

# NEMATODES FROM THE SUMMIT OF LONG'S PEAK, COLORADO

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One of the outstanding points of interest of the Rocky Mountain National Park is Long's Peak, located near the southern boundary. Rising to the height of 14,255 feet, its precipitous cliffs have been carved from a mass of Archaean granite that offers scant opportunity for the existence of plant or animal life. Timber ceases at an elevation of about 11,000 feet and above this there are occasional patches of low shrubs and grass extending up to about 12,500 feet. But above this point the inhospitable cliffs are barren of vegetation as all trace of soil has been swept away by the terrific winds, storms and avalanches that occur throughout a greater portion of the year.

Those fortunate enough to reach the summit are surprised to find a comparatively level area about 1,500 feet long by 1,000 feet wide and covered with boulders and slabs of granite. Growing in a very few protected, soil-filled crevices are small tufts of moss and grass that have survived the rigors to the high altitude. The writer experienced the pleasure of visiting this spot July 19, 1924—an unusually beautiful, cloudless, warm day without even a breeze blowing. From the crevices less than a pound of coarse granitic soil and roots of plants was collected but from it over a thousand nematodes were secured.

On July 18, 1926, Mr. Ralph Lambert ascended the peak with a party of fourteen from the Wasatch Mountain Club, Salt Lake City, Utah, and he very kindly made another collection at the summit in which over two thousand specimens were present, including several species that were not in the first collection.

Of the eighteen species found in the two collections there are five new undescribed forms. The remaining thirteen are all well known species described in European literature. The problem of such world-wide distribution offers an interesting opportunity for speculation as to the time and other factors involved. Truly it would appear that these minute organisms must be of very ancient origin.

From many such high mountain collections the writer has found that the nematode population is greater in numbers and variety of species per pound of soil than from any collections made at lower altitudes. The reasons for this are difficult to determine, but it is, nevertheless, a fact of biological interest. Many of these species live only at altitudes above 10,000 feet while others range far down the mountain slopes, even to sea level.

Following are descriptions,\* measurements and figures of the species collected. Figures of heads are of a uniform magnification of 1,000 diameters. Tails and other portions of the body are 500 diameters unless otherwise stated. Literature citations are limited to those in which the original descriptions of the species are given or those to which some reference is made in the text.

*Tylenchus davainii* Bastian, 1865.

			26.0	2.0		
1.6	9.8	16.0	63.0	88.0		
1.2	2.1	2.4	2.7	1.6		.9-1.2 mm.
1.6	9.0	15.5	M	86.0		
1.1	2.1	2.4	2.6	1.9		1.0-1.2 mm.

The coarse striae are interrupted on each lateral field by a wing area one-fourth as wide as the body, bordered by crenate margins with the wings appearing as two bright lines between them. The esophagus is typical, the median bulb being strongly developed to three-fifths the neck width. The renette pore is a striking feature, being heavily cutinized. The deirids can be seen very distinctly almost opposite the excretory pore. Fig. 1c. The cells of the rather narrow intestine are filled with coarse granules. The anterior ovary is the only one developed, the posterior being less than one body width in length. The tails of both sexes are similar in form, being conoid to the pointed terminus and strongly arcuate, especially in the last fourth. Fig. 1b.

One of the most numerous species in the collection, about 200 specimens being present. Fig. 1a-c.

*Aphelenchus pusillus* n. sp.

Diagnosis:\*\*

			40.0	9.6		
2.0	6.4	11.2	70.0	93.2		
1.6	2.0	2.4	3.2	1.8		.31 mm.

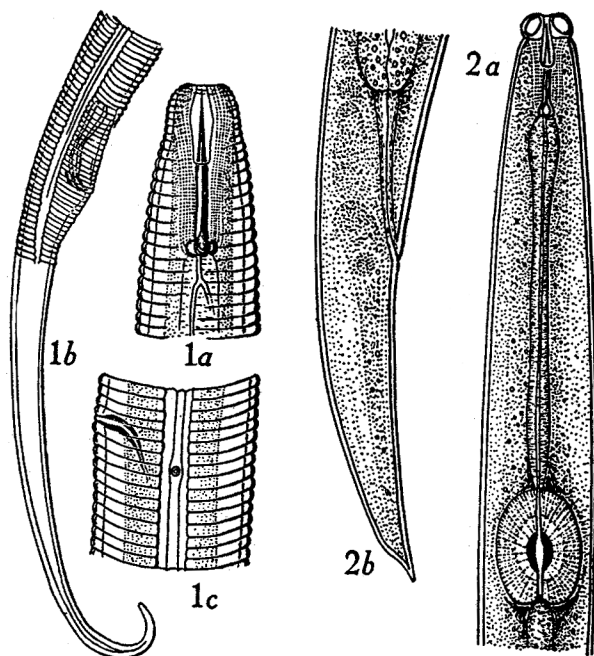
Characters somewhat similar to *Aphelenchus parietinus* Bastian but with these differences: Body only .31 mm. in length. Spear much larger with distinct trilobed base. Tail ending in a mucro formed by a sudden contraction of the terminus.

\* For explanation of the decimal formula, see Cobb, in these *Transactions*, Vol. XXXIII, page 73.

\*\* The "Diagnosis" includes the decimal formula of the measurements of the species and the first paragraph following the formula. The additional paragraphs give general, but not specific information.

The transverse stiae are exceedingly fine, being scarcely visible. There are two very indistinct wings. The lip region is set off and has a cutinous framework about the entrance to the pharynx. A narrow vestibule reaches half the spear length, at its base forming an indistinct guiding ring for the spear. The median bulb is as long as the neck width and almost as wide as the body cavity with a conspicuous valvular apparatus near its center. The nerve ring encircles the narrow tube leading from the bulb to the intestine one body width below the bulb. The renette pore is opposite the nerve ring. The anus is distinct and from it the slender rectum extends forward two anal body-widths. A prominent feature is a ventral narrowing of the body just posterior to the elevated vulva. The anterior ovary is out-stretched the posterior rudimentary and only three body-widths long. Eggs are three times as long as the vulva body-width and fill the body cavity.

Five specimens, all of which are adult females. Fig. 2a-b. 1000x.



*Dorylaimus varicaudatus* n. sp.

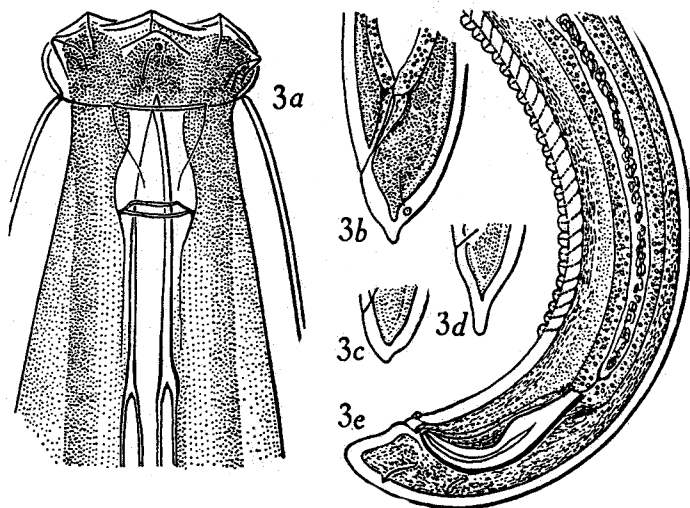
Diagnosis:

			26.0	23.0	
1.1	6.0	18.0	47.0	98.8	
1.1	1.9	2.5	3.2	1.2	3.4-3.9 mm.

			48.0			
1.1	7.7	18.0	M	98.9		
1.1	2.0	2.6	3.3	1.5		3.5 mm.

Characters probably nearest to *Dorylaimus obtusicaudatus* Bastian but with these differences: Esophagus shorter. Ovaries about twice as long; eggs smaller and present in the uterus in greater numbers. Terminus of female tail variably elongated. Male preanal supplements larger but only 24–30 in number compared to about 40 in *obtusicaudatus*. Spicula conspicuously long and rather slender. Males numerous while in *obtusicaudatus* they are rare.

The normal form of the female terminus is as shown in Fig. 3b but occasional specimens will be found with extremes as shown in Figs. 3c and 3d. Immature specimens frequently are like 3d. Posterior half of esophagus enlarged. Front ovary on the left, the rear on the right side of the body. Eggs small, only two-thirds as long as the vulva body diameter and twice as long as wide. As many as twelve may occur in the body at one time. Prerectum about equal in length to rectum. Fig. 3a-e.

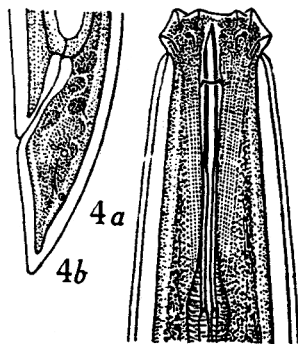


*Dorylaimus bryophilus* deMan, 1884.

		20.0	2.0		
6.1	13.0	30.0	58.0	95.2	
2.7	4.1	4.8	6.1	3.4	.85 mm.

The small robust body with its long slender spear is distinctive of this species. The posterior two-fifths of the esophagus is enlarged. The front ovary is on the right, the rear on the left, side of the body and they are reflexed to near the vulva. The eggs are one and one-half times as long as the vulva body-width and fill the body cavity. Fig. 4.a-b.

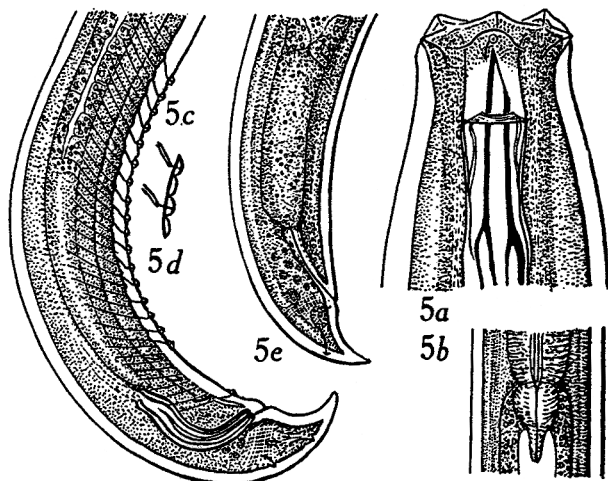
Only one adult female present in the collection



*Dorylaimus vestibulifer* Micoletzky, 1921.

		20.0	20.0		
1.0	6.2	23.0	51.5	97.6	2.42 mm.
1.2	2.1	2.9	3.3	1.9	
1.0	6.1	24.0	M	97.5	2.35 mm.
1.2	2.0	2.7	3.2	2.0	

Micoletzky gave this species the specific name because of the deep vestibule forming the pharynx. The slightly set off head bears two circlets of large papillae. The posterior half of the esophagus is enlarged by a rather



sudden expansion. The cardia is pyriform and as long as the width of the base of the esophagus. The symmetrical ovaries are reflexed one-half their length the front being on the left, the rear on the right, side of the body. The prerectum is about twice as long as the rectum.

The male tail bears a pair of supplementary organs just in front of the anus and beginning at a distance about one anal body-diameter in front of this pair is a series of ventral supplementary organs varying in number from eleven to twenty-one. Four pairs of pores are located on the tail.

Several dozen specimens in the collection. Fig. 5a-e.

***Dorylaimus uniformis* n. sp.**

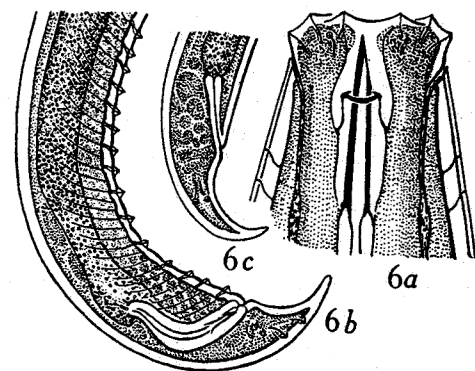
Diagnosis:

		18.0	18.0		
1.2	6.2	22.0	49.0	96.0	
1.0	2.0	2.5	3.3	1.7	2.35 mm.
		23.0	M	96.8	
1.4	7.0	23.0	M	96.8	
1.1	2.3	2.8	3.4	2.3	2.06 mm.

The uniformly separated supplementary organs of the male distinguish it from practically all other *Dorylaimus*. The two circlets of cephalic papillae differentiate it from *D. alpinus* Steiner (7) which has only one circlet. It

may be identical with the form described by Seiner (8) as *D. acuticaudatus*. Lips not set off by constriction. General body characters quite similar to *D. carteri*.

Esophagus enlarged in posterior half. Vulva conspicuous. Front ovary on the left, the rear on the right, side of the body and reflexed half their length. The prerectum is about twice as long as the rectum. The number of male preanal



papillae varies from fourteen to eighteen on the specimens examined.

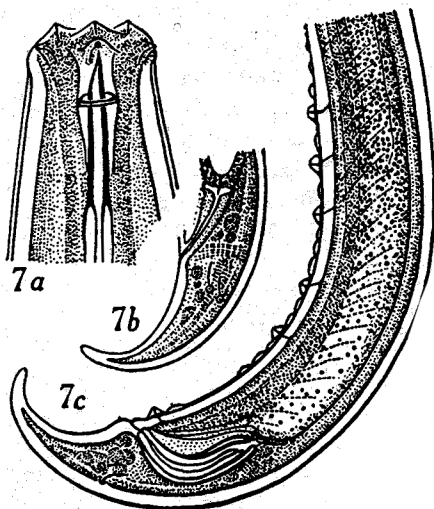
Numerous specimens in the collection. Fig. 6a-c.

***Dorylaimus carteri* Bastian, 1865.**

		17.0	17.0		
1.3	10.0	28.0	48.0	94.8	
1.3	2.1	3.0	3.5	1.7	1.35 mm.
		52.0			
1.6	9.6	28.0	M	96.0	
1.4	2.0	2.8	3.0	2.0	1.47 mm.

This species is quite generally distributed in mountain soils. About thirty specimens are in the Longs Peak collection, the females apparently being identical to the type form. However only one male was present whereas males usually are about as numerous as the females. The tail of this specimen bore thickened areas between the preanal papillae that are not present in the type form. Fig. 7c.

Posterior half of esophagus enlarged to three-fifths the neck width. Carida elongate-conoid. Front ovary on the right, the rear on the left, side of the body; they are reflexed one-half to two-thirds their length. Prerectum twice as long as the rectum. Fig. 7a-c



*Dorylaimellus hopedorus* n. sp.

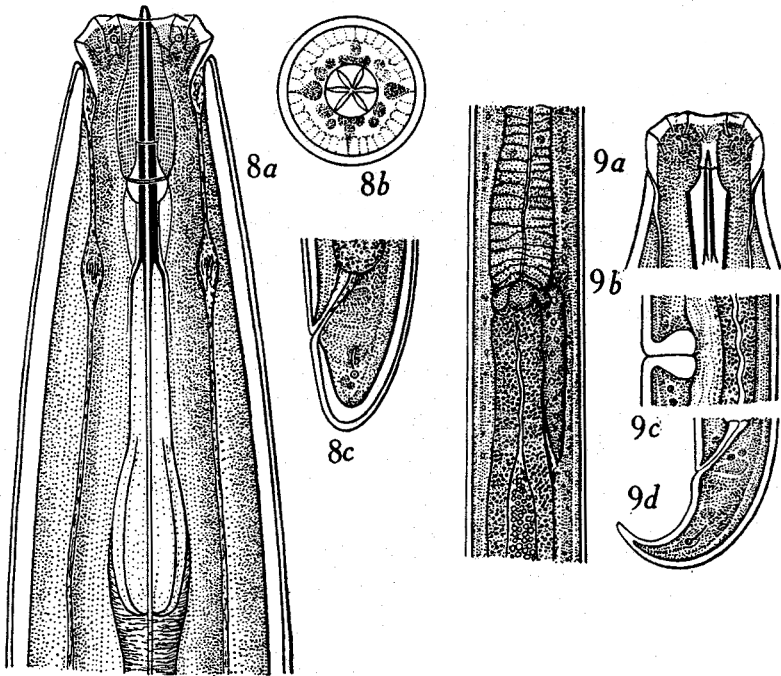
Diagnosis:

		20.0	20.0		
5.0	9.4	21.0	51.0	98.0	
2.4	2.8	3.6	4.0	2.5	1.43 mm.

This species differs from *Dorylaimellus virginianus* the type, and only species described, in that the basal third of the spear is made up of six sections. Fig. 8b. The short hemispherical tail is very different from the conoid tail of the type species.

The body is marked by excessively fine striae. There are no wings. The convex-conoid neck ends in a slightly set off lip region bearing two circlets of low innervated papillae. The broad amphids are stirrup-form with deep inner extensions leading to sensilla pouches. Fig. 8a. The spear is of three parts—the anterior a cylindrical, straight, heavily cutinized section twice as long as the width of the lip region, a second cylindrical less cutinized part five-eighths as long as the first and a basal portion as long as the second part but only slightly cutinized. When viewed in cross section this basal portion is found to be made up of six sections. Fig. 8b. The esophagus is slightly narrowed at first then expands in an elongate bulb followed by a tube about one-third the neck width that suddenly expands near the middle to form the basal portion which is three-fifths as wide as

the neck. The conoid cardia is one-fifth the body width and submerged in the intestine. The intestine is about four cells in circumference and often is green in color, doubtless due to the vegetable matter on which the nema feeds. From the depressed vulva the cutinized vagina leads half way across the body. The two symmetrical ovaries are reflexed half their length the front being on the right, the rear on the left, side of the body. The eggs are one and one-half times as long as the body width and one third as wide as long. As many as four may occur at one time. From the slightly depressed anus the rectum leads forward, being about one anal body diameter in length. The prerectum is about three times as long as the rectum. Pores lie somewhat past the middle of the tail. Fig. 8a-c.



Very numerous in the collections. This may be related to *Dorylaimus macrodorus* deMan.

This species is placed in *Dorylaimellus* only tentatively. A study is being made of this and several other related species and it may be necessary to establish a new genus to receive them.

*Nygotaiius hartingii* (deMan) nom. nov.

		13.0	13.0		
1.5	7.9	24.5	47.0	96.0	
.7	2.2	2.6	3.0	1.5	1.6 mm.



Sixteen specimens of this agile, little predacious species are in the collection. They correspond very closely to the European form described by deMan under the name *Dorylaimus hartlingii* (5), which has been found to belong to the Genus *Nygolaimus* (9).

Transverse striae excessively fine. The lip region is almost continuous with the body contour and bears two circlets of obscure papillae. Tooth as long as the width of the lip region. Posterior three-fifths of the esophagus enlarged but irregular in diameter. There are three conspicuous glands located at the cardiac constriction. A pair of long slender organs are located dorsally in the body and these crowd the anterior end of the intestine. Fig. 9b. The symmetrical ovaries are reflexed nearly to the vulva. Eggs two-thirds as wide as the body and two and one-half times as long as wide. Prerectum about three times as long as the rectum. The acute, ventrally bent tail is characteristic of this species.

Fig. 9a. Head from dorsal view. 9b. Cardiac region. 9c. Vulva region. 93. Tail.

### *Chrysonema aurum* n. g., n. sp.

Diagnosis:

			10.5	13.0		
.9	5.4	14.0	34.0	96.0		
<hr/>						
.6	1.0	1.2	1.5	.6		1.9 mm.

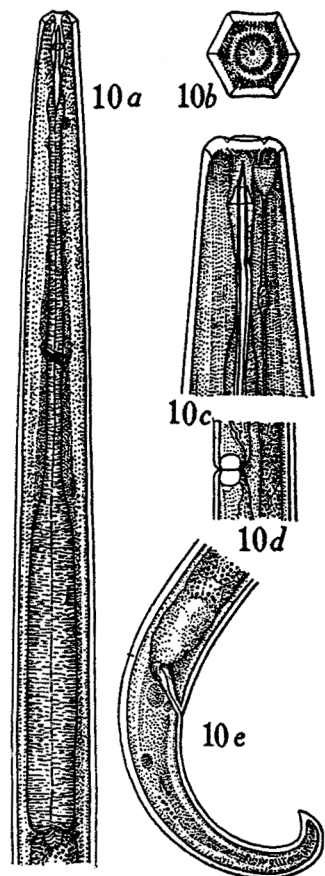
Characters of *Dorylaimus* with these differences: Labial papillae absent, their place being taken by a circular ring about the entrance to the pharynx. Vulva at 34%; ovaries two; vagina heavily cutinized the entire length, the cutinized walls being hemispherical in appearance from a lateral view. Tail ventrally bent, ending in a sharp, hooked terminus.

This exceeding beautiful nema owes its name to the brilliant golden color of the contents of the intestine. Usually only the portion posterior to the vulva is colored but occasionally it extends forward almost to the esophagus.

The slender body is widest at the vulva. Anteriorly it tapers uniformly to the lip region which is two-fifths as wide as the body width at the vulva and half as wide as the neck at the base of the esophagus. Posteriorly it tapers with a like uniformity to a point near the beginning of the prerectum where it becomes more conoid and ends in an acute, ventrally bent, hooked terminus. The cuticle is marked by excessively fine striae that usually are visible only on the anterior portion of the body. On favorable specimens these striae can sometimes be resolved into rows of exceedingly minute dots.

The hexagonal lip region bears a single circlet of innervated papillae on the outer margin but they do not interfere with the contour of the head.

The amphid openings are obscure, slit-like markings about one-fourth as wide as the head and from them the inner connections can easily be traced back to fusiform sensilla pouches located somewhat back of the base of the spear. About the mouth is a ridge set off by a circular furrow in the face. In the center of this circular area is the slightly depressed entrance to the narrow, tubular vestibule. The double guiding ring of the spear is of exceedingly delicate construction. The dorylaimoid spear is slightly longer than the width of the lip region and uniform in width in the posterior two-thirds, the anterior third tapering to a very sharp point. The anterior portion of the typically dorylaimoid esophagus is but one-fourth as wide as the posterior portion, the esophagus being enlarged at its middle by a rather sudden expansion. The indistinct nerve ring crosses the esophagus rather squarely and its location is marked by somewhat refractive bodies, apparently six in number. The lumen of the esophagus is unusually narrow. The cardia is elongate-hemispherical in form and one-third as wide as the body. The thin walls of the intestine are made up of large cells in which the granules are fine and scattered. The prerectum is one to two times as long as the rectum and is slightly narrower than the adjoining portion of the intestine. The straight rectum is as long as the anal body-diameter. From the depressed vulva the cutinized vagina leads one-third the distance across the body its walls being hemispherical. The front ovary is on the right, the rear on the left, side of the body and they are reflexed almost to the vulva. When crowded by the eggs, which are four times as long as the body width, they sometimes extend past the vulva or are folded again. No phasmids or deirids have been seen. Males unknown. Fig. 10a-e



Only one specimen in this collection but many others have been secured from soil collected in fields, deserts and mountains of Utah, Colorado and California. Three specimens found on the surface of "Mormon Crickets.

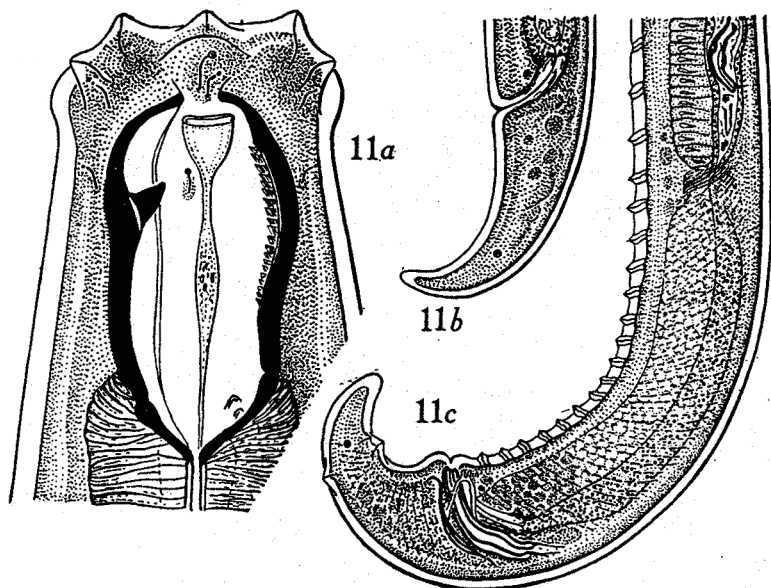
*Anabrus simplex*, secured on Diamond Mountain, Uintah County, Utah. It may inhabit the bodies of other insects which might account for its wide distribution from sea level on the Pacific Coast to the top of Longs Peak, Colorado.

**Mononchus longus** n. sp.

Diagnosis;

2.2	6.6	22.0	66.0	95.0	2.14 mm.
1.3	1.9	2.2	2.4	1.6	
			35.0		
2.3	7.4	23.5	M	96.3	2.0 mm.
1.4	2.0	2.3	2.5	2.0	

Characters of *Mononchus muscorum* Dujardin. Pharynx one-fourth deeper with corresponding increase in number of elements in saw-tooth rasp opposite the dorsal tooth. Amphids much larger and more conspicuous. Males numerous while *M. muscorum* is syngonic. Male tail bears 18 to 20 preanal supplements, three pair of caudal and three pair of preanal submedian papillae. Spicula one and one fourth-times as long as the anal body diameter, thick and strong with bifurcate lateral guiding pieces and long slender accessory pieces.



Excessively fine striae are visible on the extremities. The distinctly expanded lip region bears the usual two circlets of very prominent papillae. The amphids are a conspicuous feature owing to the inner extensions which are very distinct on some specimens. The capacious pharynx bears the dorsal tooth near its entrance and this is opposed by a row of denticles on the opposite side, usually about 18 in number. The esophagus is at first one-half the neck width but after passing through the nerve ring is about

three-fifths as wide as the neck. The disc shaped cardia is half as wide as the body. An indistinct pore is opposite the nerve ring, probably the renette pore. The somewhat tessellated intestine is six to eight cells in circumference. All the females were too young to show any details of the ovaries. The rectum is about as long as the anal body-diameter.

The thick, blunt spicula rest on slender accessory pieces that are connected by muscular bands to the furcate guiding pieces. Pores lie about one-third the tail length from the terminus. Fig. 11a-c.

Remains of devoured nemas were found in the intestines of several specimens. The spear and spicula of a small *Dorylaimus* are shown in Fig. 11c.

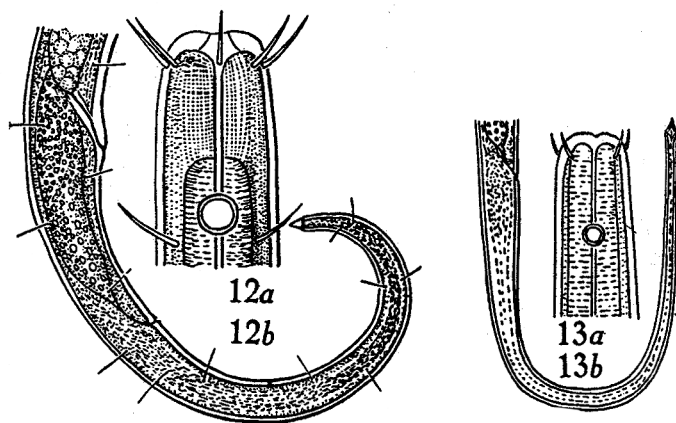
Two males and five immature females in the collection.

*Monhystra villosa* Bütschli, 1873

			43.0		
0.0	6.2	19.0	M	81.0	
1.6	1.7	1.9	2.4	2.5	.94 mm.

			43.0		
0.0	8.0	21.0	77.0	83.0	
1.7	2.0	2.3	2.7	2.3	.88 mm.

The formulas and figures give all the description necessary for this characteristic species which often is found in soil, along streams and in lakes of western mountains. Males and females about equal in numbers in the collection of forty specimens. Fig. 12a-b.



*Monhystra filiformis* Bütschli, 1873.

0.0	7.5	23.0	54.0	73.0	
1.8	2.1	2.7	4.2	2.4	.41 mm.

Only five specimens of this minute, agile species appeared in this collection. It frequently appears in high mountain soils, especially those along streams and lakes. Fig. 13a-b. 1000 x.

*Rhabdolaimus terrestris* deMan, 1884.

4.5	11.5	21.5	43.0	68.0	.4 mm.
2.6	3.3	4.0	4.5	3.0	

Cuticle thick with exceedingly fine striae. The amphids are elongate oval markings one-eighth the head width and have deep inner connections plainly visible from a lateral view. No papillae or setae are visible. At the opening of the pharynx are three refractive denticle-like organs similar to those of *Ironus*. The eggs are three to four times as long as the body width and usually crowd the ovaries out of position. The long tapering tail ends in a very prominent pointed spinneret four times as long as wide. Fig. 14a-c.

This rare species has been collected by the writer only from high mountain soils. Three specimens were in this collection.

*Teratocephalus terrestris* Bütschli, 1873

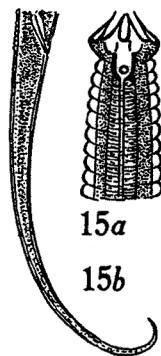
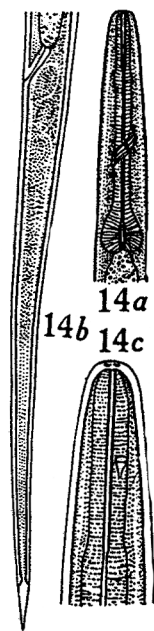
1.8	10.5	27.0	53.0	76.0	.44 mm.
1.5	2.4	3.0	3.6	2.1	

This species is immediately distinguished by its small size, coarsely striated cuticle and long filiform tail with its arcuate terminus. The head with its cutinous framework is an especially prominent feature.

This is one of the most widely distributed species in the western mountains but occurs only in small numbers. Two specimens appeared in this collection. Fig. 15a-b

*Plectus cirratus* Bastian, 1865.

		18.5	17.0		
3.3	14.0	21.0	46.0	90.0	1.27 mm.
2.3	3.7	4.6	5.5	2.8	
			35.0		
2.5	12.5	25.0	M	92.4	1.32 mm.
1.8	3.0	3.4	4.2	3.0	



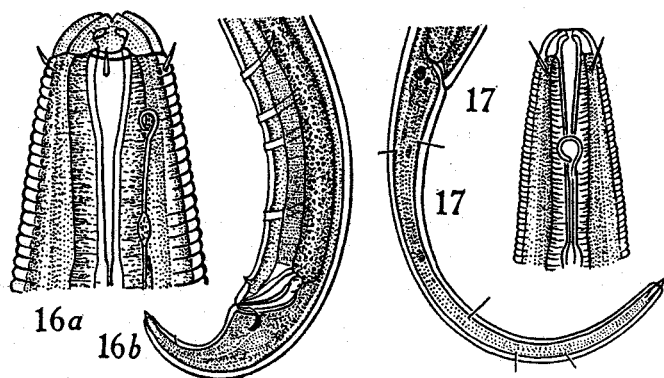
The females of this species correspond very closely to deMan's description of *Plectus cirratus* and have been identified by Dr. Cobb and

Dr. Steiner as being that species. However the rare males that occur in the western states differ greatly from the single specimen collected by deMan but the writer feels that too much importance should not be attached to these occasional, aberrant forms.

Lip region distinctly set off. Four short, stout setae. Cutinous framework about the vestibule leading to the pharynx. Amphids with sensilla pouches located near the base of the pharynx. Front ovary on the right, the rear on the left side of the body. Several setae on the tail not shown by deMan but figured by Cobb. (4).

The tail of the male bears a small acute, elevated ventral organ just on front of the anus and anterior to this is a series of four to six ventral supplements with long tube-like extensions reaching far back into the body, passing between the testes. These organs are very similar to those of the males of *Plectus granulatus*. There are two testes, the anterior ends being reflexed a distance equal to three times the body width.

About fifty females and one male in this collection. Fig. 16a, x1000, 16b x200.



*Plectus rhizophilus* deMan, 1884.

3.5	9.3	25.0	52.0	85.0	.75 mm.
1.5	3.1	3.5	3.9	2.3	

The cuticle is marked by rather coarse striae. The two wings are prominent. The lip region is very slightly set off in an amalgamated hemispherical area. There are four strong setae half as long as the width of the base of the lips. The large amphids are about one-fourth as wide as the head, hooked in form and located just below the middle of the pharynx. The renette pore lies just behind the nerve ring. The two ovaries are symmetrical the front being on the right, the rear on the left, side of the body. The eggs are one and one-half times as long as the body width and half as

wide as long. The rectum is about half as long as the anal body-diameter. Perhaps the most distinguishing feature about this species is the long gradually tapering tail. Slender bristles occur at various points on the body. Fig 17a-b

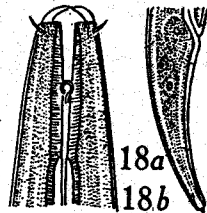
The three specimens in this collection are all that the writer has found in the western states.

*Plectus parvus* Bastian, 1865.

		12.0	14.0			
4.0	15.0	25.0	50.0	89.5		
2.5	4.0	5.1	6.0	3.1	.43	mm.

The figures and measurements are almost sufficient to describe this tiny species. The striae are fine and are interrupted on the lateral fields by two distinct wings. The front ovary is on the right, the rear on the left, side of the body. The eggs are huge and at times the ovaries are crowded until the reflexed portion passes the vulva. Fig. 18a-b.

This active little species is one of the most common nemas found in the mountain soils. About twenty specimens in this collection.



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