



Research Article

Compendium of the Genus *Psilenchus* de Man, 1921 (Tylenchida: Psilenchidae)

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Abstract | The compendium of the genus *Psilenchus* de Man, 1921 comprised of 19 species based on the characteristics of the total body length, ratio of a, b, c, c', V%, stylet, MB, head shape, tail length, DGO, oesophagus, excretory pore, spicules and gubernaculum. The allometric and morphometric characteristics were derived from the original descriptions. An updated list of valid species of *Psilenchus de Man, 1921* along with illustrations of the anterior and posterior regions taken either from the original descriptions or subsequent re-descriptions is also incorporated herein. A total of seven species have so far been reported from Pakistan.

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Introduction

The genus *Psilenchus* was established by de Man (1921) with *P. hilarulus* as the type species, a species of nematodes with didelphic ovary, stylet without knobs, head with distinct amphidial aperture, post labial, median bulb posterior to middle of oesophagus, adanal bursa, tail clavate or cylindroid to small rounded terminus in both sexes. Later on, Thorne, 1949 described the genus *Psilenchus* in more detail and added four new species viz., *P. striatus*, *P. magnidens*, *P. gracilis* and *P. aberrans* and placed *Tylenchus clavicaudatus* Micoletzky, 1922 under the genus *Psilenchus*. Later on, two species were transferred to *Basiria* by Siddiqi, 1963 as *B. aberrans* (Thorne, 1949; Siddiqi, 1963) and *B. gracilis* (Thorne, 1949; Siddiqi, 1963). Afterwards Thorne and Malik, 1968 transferred *P. magnidens* to *Neopsilenchus*. Luc et al., 1987 and Ryss, 1993 regarded *Psilenchus de Man (1921) Atetylenchus* Cobb, 1913 and *Antarctenchus*

Spaull, 1972 representing as the most primitive taxa of Tylenchida. Siddiqi, 2000 clearly differentiated the family Psilenchidae Paramonove, 1967 (Khan, 1969) from Tylenchidae Orley, 1880 in having didelphic ovary and the presence of phasmids on the tail, and placed it in the superfamily Dolichodoroidea in (Chitwood, 1950) Siddiqi, 1986 of the suborder Hoplolaimina Chizhov and Berezina, 1988. He divided the family Psilenchidae into two subfamilies, (i) Psilenchinae Paramonove, 1967 (stylet not knobbed, vulva without lateral membrane and epiptygma) with two genera *Atetylenchus* and *Psilenchus*; and (ii) Antarctenchinae Spaull, 1972 (stylet knobbed, vulva with lateral membrane and epiptygma) with one genus *Antarctenchus*. In *Psilenchus* cephalic region appearing smooth, amphidial aperture distinct, post labial, median bulb posterior to middle of oesophagus whereas *Atetylenchus* was characterized by cephalic region distinctly annulated, amphidial aperture indistinct, labial, median bulb anterior to middle of

oesophagus. Seven species of the genus *Psilenchus* have so far been reported from Pakistan (Shahina et al., 2019).

Materials and Methods

In the compendium fifteen characters (allometric and morphometric) are used to separate *Psilenchus* species (Table 1). Drawing of anterior and posterior ends of 19 species were taken from original publications or subsequent re-descriptions (Figures 1-3).

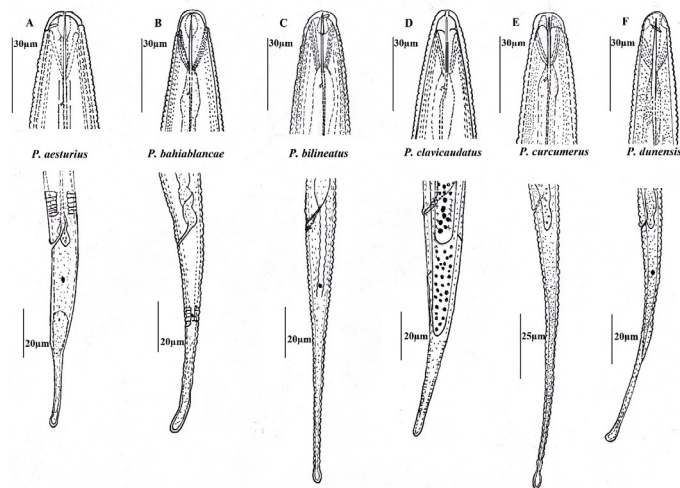


Figure 1: (A-F) Anterior and posterior regions of *Psilenchus* species redrawn from original descriptions.

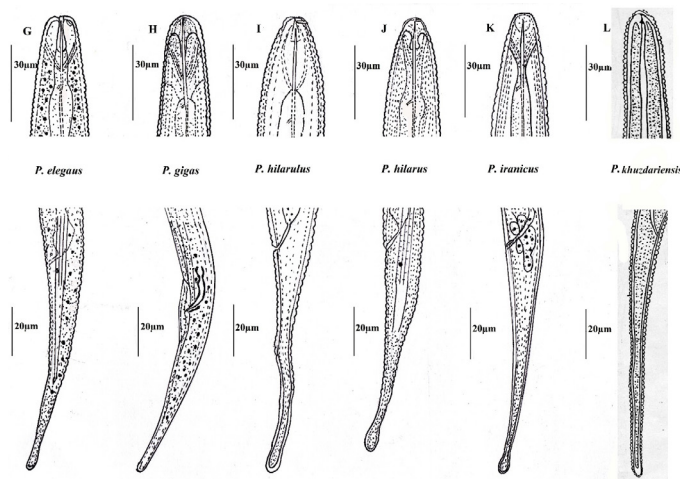


Figure 2: (G-L) Anterior and posterior regions of *Psilenchus* species redrawn from original descriptions.

Genus *Psilenchus* de Man, 1921

Diagnosis: Medium sized to large nematodes (0.7-1.70 mm), straight to curve when heat relaxed. Cuticle distinctly annulated, lateral field with four incisures, inner lines often indistinct. Amphidial aperture generally distinct as transverse slits at base of lateral lip areas. Cephalic region continuous or slightly narrower than body. Cephalic framework

weekly developed. Stylet cylindrical, cone about one third of stylet length, basal knobs absent but minute swellings may occur. Median bulb prominent with distinct thickenings of lumen wall, usually behind middle of oesophagus. Basal bulb small, pyriform. Cardia discoidal or rounded. Female reproductive system paired, outstretched in opposite directions. Vulva without lateral vulval membranes, spermatheca axial and elongated. Tail elongated or shorter and thicker, with clavate or nonclavate rounded tip. Distinct phasmids on tail, anterior to its middle. Bursa adanal, prominent. Spicules tylenchoid 25-33µm long. Gubernaculum simple, fixed trough shaped. An updated list of valid 19 species of the genus *Psilenchus* is given below:

Type species: *Psilenchus hilarulus* de Man, 1921

Other species: *P. aestuaris* Andrassy, 1962; *P. bahiablancae* Doucet, 1996; *P. bilineatus* Mizokubo and Nakasono, 1987; *P. clavicaudatus* (Micoletzky, 1922), Thorne, 1949; *P. curcumerus* Rahaman et al., 1994; *P. dunensis* Thapa and Ganguly, 1999; *P. elegans* Thorne and Malik, 1968; *P. gigas* Thorne and Malik, 1968; *P. hilarus* Siddiqi, 1963; *P. iranicus* Kheiri, 1970; *P. khuzdarensis* Khan et al., 2004; *P. magnificus* Lal and Khan, 1990; *P. minor* Siddiqi, 1963; *P. mixus* Bajaj, 1997; *P. pratensis* Doucet, 1996; *P. pini* Lal and Khan, 1990; *P. striatus* Thorne, 1949; *P. vinciguerrae* Brezeski, 1991.

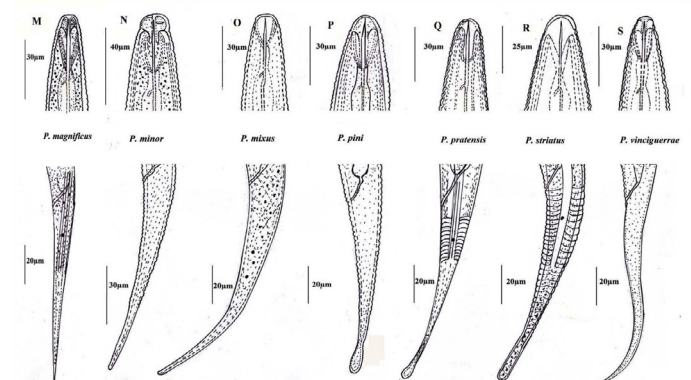


Figure 3: (M-S) Anterior and posterior regions of *Psilenchus* species redrawn from original descriptions.

Discussing the systematics of the genus, De Ley et al., 2006 in the modified classification of Phylum Nematoda on molecular studies placed the genus under the family Tylenchidae; while Siddiqi, 2000 included the genus *Psilenchus* in the family Psilenchidae. The adanal bursa and long tail distinguished the family Psilenchidae from the other families of

Table 1: Compendium of the genus *Ptilenchus* de Man, 1921.

S. No.	Name of species	L	a	b	c	c'	V%	Styler	MB	Ex-pore	Oesophagus	Spicules	Gubernaculum	Head
1.	<i>P. aetnaris</i>	1.0-1.5	35.91-47.91	6.22-8.79	6.62-8.44	7-89	45-49.3	15-18	55-62	118-124	25-274	29-34	8-12	Smooth
2.	<i>P. babilanicae</i>	1.1-1.5	45.7-70.2	8.4-11.6	7.4-11.5	6-11.1	48.4-55.9	13-17	51-58	94-132	122-148	30-38	10-15	Smooth
3.	<i>P. bilineatus</i>	761-9.82	36-50	5.9-7.5	6.3-8.5	7-12	45-50	12.3-15	55-60	23-103	115-138	18-21.4	6.3-8.7	Straight
4.	<i>P. clavicaudatus</i>	1.23	37	10	9.3	4.5	65.5	13	-	-	-	-	-	Smooth
5.	<i>P. circummers</i>	0.83-1.04	47.7-55.3	6.5-7.7	6.0-6.9	10.2-12.0	46-48	12-13.5	56-65	90-108	120-144	27-30	10.5-12	Smooth
6.	<i>P. danensis</i>	935-1190	40-51.7	5.9-9.1	6-8	8-12	44.5-49	18-22	72-88	90-110	-	26-28	8-10	Smooth
7.	<i>P. elegans</i>	1.2	34	7.0	10.1	5.5	46	1.5	57	-	-	-	-	Striated
8.	<i>P. grigas</i>	1.5	39	7.3	10	6	55	22	50	-	-	36	13	Striated
9.	<i>P. bilarulus</i>	1.0-1.42	37-41	6-7.8	8.2-9.5	3.4-6.4	49-52	15-17	55-66	-	-	27-33	7-13	Offset
10.	<i>P. bilarus</i>	1.07-1.44	37.1-51.2	6.5-8.7	9.3-12.2	3.4-6.4	51.1-56.9	15-18	58-66	112-150	146-176	27-33.1	10-13	Striated
11.	<i>P. francus</i>	1.26-1.30	34.41	7.1-8.1	9.3-9.3	6.4-6.7	49.49	16.16	56-60	135	183-155	33	1	Striated
12.	<i>P. kbuzdarensis</i>	0.99-1.04	34.88-48	5.32-8.58	4.22-6.0	8.7-13	52-64	11-12	-	-	-	-	-	Smooth
13.	<i>P. magnificus</i>	1.03-1.30	38-45	-	7.6-8.7	6.4-7.5	47-49	16-16.5	56-59	-	-	28-30	7-9	Smooth
14.	<i>P. minor</i>	0.855	45	5.6	5.8	11	47.6	13	55	-	-	28	6	Smooth
15.	<i>P. mixus</i>	0.704-1.013	26-37	5.2-6.8	8.5-9.4	7	51-54	13	48-52	94-123	-	17-19	7-8	Striated
16.	<i>P. pratensis</i>	0.87-1.24	45.4-59.3	6.2-9.1	7.2-9.8	8.3-11	50.5-61.2	12-15	53-58	106-118	130-166	25-32	8-12	Smooth
17.	<i>P. pini</i>	0.80-1.01	44-51	-	5.3-7	10-14	46-48	14-16	57-59	110	-	24-20	8-10	Smooth
18.	<i>P. striatus</i>	1.6	35	7.6	14	6	50	23	60	-	-	-	-	Striated
19.	<i>P. vinniguerrae</i>	702-1006	37-43	5.8-7.9	50-56	4.9-8.4	57-61	10-13	61-68	95-111	117-134	18-22	6.9	Straight

Hoplolaimina, Dolichodoroidea. This family resembles in the short stylet, structure of oesophagus and long tail with the family Tylenchidae but the paired ovaries and the presence of phasmids clearly distinguished it from Tylenchidae. In the present paper authors agreed with the opinion of Siddiqi, 1986, 2000 that the paired gonad and the presence of caudal phasmids appear to be the essential distinguishing characters of Psilenchidae. At present, 19 species are considered valid of the genus according to Siddiqi, 2000 and Geraert, 2008. From Pakistan seven species of the genus *Psilenchus* have so far been reported among them one new species *P. khuzdarensis* was described by Khan *et al.*, 2004 from pomegranate (*Punica granatum* L.) from district Khuzdar, Balochistan Province. Two species *P. aestuarius* Andrassy, 1962 and *P. iranicus* Kheiri, 1970 are reported for the first time from Pakistan by Shahina and Maqbool, 1992 from banana field of Sindh. Erum and Shahina, 2010 reported *P. pratensis* Doucet, 1996 as a new record species from wheat field of Khyber Pakhtunkhwa Province. Khan and Bilqees 1993 and 1994 reported *P. minor* from walnut (*Juglans* spp.) and paddy crops (*Oryza sativa* L.), respectively from Bajore Agency, Khyber Pakhtunkhwa Province for the first time from Pakistan.

Saeed and Ashrafi, 1973 reported *P. hilarus* Siddiqi, 1963 from *Achras zapota* in Malir Karachi. Association of this species with the roots of *Achras zapota* is a new record. *P. hilarulus* de Man, 1880 was reported by Saeed and Ghaffar, 1979 in a survey of stylet bearing nematodes collected from soil around the roots of sapodilla. This species occurring in 42% of the samples. Maqbool, 1986 and 1988 reported *P. hilarulus* and *P. hilarus* from *Carica papaya* from KP, Punjab and Sindh. Shahina and Maqbool, 1992 reported *P. hilarulus* and *P. hilarus* from banana field in Sindh. Gul and Saifullah, 1991, during the survey of nematodes reported *P. hilarus* from wheat field in KP, while Maqbool, 1992; also reported this species from wheat. Maqbool, 1988 reported *P. hilarulus* from barley (*Hordeum vulgare*) and wheat (*Triticum aestivum*). Islam *et al.*, 1994 reported *P. hilarulus* associated with apple trees in Swat, KP, Pakistan. Maqbool, 1992 reported *P. hilarulus* from various host *viz.*, *Lycopericon esculentum*, *Nicotiana tabacum*, *oryza sativa*, *Prunus armeniaca* and *Punigranatum*. Maqbool *et al.*, 1975 reported *P. hilarulus* from sugarcane in Sindh. Qasim and Ahmad, 1989 reported *P. hilarulus* from potato (*Solanum tuberosum*) in the northern areas

of Pakistan. The genus *Psilenchus* was also reported by many early researchers but up to generic level only from different hosts and localities (Maqbool and Shahina, 2001; Zarina and Shahina, 2012).

The aim of this study is to congregate the comprehensive information and consolidate the valuable contributions on plant-parasitic nematode, *Psilenchus*. It provides the complete review of the *Psilenchus* species described and reported from Pakistan by various researchers from time to time and also discussed the systematic position of this genus. A complete list of valid *Psilenchus* species is also incorporated in this compendium along with their morphometrics and illustrations for the convenience of the researchers.

Novelty Statement

The aim of this study is to congregate the comprehensive information and consolidate the valuable contributions on plant-parasitic nematode, *Psilenchus*. It provides the complete review of the *Psilenchus* species described and reported from Pakistan.

Author's Contribution

Yawar Iqbal Erum, prepared the manuscript. Hussain Sagir, conducted the field survey, collected and processed the soil samples. Kazi Nasira, provided technical assistance in preparing the compendium. Fayyaz Shahina, reviewed the manuscript.

Conflict of interest

The authors have declared no conflict of interest.

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