females (1985.2185–2190) in the British Museum, London, U.K.; and 4 intact males and females (79803) in the United States National Museum Helminthological Collection (USNM Helm. Coll., USDA), Beltsville, Maryland, U.S.A.


**Habronema tomasi sp. n.**

(Figs. 8–16, Table 1)

**GENERAL:** Anteriorly in buccal capsule, and interlabially, is a pair of medial ridges with a slit-like opening between them. Each has 3 teeth. Posteriorly there is a larger tooth on either side of the ridges. Two lateral pseudolabia with 4 inner labial papillae. Four cephalic papillae with 1 outer labial papilla next to each, and 2 amphids with 1 outer labial papilla next to each.

**DESCRIPTION:** Dimensions given as range (mean in μm ± 1 standard deviation) unless otherwise indicated.

**MALES** (10 specimens): Length 7.9–10.9 (9.1 ± 0.9) mm. Width 144–208 (174 ± 20.2). Depth of buccal capsule 28–52 (40 ± 7.4). Width of buccal capsule 12–32 (21 ± 6.2). Base of buccal capsule to outer lip 76–82 (80 ± 2.4). Esophagus 2.2–2.8 (2.4 ± 0.2) mm long and 72–112 (86 ± 12.1) wide. Nerve ring 180–240 (204 ± 15.8) from base of stoma. Right spicule stout and striated, 336–480 (410 ± 49.5) and distal fourth with flanged tip. Left spicule slender, 690–992 (851 ± 108.9). Spicule length ratio ranging (right: left) 1:1.5 to 1:2.95. Four pairs of pedunculated preanal papillae, 4 on the right slightly anteriorly placed relative to the cloaca. Four postanal papillae, 1 next to lip of cloaca, 1 single and 1 pair ½ distance from anus to posterior extremity.

**HOST RECORD INFORMATION:** Total burdens (3–1,244) of this species were recovered from the stomachs of both Hartmann’s mountain zebras and Burchell’s zebras in the KNP and Etosha National Park.

**TYPE SPECIMENS:** Three intact males and females (T-2169) in the Ondersteypoort Helminthological Collection, Veterinary Research Institute, Ondersteypoort, South Africa; 3 intact males and females (1985.2185–2190) in the British Museum, London, U.K.; and 4 intact males and females (79803) in the United States National Museum Helminthological Collection (USNM Helm. Coll., USDA), Beltsville, Maryland, U.S.A.
Figure 1-5. *Habronema malani* sp. n. 1. Lateral view of head. 2. En face view of head. 3. Lateral view of male tail showing spicules. 4. Ventral view of male tail with papillae. 5. Lateral view of female vulva, vagina, and ovejector.

of the distance between the tip of the tail and the cloaca.

**FEMALES** (10 specimens): Length 13.2–16.4 (14.9 ± 1.1) mm. Width 192–260 (229.2 ± 20.9). Depth of buccal capsule 48–92 (67.2 ± 14.6). Width of buccal capsule 12–32 (20.8 ± 5.9). Base of buccal capsule to outer lip 72–100 (86.0 ± 8.7). Esophagus 2.3–4.2 (3.0 ± 0.6) mm long and 80–128 (105.6 ± 17.6) wide. Nerve ring 176–360 (251.6 ± 61.0) from base of stoma. Vagina very short, 20–40 (22.2 ± 6.7). Ovejector long and straight, 300–400 (346.6 ± 33.5) with spiral-shaped muscles. Vulva 5.0–7.0 (6.2 ± 0.7) mm from anterior extremity. Anus 136–200 (176.4 ± 19.3) from tip of tail. Egg 96–120 (110.4 ± 10.4) long and 8–12 (8.4 ± 4.1).

**HOST RECORD INFORMATION:** Total burdens (1–1,243) of this species were recovered from the small intestines of 35 Burchell’s zebras in the KNP.

**TYPE SPECIMENS:** Three intact males and females (T-2170) in the Onderstepoort Helminthological Collection, Veterinary Research Institute, Onderstepoort, South Africa; 3 intact males and females (1985.2191–2196) in the British Museum, London, U.K.; and 5 intact males
and females (79804) in the United States National Museum Helminthological Collection, USDA, Beltsville, Maryland, U.S.A.


SITE OF INFECTION IN HOST: Small intestine.

ETYMOLOGY: This species is named after my husband, Mr. Tomas E. Krecek.

**Discussion**

The 6 habronematid species reported from equids are: H. longistoma van den Berghe, 1943; H. muscae; H. tyosenense Yamaguti, 1943; H. zebrae Theiler, 1923; and D. megastoma. With the exception of H. tyosenense, all these species have been reported from Hartmann's mountain zebras and Burchell's zebras (Theiler, 1923; Round, 1968; Scialdo et al., 1982; Scialdo-Krecek, 1983; Scialdo-Krecek et al., 1983).

Although H. muscae is reported from a different host than H. malani sp. n., this new species most closely resembles H. muscae. Between these 2 species, H. malani has a shorter vagina. This structure crosses the body transversally in both species before reaching a long muscular ovejector. Further, the spicule ratio of H. malani is smaller than that of H. muscae. Habronema malani is a large worm surpassed only by H. majus in total body length. Habronema malani is further distinguished by the buccal capsule shape, which is narrower anteriorly than posteriorly, and by the anterior projections on the buccal capsule walls.

Although H. tomasi sp. n. does not closely resemble any of the other known species, its closest possible congener in terms of ovejector shape is H. majus. Habronema tomasi differs from Theiler's (1923) H. majus in the distance between the anterior wall of the buccal capsule and inner surface of the lateral lips, which is almost equal to the buccal capsule depth. Habronema tomasi has 1 more postanal papilla near the cloaca than H. majus. The ovejector of H. tomasi is muscular and spiral-shaped but elongated, while that of H. majus is muscular and rounded. Further, H. tomasi is a small worm and delicate in appearance. This may be because of its short
Table 1. Principal measurements of Habronema muscae, H. majus, H. malani, and H. tomasi (all measurements in mm unless otherwise indicated).

<table>
<thead>
<tr>
<th></th>
<th>H. muscae</th>
<th>H. majus</th>
<th>H. malani</th>
<th>H. tomasi</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total length</strong> (mm)</td>
<td>9.5-13.0</td>
<td>15.2-18.4</td>
<td>16.3-19.6</td>
<td>9.9-14.9</td>
</tr>
<tr>
<td><strong>Width</strong></td>
<td>11.2-19.7</td>
<td>360-400</td>
<td>440-500</td>
<td>305-322</td>
</tr>
<tr>
<td><strong>Buccal capsule length</strong></td>
<td>199-279</td>
<td>360-400</td>
<td>305-322</td>
<td>199-279</td>
</tr>
<tr>
<td><strong>Distance from base of stoma to tip of tail</strong></td>
<td>88-144</td>
<td>96-140</td>
<td>96-140</td>
<td>96-140</td>
</tr>
<tr>
<td><strong>Distance between bases of stoma (mm)</strong></td>
<td>119-244</td>
<td>198-297</td>
<td>198-297</td>
<td>198-297</td>
</tr>
<tr>
<td><strong>Distance from anterior end of esophagus to base of stoma</strong></td>
<td>199-279</td>
<td>360-400</td>
<td>305-322</td>
<td>199-279</td>
</tr>
<tr>
<td><strong>Distance from anterior end of esophagus to outer lip</strong></td>
<td>199-279</td>
<td>360-400</td>
<td>305-322</td>
<td>199-279</td>
</tr>
<tr>
<td><strong>Esophagus length</strong></td>
<td>42-70</td>
<td>4.1-0.4</td>
<td>3.3-3.8</td>
<td>2.2-2.8</td>
</tr>
<tr>
<td><strong>Distance from base of stoma to vulva</strong></td>
<td>5.5-8.1</td>
<td>72-112</td>
<td>72-112</td>
<td>72-112</td>
</tr>
<tr>
<td><strong>Distance from anus to tip of tail</strong></td>
<td>8-12</td>
<td>60-80</td>
<td>60-80</td>
<td>60-80</td>
</tr>
<tr>
<td><strong>Egg length</strong></td>
<td>8-12</td>
<td>60-80</td>
<td>60-80</td>
<td>60-80</td>
</tr>
<tr>
<td><strong>Egg width</strong></td>
<td>1.8-2.8</td>
<td>1.8-2.8</td>
<td>1.8-2.8</td>
<td>1.8-2.8</td>
</tr>
</tbody>
</table>

Note: Bolded cells indicate measurements that are only applicable to the specific species.
body length but widely separated transverse striations of the cuticle.

The medial interlabial ridges of the buccal capsule of *H. tomasi* may be an extension of the capsule walls and of the interlabia, and appear to separate the buccal capsule into a lower and an upper chamber. This buccal capsule differs considerably from all of the other equine species of this genus. However, there is some morphologic similarity with a free-living marine enoplid *Pontonema yaena* Inglis, 1964. This species has ventro-lateral and dorsal tooth-like structures (onchia) that develop from the lining of the buccal capsule (Inglis, 1964). Inglis speculated on the feeding functions of these structures. *Habronema tomasi* inhabits the small intestine of the zebra, and in the equid this organ is rarely inhabited by helminths. The viscous character of the small intestinal contents contrasts markedly with the dry, coarse ingesta of the stomach of equids. In the present study, it appears that the interlabial ridges could be of assistance during feeding in this viscous environment.

The description of the genus *Habronema* ac-
According to Lichtenfels (1975) should be revised to accommodate the total body length as 7–35 mm and not 8–35 mm.

The location in the host for the Habronema species known in the horse is the stomach (Lichtenfels, 1975). It is of interest to note that H. tomasi sp. n. was recovered only from the small intestine in the zebras. Contrastingly, in horses it is uncommon to recover any nematodes from this organ.

The absence of the 2 new species from Theiler's (1923) study may be attributable to several factors. Habronema tomasi is a much smaller nematode than the others of its genus. The mean total length is almost half the length if compared with H. malani. Hence, such a nematode could be easily missed using conventional recovery techniques. Furthermore, few nematodes appear to inhabit the small intestine of the equid as compared with the other organs (Lichtenfels, 1975). It remains though a sizeable organ, and if not sampled adequately, a small nematode such as H. tomasi may be overlooked. Theiler's study was only semi-quantitative, and presumably

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techniques used for nematode recovery were not as advanced as those of today. The high prevalence of *H. malani* in recent reports, 96% in 25 Burchell’s zebras (Krecek et al., 1987), suggests that this nematode may have been present but was not detected in Theiler's small sample size of 3 zebras. Alternatively, it is possible that conditions required for the presence of a suitable intermediate host for these nematodes were absent in the habitat of Theiler's zebras, and therefore, the life cycle of this nematode was not completed.

A key to distinguish all equine species of the genus *Habronema* follows.

1a. Very long cylindrical buccal capsule .......................... 2
1b. Short buccal capsule ........................................ 3

2a. Cuticular collar present at anterior end of stomata .......................... *H. longistoma*
2b. Cuticular collar absent; left spicule 4 times length of right; vagina long and narrow, crosses body transversely before reaching long muscular ovejector .......................... *H. zebræ*

3a. Left spicule 2–3 times length of right; vagina very short before reaching rounded part of muscular ovejector .......................... 4
3b. Left spicule 2–5 times length of right; vagina crosses body transversely before reaching long muscular ovejector .......................... 5

4a. Vagina short (136–140 μm) with large rounded ovejector (200–250 μm); cuticle without widely separated transverse striations; teeth present on ventral and dorsal walls of buccal capsule .......................... *H. majus*
4b. Vagina very short (20–40 μm); ovejector 300–400 μm long with spiral-shaped muscles; cuticle with widely separated transverse striations; pair of medial ridges interlabially with slit-like opening and 3 small teeth on each ridge, also, larger tooth either side of the ridges .......................... *H. tomasi*

5a. Vagina short (72–104 μm); left spicule 2½–3½ times length of right .......................... *H. malani*
5b. Vagina long and narrow (176–400 μm); left spicule 5 times length of right .......................... *H. muscae*

*H. tyosenense* is not included in the preceding key because type specimens were not available. Based on Yamaguti (1961), *H. tyosenense* resembles *H. majus* and *H. tomasi* with a 1:2 (right : left) spicule ratio. *Habronema tyosenense* differs from all other species in the arrangement and number of genital papillae. The number of papillae are fewest and are the most symmetrically arranged, with 4 pairs of preanal and 2 pairs of postanal papillae. All other *Habronema* species have extra papillae post- or preanally as well as an asymmetric arrangement.

**Acknowledgments**

I thank Dr. F. S. Malan, Professor R. K. Reinecke, and Professor Anna Verster, who contributed to discussion of the new species; Professor Verster for helpful comments regarding the manuscript; Dr. J. R. Lichtenfels for his helpful comments regarding the 2 new species; United States National Museum Helminthological Collection for the loan of study specimens; Mr. T. E. Krecek for helpful discussion and assistance with the drawings and in layout of the plates; Mrs. Norita Chaney, Plant Stress Laboratory, Electron Microscope Facility, Agricultural Research Service, Beltsville, Maryland, U.S.A., for the scanning electron micrographs; and the referees whose criticism substantially contributed to the manuscript. This is a portion of a dissertation submitted for the D.Sc. degree in Zoology, University of Pretoria, South Africa, and was supported by the following in South Africa: University of Pretoria, Council for Scientific and Industrial Research, Hoechst, and the Fritz Visser Agricultural Bursary.

**Literature Cited**


