A compendium of the genus *Pratylenchus* Filipjev, 1936 (Nemata : Pratylenchidae)[1]

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SUMMARY

Analysis of descriptions of 89 species of *Pratylenchus* has revealed that a number of species were erected on weak, inadequate comparisons, subjective criteria, a minimal number of specimens, and/or insufficient diagnostic data. Only a few investigators have reported studies on the extent of variation in certain species. In the proposed synonymies which follow, the first species named will be the junior synonym to the second species named : *Pratylenchus australis* Valenzuela & Raski, 1985 is regarded a junior synonym to *P. bolivianus* Corbett, 1983; *P. fallax* Seinhorst, 1968 and *P. manohari* Quraishi, 1982 to *P. cerealis* Haque, 1966; *P. neocapitatus* Khan & Singh, 1975 to *P. neglectus* (Rensch, 1924) Filipjev & S. Stekhoven, 1941; *P. penetrans* (Cobb, 1917) Filipjev & S. Stekhoven, 1941 and *P. pratensisobrinus* Bernard, 1984 to *P. pratensis* (de Man, 1880) Filipjev, 1936; *P. sefaensis* Fortuner, 1973 to *P. pseudopratensis* Seinhorst, 1968; *P. singhi* Das & Sultana, 1979 to *P. delattrei* Luc, 1958; and *P. ventroprojectus* Bernard, 1984 to *P. kralli* Ryss, 1982. The results of this study reveal that the genus currently is composed of 49 valid species.

RÉSUMÉ

Compendium du genre Pratylenchus *Filipjev, 1936 (Nemata : Pratylenchidae)*

L'analyse des descriptions originales de 89 espèces de *Pratylenchus* a révélé que bon nombre d'entre elles ont été établies à partir de comparaisons superficielles ou inadéquates, de critères subjectifs, d'un nombre minime de spécimens, et (ou) d'éléments de diagnose insuffisants. Très peu d'observateurs ont consacré leurs études à la variabilité intraspécifique. Les synonymisations suivantes sont proposées : *Pratylenchus australis* Valenzuela & Raski, 1985, est considéré comme un synonyme mineur de *P. bolivianus* Corbett, 1983; *P. fallax* Seinhorst, 1968 et *P. manohari* Quraishi, 1982 de *P. cerealis* Haque, 1966; *P. neocapitatus* Khan & Singh, 1975 de *P. neglectus* (Rensch, 1924) Filipjev & S. Stekhoven, 1941; *P. penetrans* (Cobb, 1917) Filipjev & S. Stekhoven, 1941 et *P. pratensisobrinus* Bernard, 1984 de *P. pratensis* (de Man, 1880) Filipjev, 1936; *P. sefaensis* Fortuner, 1973 de *P. pseudopratensis* Seinhorst, 1968; *P. singhi* Das & Sultana, 1979 de *P. delattrei* Luc, 1958; enfin *P. ventroprojectus* Bernard, 1984 de *P. kralli* Ryss, 1982. Il résulte de cette étude que le genre *Pratylenchus* comprend actuellement 49 espèces valides.

The genus *Pratylenchus* was first proposed by Filipjev (1934) who failed to offer any description but did designate the type species as *Pratylenchus pratensis* (de Man, 1880). Two years later, Filipjev characterized the genus as having " oesophagus aphelenchoid, ovary single ". He formally designated *P. pratensis* (de Man, 1880) n. comb. as type and also transferred five other species into the genus, none of which have remained as valid within the genus. Sher and Allen (1953) published a major revision of the genus which was further clarified and expanded by the extensive work of Loof (1960, 1978).

The genus *Pratylenchus*, because of its ubiquity, has become a popular area for taxonomic manipulations by some workers who either did not know, or investigate fully, the diagnostic characters of other nominal species before declaring their taxa as unique. As a result, the genus contains a number of species which are diagnostically distinguished only from a few other species which the authors felt were related, but usually not from the entire group of species within the genus (Fortuner, 1985*b*). Many of the problems concerned with proper identification of species lay in the original descriptions, where subjective statements such as " comparatively bigger first annule ", " stylet not quite as stout ", and " body somewhat slimmer " occurred. Measurements of body parts that are expressed in tenths and even hundredths of a micrometer are useless considering that human error which can occur, even by practicing taxonomists, can be up to several micrometers (Frederick & Tarjan, 1978). Several descriptions are based on a minimal or subminimal number of specimens, as already

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pointed out by Fortuner (1984). Such descriptions offer slight indication of intraspecific variability within the taxon.

The purpose of this paper is to explore in depth published accounts of all *Pratylenchus* species to determine interrelationships, to define valid diagnostic characters, and to propose a key to species based on information available.

MATERIALS AND METHODS

The present paper is based solely on bibliographic research. The original description and figures are almost invariably considered as being paramount in importance, but may be supplemented by subsequent redescriptions. Considerable value is placed on experimental work dealing with intraspecific variability (Roman & Hirschmann, 1969; Tarte & Mai, 1976*a, b;* Tarjan & Frederick, 1978; Corbett & Clark, 1983). Diagnostic characters used were rated according to their frequency of usage in the literature and their relative lack of intraspecific variability. The number of lip annules carried considerable weight in differentiating species, primarily because this was the most widely used, most consistent, and most reliable (Corbett & Clark, 1983) criterion available when an adequate number of specimens are observed. The most important biometrics for separating species, because of comparatively less intraspecific variability and low coefficients of variability, were stylet length (Roman & Hirschmann, 1969; Tarjan & Frederick, 1978) and vulva percentage (Roman & Hirschmann, 1969; Tarte & Mai, 1976*a*). Annulations around the tail terminus usually were used as a secondary diagnostic character, although a degree of variability in this morphological part dictates judicious appraisal by the observer. Body length and number of tail annules, although not as reliable, were used for further separation of some species which showed consistent differences. Presence or absence of males were considered only for those species where there had not yet been conflicting reports on their presence (e.g. *P. penetrans*).

In order to set ranges for biometric data and attempt to determine points of separation between species while minimizing variation in data by individual observers, averages of published population data on a species were calculated wherever possible. An overall average for particular measurements or ratios from various publications dealing with a species was made only from individual averages furnished within those publications. For example, if four publications furnished biometric data on a particular species with only two giving an average for stylet length, only those two averages were used to calculate the " overall average ".

Other than those species discussed in the following two sections of rejections and retentions, all of the rejections from the genus listed by Loof (1978) are accepted.

PRATYLENCHUS SPECIES REJECTIONS

Pratylenchus agilis Thorne & Malek, 1968

The number of specimens on which the description of this species was based is unknown since only a stylet range was presented and there was no mention of variability in the other diagnostic characters. *P. agilis* was compared to only one species, *P. scribneri* Steiner, 1943, from which it differs by longer stylet (16-18 µm *vs* 14-16 µm) and a fewer number of tail annules (16 *vs* 18-22). Loof (1978) expressed doubts about the validity of this species; we regard *P. agilis* as *species inquirenda.*

Pratylenchus australis Valenzuela & Raski, 1985

P. australis was compared to and differentiated from only two other *Pratylenchus* species in the original diagnosis. The only outstanding morphometric difference between *P. australis* from Chile and *P. bolivianus* Corbett, 1983 from Bolivia is in the " b " ratio which usually shows high intraspecific variability and is considered inadequate as the only differentiating characteristic. *P. australis* was described as having heavy cephalic sclerotization whereas a similar situation was described for *P. bolivianus* in the statement " ... massive skeleton extending into body at least two annules ". *P. australis* Valenzuela & Raski, 1985 is designated a junior synonym of *P. bolivianus* Corbett, 1983.

Pratylenchus fallax Seinhorst, 1968

There are no significant morphological or biometric differences between this species and *P. cerealis* Haque, 1966, except in the much lower " a " ratio for *P. cerealis.* This most likely, is a result of *P. cerealis* having been " described from flattened specimens " (as stated by Loof, 1978) and as indicated in Fig. 2, Haque (1966). The possibility of such a condition occurring was verified by our examining glycerine-mounted specimens from which a *P. brachyurus,* mounted in 1966, exhibited the same abnormality.

The principle of priority demands that the oldest named species becomes the senior synonym, the excellence and accuracy of the description not withstanding. Accordingly, *P. fallax* Seinhorst, 1968 is synonymized to *P. cerealis* Haque, 1966, even though the description by Seinhorst is more precise than that by Haque (1966).

Pratylenchus neocapitatus Khan & Singh, 1975

There are no reliable morphometric or physical cri-

teria which separate this species from *P. neglectus* (Rensch, 1924) as indicated in the study by Loof (1960) of 900 *P. neglectus* specimens and as further described by Loof (1978). We regard *P. neocapitatus* as a junior synonym of *P. neglectus* as already alluded to by Loof (1978).

Pratylenchus obtusicaudatus Romaniko, 1977

Pratylenchus stupidus Romaniko, 1977

Pratylenchus variacaudatus Romaniko, 1977

Due to poor drawings and the lack of information, adequate comparisons could not be made. Therefore, the above three species of Romaniko (1977) are considered to be *species inquirendae.*

Pratylenchus penetrans (Cobb, 1917) Filipjev, 1936

De Man (1880) gave a brief description of *Tylenchus pratensis* which he infrequently found in moist or sandy soil of the Dutch meadows and marshes. He specifically described the tail as cone-shaped, short, and bluntly rounded. He made no mention of annulations nor did he illustrate the species. In 1884, de Man illustrated this species in Taf. XXII, Figures 95, 95 a-c. His drawings are reproduced in Figure 1. Note that de Man's drawing of the female tail (95 b) does not show any distinct evidence of terminal annulation.

Cobb (1917) erected the new species *Tylenchus penetrans,* but (at the time) made no reference of resemblances to *T. pratensis,* nor did he describe the terminus of the female tail. In 1927, he decided that *T. penetrans* " is probably a synonym of *T. pratensis* de Man ".

Steiner (1928) referred to Cobb's action in his statement " In a later note in his files he came to the conclusion that *T. pratensis* and *T. penetrans* were identical. " In referring to specimens at hand, Steiner considered those specimens " beyond doubt to be *Tylenchus penetrans* of Cobb = *T. pratensis* of de Man ". Steiner also stated " A further point in favor of considering *Tylenchus penetrans* identical with *T. pratensis* is a note in Cobb's files referring to a cablegram from the Netherlands stating that *T. pratensis* was common there in the roots of lily of the valley at the time Cobb examined roots of the same plant... " He concluded with the statement " The situation to-day, therefore, is such that *Tylenchus pratensis* de Man, 1884 must be considered as synonymous with *T. penetrans* Cobb, 1917 and *Aphelenchus neglectus* Rensch, 1924. "

Goodey (1933) also recognized *T. penetrans* as a synonym of *T. pratensis* as did Filipjev and Schuurmans Stekhoven (1941).

Thorne (1949) was the first to specifically describe and draw the tail terminus of *Pratylenchus pratensis* (de

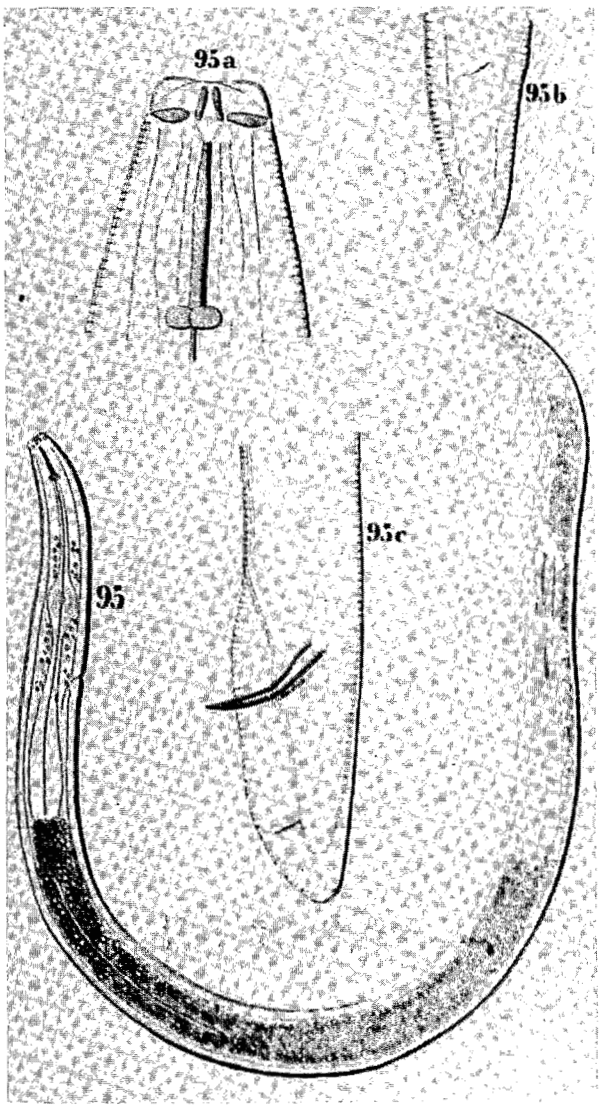

Fig. 1. *Tylenchus pratensis* de Man, 1880 (original from de Man, 1884).

Man, 1880) Filipjev, 1936 as being annulated. However, he did this on specimens sent to him " from a meadow in the vicinity of Sydenham, England, where de Man made his type collection ".

Goodey (1951) did not list *P. penetrans* as a valid *Pratylenchus* species, nor did he make reference to Thorne's figure showing a terminally annulated female tail.

Sher and Allen (1953) followed Thorne's view that the female tail terminus of *P. pratensis* was annulated, and used that feature to differentiate the species from *P. penetrans* which they considered as having a smooth tail terminus. It should be noted they decided that

Cobb's (1917) illustration of *P. penetrans* was actually that of *P. scribneri.* Loof (1960) also recognized both *P. pratensis* and *P. penetrans* as distinct species and decided that the male of *P. pratensis* described by de Man (1881) and figured in 1884 " ... might rather belong to *P. penetrans* ". Loof (1961) examined the *P. pratensis* collection of de Man and concluded that de Man's descriptions were based on specimens collected near Leiden, Holland and not Sydenham, England. He designated as lectotype an adult female and illustrated the tail terminus of the specimen as having faint annulation in outer contour.

We recognize Loof as a competent observer and accept his drawing of what he observed as the female tail of *P. pratensis* as accurate. One should take into consideration that the specimen was 80 years old and not in good condition. In support of this are his statements that the slides in the " Hollandsche Collectie " were " ... quite dried out and the condition of these specimens is highly variable " and " compared with recent preparations the nematodes in de Man's collection are always in an inferior state of preservation ". Although Loof (1961) designated as lectotype the specimen drawn by de Man, Loof's drawing of the female tail shows the anus on the left side and a tail/anal body width ratio of 2.3. De Man's drawing showed the anus on the right side and a ratio of 1.8. This indicates that the specimen was remounted and may have suffered in the process, as inferred by Loof (1961, p. 170). As previously pointed out, de Man's (1884) illustration of the female shows a smooth tail terminus and the statement by Steiner (1928) referring to de Man as " ... one of the keenest observers... " should not be disregarded.

Thorne (1949) drew an annulated female tail terminus for *P. pratensis,* which was based on specimens from Sydenham, England, that Loof determined was not the type locality. Sher and Allen (1953) accepted Thorne's description as valid, as did Loof (1960), which ostensibly fostered the current view of *P. pratensis* having only an annulated tail terminus.

Roman and Hirschmann (1969) depicted three *P. penetrans* tails with evidence of crenation almost around the terminus. They stated " ... however, the annules of this species never extend completely around the terminus. " Tarte and Mai (1976) worked exclusively with *P. penetrans.* They reported that a population originating from a single gravid female exhibited pronounced heteromorphism. There were several shapes of stylet knobs, " ... 50 % of them were anteriorly flattened or indented. " Also that the shape of the spermatheca was from round to oval, that approximately 30 % of the females had a crenate tail terminus, and that " ... host plant was most effective in inducing changes in this qualitative character. "

The foregoing demonstrates that *P. penetrans* can have from distinctly annulated to non-annulated tail termini. Cobb, Steiner and Goodey recognized the conspecificity of *P. penetrans* with *P. pratensis;* we choose to agree.

Pratylenchus pratensisobrinus Bernard, 1984

Bernard (1984) admitted that this species " closely resembles *P. pratensis* (de Man, 1880) Filipjev, 1936 and could conceivably be considered an extreme variant of that species ". We agree with this view after comparisons of his measurements and drawings with those of other authors on *P. pratensis.* Accordingly, *P. pratensisobrinus* Bernard, 1984 is regarded a junior synonym of *P. pratensis* (de Man, 1880) Filipjev, 1936.

Pratylenchus sefaensis Fortuner, 1973

Fortuner (1973) did not specifically compare this species with *P. pseudopratensis* Seinhorst, 1968, the description of which was later bolstered by the two supplemental descriptions of this species offered by Geraert, Zepp and Boranzanci (1975) and Brzeski and Szczygiel (1977). As compared to Seinhorst's data, or the average of morphometric data of the three accounts referred to above, *P. sefaensis* Fortuner, 1973 cannot be adequately separated and is considered a junior synonym of *P. pseudopratensis* Seinhorst, 1968.

Pratylenchus singhi Das & Sultana, 1979

P. singhi is almost identical with *P. delattrei* Luc, 1958 except for the presence of a spermatheca filled with sperm. A spermatheca can be almost indistinguishable unless it is filled with sperm. Males may be formed in some species only in times of biological stress. With these facts in mind, along with the knowledge that the description was based on only seven specimens, it is concluded that *P. singhi* is conspecific with *P. delattrei.*

Pratylenchus uralensis Romaniko, 1966

Although the author claims to have collected 27 specimens, he presents a minimum of biometric data, without any ranges for individual measurements. We feel that the species is closely related to those species in the " *pratensis* group " but Romaniko's illustrations are not adequate to determine additional critical details for comparison with other taxa in the group. For these reasons we choose to regard this species as *species inquirenda.*

Pratylenchus ventroprojectus Bernard, 1984

It appears likely that Bernard (1984) was unaware of the work by Ryss (1982) describing *P. kralli.* Biometric

data for *P. kralli* and *P. ventroprojectus* are similar, as are the shapes of tail termini and male biometric data. Accordingly, *P. ventroprojectus* is regarded as a junior synonym of *P. kralli.*

PRATYLENCHUS SPECIES RETENTIONS

Pratylenchus barkati Das & Sultana, 1979

The description of *P. mulchandi* Nandakumar & Khera, 1970 was based on 55 females, whereas that for *P. barkati* was on ten females. There are few diagnostic differences in morphology or biometrics between these two species. The post uterine sac of *P. barkati* is short (one vulval body width) and a spermatheca was described, whereas the post uterine sac of *P. mulchandi* is longer (greater than 1-1/2 widths) and a spermatheca was not mentioned. In addition, *P. barkati* was reported to have an annulated terminus, although this could not be confirmed from the illustrations which were small and substandard. *P. mulchandi* was reported to have a smooth tail terminus, sometimes " ... with feeble, indistinct and irregular striae ". Although we do not consider the above-mentioned differences as being major, the two species are tentatively regarded as distinct and placed within the *P. pratensis* group of related species.

Pratylenchus clavicaudatus Baranovskaya & Haque, 1968

Loof (1978) regarded this species as " provisionally identical with *P. crenatus* ". The original description and figures clearly point to four annules in the labial region. Although Loof stated that *P. crenatus* occasionally has two or four lip annules, the four descriptions of the species by other authors mention only three lip annules. On this basis alone we feel that *P. clavicaudatus* Baranovskaya & Haque, 1968 should retain its validity until additional observations of this species are made.

Pratylenchus crenatus Loof, 1960

The investigation by Loof (1960) establishing the validity of this species based on 131 specimens clearly defined the criteria for identification of this species. Subsequently, additional data were offered by Wilski (1964), Corbett (1970), van den Berg (1971), Szczygiel (1974), and Loof (1978) which adhered closely to the original concept for identification of *P. crenatus.* Van den Berg (1986) described twelve specimens of a population which almost all had clavate tail shapes and a stylet length range of 18.6 µm (18.1-19.2). The tail shape of her population is reminiscent of *P. clavicaudatus* Baranovskaya & Haque, 1968, which Loof (1978) provisionally synonymizes with *P. crenatus,* a synonymy with which we cannot agree because Baranovskaya and Haque were quite specific that the labial region of their population (n = 15) bears four clearly defined annules. Van den Berg's (1986) population is described as having " ... lip annules indistinct, mostly three, but in some specimens they appear to be two ". In addition, the stylet length of her population clearly is greater than that ascribed for *P. crenatus* or *P. clavicaudatus.*

We regard *P. crenatus* of van den Berg (1986) as distinct and to be *species inquirenda.*

Pratylenchus impar Khan & Singh, 1975

Loof (1978) placed this taxon in *species inquirendae* based on uncertainty in determining the true number of lip annules and on similarities with *P. zeae* Graham, 1951. The original description describes the lip region " ... with two annules having comparatively large first annule. " We have examined twelve population descriptions of *P. zeae* by different authors which place number of lip annules at three (rarely four). We do not feel that the original description can summarily be judged in error; we regard *P. impar* as valid pending further studies on the species.

Pratylenchus manohari Quraishi, 1982

P. manohari was proposed on the basis of five specimens. In the diagnosis, it was compared only to *P. pinguicaudatus* Corbett, 1969. No morphological feature or biometrics distinguish this species from *P. fallax* Seinhorst, 1968 except for number of tail annules which are reported as 13-15, but depicted as about 17. The variability of this feature, coupled with the limited number of specimens found, prompt comparisons of this species with *P. cerealis* Haque, 1966, *P. fallax* Seinhorst, 1968 (= *P. cerealis*) and *P. mulchandi* Nandakumar & Khera, 1970 with which very close similarities exist.

Pratylenchus pinguicaudatus Corbett, 1969

The original differential diagnosis stated that *P. pinguicaudatus* differed " from all but five species of *Pratylenchus* in having three head annules, a smooth tail tip and no males ". Unfortunately, *P. andinus* Lordello, Zamith & Boock, 1961, which fulfills all of the criteria above, was not considered until its neotype description was made by Corbett (1983). His account claimed that *P. andinus* differed from *P. pinguicaudatus* in head pattern (viewed by SEM), in head shape and in sclerotization, in having a more robust stylet (16-20 *vs*

15-17 µm), and a much longer esophageal overlap. Head shape and sclerotization are subjective differences and are not sufficient to objectively differentiate the two species. The range of stylet lengths of *P. andinus* (15-17 µm) is slightly smaller than that stated for *P. pinguicaudatus* (16-20), however, the overlap in ranges precludes exclusive use of that statistic as a sole differentiating character. Esophageal length has been shown to have the highest coefficient of variability for individuals of the same population of *P. penetrans* cultured on different hosts (Tarte & Mai, 1976*a*) while Goodey (1952) showed that considerable diversity in lengths and sizes of gonads existed according to host within the same population of *Ditylenchus destructor*. *P. pinguicaudatus* was isolated from wheat roots and soil while *P. andinus* came from potato roots and soil. It is conceivable that esophageal overlap and length could similarly have been influenced by host. An additional differentiating character between the two species is the number of tail annules (*P. andinus* : 16-19; *P. pinguicaudatus* : 19-25).

Based on the foregoing, the extreme similarity of *P. andinus* and *P. pinguicaudatus* cannot be overlooked, however, we regard both species as being valid pending further investigation.

Pratylenchus sensillatus Anderson & Townshend, 1985

This species, in its diagnosis, was compared only to nominal species possessing three head annules, a smooth tail terminus, and without a functional spermatheca and males. It was not compared to *P. vulnus* Allen & Jensen, 1951, presumably because of the absence of males. Van den Berg (1971) described this species from four different locations; males were found at only one location and composed only 6 % of the population which discounts the omnipresence of males with females in *P. vulnus*. The tail termini of *P. vulnus* have been illustrated as quite variable by Roman and Hirschmann (1969) and van den Berg (1971) and similar to those illustrated for *P. sensillatus*. Despite these similarities, *P. sensillatus* can be separated by some diagnostic criteria, as shown in the key, and is retained as a valid species.

Pratylenchus similis Khan & Singh, 1975

Loof (1978) synonymized *P. similis* to *P. neglectus* (Rensch, 1924) on the basis of what we assume was his reexamination of the four specimens from Jadid. In doing so, he found that the stylet length was 16 µm, and not 13-14 µm, as originally reported. The synonymy was made on his apparent assumption that the reported stylet lengths for the primary types were also in error. Although we do not regard his assumption unreasonable, we nonetheless feel that the synonymy is invalid until the primary types can be reexamined and the reported measurements found to be invalid.

Pratylenchus thornei Sher & Allen, 1953

The demanian formulae, stylet length range, number of tail annules, and length of posterior uterine sac either coincide or closely overlap between this species and *P. pratensis*. The differentiating criteria for this species were stated by Sher and Allen (1953) to be a " ... peculiar lateral sclerotization of the lip region and round blunt tail ". Of these criteria, only the tail shape appears to be valid and has been used primarily for diagnosis by a number of authors (Loof, 1960; Brzeski, 1968; Corbett, 1970; van den Berg, 1971; Inserra, Zepp & Vovlas, 1979). One differing view has been proposed by Singh and Khan (1981), who studied morphological variation of *P. thornei* and depicted a variety of tail shapes from truncate to narrowly rounded. It should be pointed out that their studies presumably were on populations from field soil, and subject to query since the nematodes were not propagated under controlled conditions. *P. thornei* has never been synonymized with another species and we still considered it to be valid, however, its close similarity to *P. pratensis* should be noted.

THE " *PRATENSIS* GROUP " OF SPECIES

The " *pratensis* group " consists of sixteen species (marked by an asterisk in the list which follows) and their synonyms, which show close resemblance to *P. pratensis*. Members of this group, for which there are few, if any, distinct specific features, bear three lip annules, and cannot be separated conveniently on the basis of biometrical measurements because of overlapping ranges. Whereas one might conveniently separate *P. pseudopratensis* from *P. barkati* on the basis of stylet length (13-15 *vs* 18-19 µm), *P. sudanensis* (14-16 µm) and *P. pinguicaudatus* (16-19 µm) form a " bridge " between the species creating the problem of separation within the confines of a key. Perhaps the most distinctive separating feature ordinarily would be regarded as tail shape and terminus crenation. The work of Tarte and Mai (1976 *a*, *b*), showing the wide range of tail shapes and annulation obtained in greenhouse cultures of *P. penetrans* (= *P. pratensis*), tends to negate the utility of these diagnostic features. We feel it is an exercise in futility to attempt a key for the " *pratensis* group " of species and prefer to let the reader make his own decision as to specimen identity based on the diagnostic data presented in Table 2. Diagnostic data for all *Pratylenchus* species we consider valid, including those we consider as new synonyms, are present in Tables 1 and 2. A list of nominal species of *Pratylenchus* is given below.

Table 1

Diagnostic values for *Pratylenchus* species (females), excluding those belonging to " *pratensis* group ".

Species	L (µm)	a	c	V	Stylet (µm)	Lip annules	Tail annules	Tail code*
agilis	500	24	18	76	—	2	16	hem/
	—	—	—	—	16-18	—	—	smo
alleni	380	—	—	80	14	2	—	shm/
	330-440	19-27	15-25	78-83	13-15	—	15-19	smo
andinus	—	—	—	—	—	3	—	shm/
	540-560	21-22	27-28	81-85	17-18	—	—	smo
australis	630	—	—	81	19	3	22	cla-blp/
	570-720	25-33	16-22	77-83	18-20	—	—	smo
bolivianus	590	—	—	81	19	3	—	shm-blp/
	530-630	26-29	16-21	80-82	17-20	3-4	15-19	smo
brachyurus	570	22	20	86	19	2	—	trc-shm/
	480-660	17-25	16-23	83-88	18-20	—	15-21	smo
clavicaudatus	380	20	22	82	16	4	—	cla/
	290-430	17-27	18-26	79-89	14-17	—	—	ann
coffeae	580	25	21	79	16	2	—	hem-blp/
	460-630	21-30	17-27	76-82	15-17	—	17-24	smo
crassi	—	—	—	—	—	2	—	blp/
	410-450	20-26	18-24	72-77	17-18	—	12-15	smo
crenatus	570	28	19	82	17	3	—	cla-shm/
	430-570	23-32	18-25	80-84	16-18	—	21-25	ann
cruciferus	730	33	22	77	16	3	—	hem/
	650-790	26-40	19-28	76-81	15-16	—	—	smo
ekrami	530	29	21	80	12	3	—	var/
	430-630	20-39	17-30	79-83	11-13	—	26-40	smo-cft
emarginatus	—	—	—	—	15	3	—	hem-shm/
	280-400	18-24	14-21	68-73	—	—	19-20	smo-cft
estoniensis	—	—	—	—	—	2	—	hem/
	330-500	17-28	16-22	79-86	15-17	—	—	ann
flakkensis	430	26	17	76	16	2	—	hem-blp/
	400-520	21-31	13-19	72-78	14-17	—	19-24	smo-ann
gibbicaudatus	480	20	15	73	15	2	30	trc-shm/
	410-530	16-30	13-19	69-77	14-16	—	24-39	ann-cft
goodeyi	—	—	—	—	—	4	—	fnp-dig/
	640-680	27-37	16-18	73-75	16-17	—	—	smo
hexincisus	440	24	19	78	15	2	23	shm/
	360-530	19-30	17-23	75-82	14-16	—	—	smo
impar	400	22	17	69	15	2	28	shm-blp/
	370-430	22-23	13-25	68-73	15-17	—	20-35	smo
jordanensis	490	29	18	78	15	2	21	hem-shm/
	380-590	26-32	16-25	75-79	14-15	—	19-24	smo-cft
kasari	—	—	—	—	—	3	—	fnp/
	560-770	32-44	16-20	75-81	16-17	—	32-44	ann
loosi	580	32	20	82	—	2	—	fnp/
	480-640	28-36	18-25	79-85	14-18	—	—	smo
macrostylus	—	—	—	—	—	2	—	var/
	510-680	22-33	16-24	85-88	21-25	2-3	17-26	smo-cft
microstylus	390	22	18	76	—	3	—	hem-blp/
	330-460	19-26	16-22	75-77	11 or 12	—	—	smo
morettoi	740	34	15	76	16	—	—	fnp-dgt
	560-930	26-40	13-19	73-80	14-19	3-4	—	
neglectus	490	27	21	82	17	2	—	shm-blp/
	410-530	23-31	17-23	80-84	16-18	—	16-21	smo
neocapitatus	460	24	19	82	15	2	—	hem/
	400-490	21-28	16-21	79-85	15-17	—	17-20	smo
nizamabadensis	—	—	—	—	—	4	—	hem/
	410-520	23-27	17-27	67-79	17-19	—	15-24	ann
obtusicaudatus	—	—	—	77	15	—	—	trc/
	400-470	21-22	20-22	—	—	—	—	smo
ranjani	530	28	17	75	16	4	—	hem-shm/
	490-600	24-32	13-23	73-78	15-17	—	25-35	smo
scribneri	490	24	17	77	15	2	—	shm-blp/
	410-590	20-28	15-20	74-80	14-16	—	18-22	smo
sensillatus	621	34	24	79	16	3	20	trc-hem/
	570-685	28-42	20-31	77-81	15-17	—	14-25	smo-cft
similis	440	27	15	80	12	2	—	shm/
	420-480	23-32	12-24	77-83	12-13	—	16-18	ann
stupidus	—	—	—	77	15	—	—	shm
	390-480	17-17	13-13	—	—	—	—	
teres	500	27	16	72	17	3	—	shm/
	450-550	24-31	13-20	70-77	17-18	—	24-30	ann
typicus	—	—	—	—	—	4	—	blp/
	590-680	27-37	10-26	79-84	15-17	4-5	24-26	smo
uralensis	530	24	22	73	14	3	—	trc
	—	—	—	—	—	—	—	
variacaudatus	—	—	—	80	15	—	—	var
	420-500	14-15	17-18	—	—	—	—	
vulnus	620	30	20	78	15	—	—	blp/
	500-750	25-37	16-24	76-81	14-16	3-4	22-29	smo-cft
wescolagricus	600	29	21	81	18	4	—	hem-shm/
	500-680	25-32	17-25	79-82	17-19	3-4	16-20	smo

* See Fig. 2 (var = too much variation in shape to list in the table).

Table 2

Diagnostic values for *Pratylenchus* species (females).
Species belonging to " *pratensis* group ".

Species	*L* (µm)	*a*	*c*	*V*	*Stylet* (µm)	*Lip annules*	*Tail annules*	*Tail code**
barkati	—	—	—	—	—	3	—	shm/
	490-550	25-29	17-21	74-79	18-19	—	—	ann
cerealis	—	—	—	—	—	3	—	shm/
	420-480	14-17	19-19	79-80	15-16	—	—	ann
convallariae	540	29	18	79	17	3	—	hem-shm/
	490-600	22-30	17-24	77-81	15-18	—	16-19	cft-ann
dasi	—	—	—	—	—	3	—	shm/
	450-560	23-31	14-21	72-78	18-19	—	—	smo
delattrei	—	—	—	75	—	3	—	shm-blp/
	390-470	20-26	18-22	73-80	16-18	—	—	smo
exilis	—	—	—	—	—	3	—	shm-blp/
	490-560	30-34	15-20	73-76	17-18	—	17-20	ann
fallax	480	27	19	80	—	3	—	hem-blp/
	400-530	23-32	17-23	77-82	15-17	—	16-26	smo-ann
kralli	—	—	—	—	—	3	—	blp/
	400-500	20-33	17-23	74-80	14-15	—	16-23	smo
manohari	—	—	—	—	—	3	—	hem/
	420-510	17-25	18-20	78-80	15-18	—	13-15	smo
mediterraneus	510	27	21	78	15	3	—	hem-trc/
	430-580	24-31	17-25	77-80	14-16	—	15-22	smo
mulchandi	510	24	22	77	—	3	—	trc-shm-blp/
	440-580	22-28	17-27	75-78	16-20	—	16-22	smo
penetrans	540	27	20	79	16	3	—	hem-blp/
	450-620	22-30	16-23	77-83	15-17	—	15-27	smo-ann
pinguicaudatus	550	26	19	81	18	3	—	hem/
	470-610	22-29	16-21	78-82	16-19	—	19-25	smo
pratensis	520	25	19	75	16	3	—	shm-blp/
	470-590	22-28	15-21	74-78	14-16	—	23-28	smo-ann
pratensisobrinus	480	28	14	77	16	3	—	shm-blp/
	390-560	25-31	12-15	75-80	15-17	—	23-27	ann-smo
pseudopratensis	400	25	22	79	14	3	—	hem-shm/
	380-510	22-29	19-27	76-80	13-15	3-4	14-20	smo
sefaensis	450	27	21	78	14	3	—	hem/
	400-530	25-31	19-24	77-80	13-16	—	16-23	smo-cft
singhi	—	—	—	—	—	3	—	shm/
	440-490	20-25	18-23	75-77	17-18	—	—	smo
subpenetrans	400	24	18	80	16	3	—	shm/
	330-480	18-28	16-21	77-83	15-16	—	—	smo
sudanensis	—	—	—	73	—	3	—	shm/
	390-590	22-31	14-23	70-76	14-16	—	18-23	smo
thornei	540	33	20	76	17	3	—	trc/
	460-610	26-34	18-24	75-79	15-18	—	20-29	smo
ventroprojectus	440	30	19	79	15	3	—	sbd/
	390-480	27-35	14-22	78-80	14-16	—	—	smo/cft
zeae	490	23	16	73	16	3	25	blp/
	380-570	19-29	13-19	69-75	15-17	—	21-26	smo-ann

* See Fig. 2.

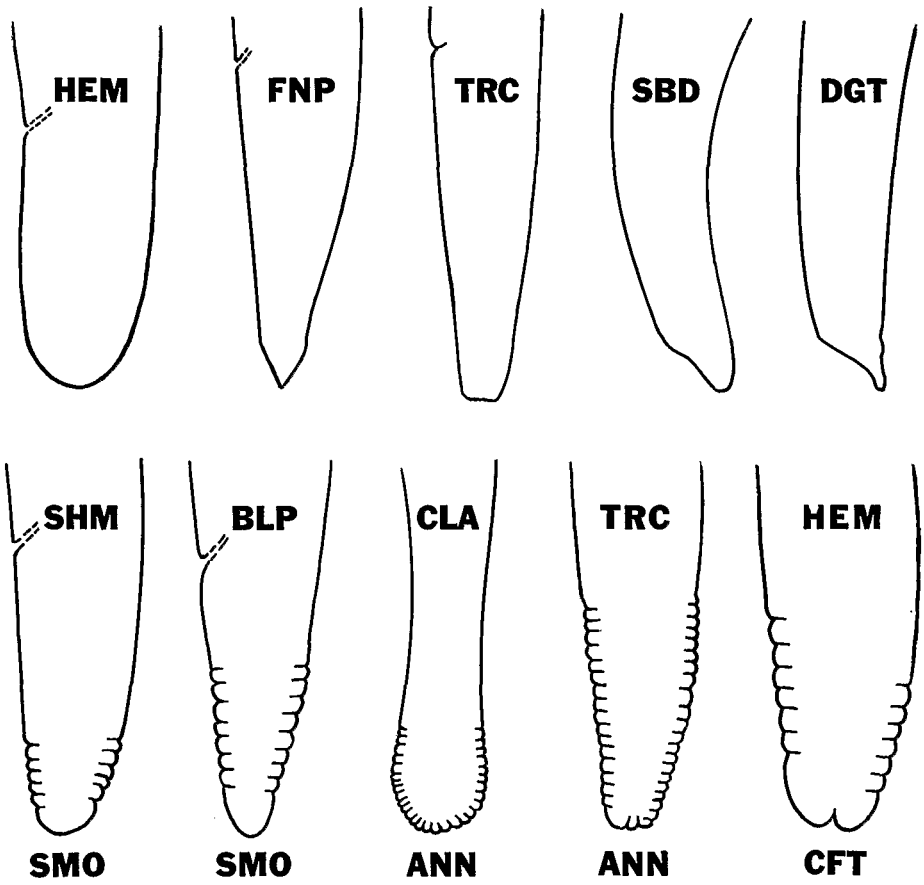

Fig. 2. *Pratylenchus* species. Tail tip shape and tail tip annulation codes. Tail tip shapes : BLP = blunty pointed; DGT = digitale; FNP = finely pointed; HEM = hemispherical; SBD = subdigitate; SHM = subhemispherical; TRC = truncate. Tail tip annulation : ANN = annulated; CFT = cleft; SMO = smooth; CLA : clavate.

PRATYLENCHUS SPECIES LIST

TYPE SPECIES

**P. pratensis* (de Man, 1880) Filipjev, 1936
= *Tylenchus pratensis* de Man, 1880
= *Anguillulina pratensis* (de Man, 1880) Goffart, 1929
= *P. globulicola* Romaniko, 1960
= *P. gulosus* (Kühn, 1890) Filipjev & S. Stekhoven, 1941
= *P. helophilus* Seinhorst, 1959
= *P. irregularis* Loof, 1960
= *P. penetrans* (Cobb, 1917) Filipjev & S. Stekhoven, 1941 (n. syn.)
= *P. pratensisobrinus* Bernard, 1984 (n. syn.)

* Species belonging to the " *pratensis* group ".

OTHER SPECIES

P. alleni Ferris, 1961
P. andinus Lordello, Zamith & Boock, 1961
**P. barkati* Das & Sultana, 1979
P. bolivianus Corbett, 1983
= *P. australis* Valenzuela & Raski, 1985 (n. syn.)
P. brachyurus (Godfrey, 1929) Filipjev & S. Stekhoven, 1941
= *P. leiocephalus* Steiner, 1949
= *P. steineri* Lordello, Zamith & Boock, 1954
**P. cerealis* Haque, 1966
= *P. fallax* Seinhorst, 1968 (n. syn.)
= *P. manohari* Quraishi, 1982 (n. syn.)
P. clavicaudatus Baranovskaya & Haque, 1968
P. coffeae (Zimmermann, 1898) Filipjev & S. Stekhoven, 1941

= *P. mahogani* (Cobb, 1920) Filipjev, 1936
= *P. musicola* (Cobb, 1919) Filipjev, 1936
**P. convallariae* Seinhorst, 1959
P. crassi Das & Sultana, 1979
P. crenatus Loof, 1960
P. cruciferus Bajaj & Bhatti, 1984
**P. dasi* Fortuner, 1985
= *P. capitatus* Das & Sultana, 1979 *nec* Ivanova, 1968
= *P. hyderabadensis* Das & Sultana, 1986
**P. delattrei* Luc, 1958
= *P. singhi* Das & Sultana, 1979 (n. syn.)
P. ekrami Bajaj & Bhatti, 1984
P. emarginatus Eroshenko, 1978
P. estoniensis Ryss, 1982
**P. exilis* Das & Sultana, 1979
P. flakkensis Seinhorst, 1968
P. gibbicaudatus Minagawa, 1982
P. goodeyi Sher & Allen, 1953
P. hexincisus Taylor & Jenkins, 1957
P. impar Khan & Singh, 1975
P. jordanensis Hashim, 1983
P. kasari Ryss, 1982
**P. kralli* Ryss, 1982
= *P. ventroprojectus* Bernard, 1984 (n. syn.)
P. loosi Loof, 1960
P. macrostylus Wu, 1971
**P. mediterraneus* Corbett, 1983
P. microstylus Bajaj & Bhatti, 1984
P. morettoi Luc, Baldwin & Bell, 1986
**P. mulchandi* Nandakumar & Khera, 1970
P. neglectus (Rensch, 1924) Filipjev & S. Stekhoven, 194
= *P. capitatus* Ivanova, 1968
= *P. minyus* Sher & Allen, 1953
= *P. neocapitatus* Khan & Singh, 1975 (n. syn.)
P. nizamabadensis Maharaju & Das, 1981
**P. pinguicaudatus* Corbett, 1969
**P. pseudopratensis* Seinhorst, 1968
= *P. sefaensis* Fortuner, 1973 (n. syn.)
P. ranjani Khan & Singh, 1975
P. scribneri Steiner, 1943
P. sensillatus Anderson & Townshend, 1985
P. similis Khan & Singh, 1975
**P. subpenetrans* Taylor & Jenkins, 1957
**P. sudanensis* Loof & Yassin, 1971
P. teres Khan & Singh, 1975
P. thornei Sher & Allen, 1953
P. typicus Rashid, 1974
P. vulnus Allen & Jensen, 1951
P. wescolagricus Corbett, 1983
**P. zeae* Graham, 1951
= *P. cubensis* Razjivin & O'Relly, 1976

SPECIES INQUIRENDAE VEL DUBIAE

P. agilis Thorne & Malek, 1968 (nov. auct.)
P. bicaudatus (Meyl, 1954) Meyl, 1961
P. brevicercus Das, 1960
P. chrysanthus Edward, Misra, Rai, & Peter, 1969
P. coffeae brasiliensis Lordello, 1956
P. coffeae brevicauda Rahm, 1928
P. heterocercus (Kreis, 1930) Sher & Allen, 1953
P. indicus Das, 1960
P. montanus Zyubin, 1966
P. obtusicaudatus Romaniko, 1977 (nov. auct.)
P. obtusus (Bastian, 1865) Goodey, 1951 *species dubia*
P. pratensis bicaudatus Meyl, 1954
P. pratensis tenuistriatus Meyl, 1953
P. sacchari Soltwedel, 1888
P. stupidus Romaniko, 1977 (nov. auct.)
P. tenuis Thorne & Malek, 1968
P. tulaganovi Samibaeva, 1966
P. tumidiceps Merzheevskaya, 1951
P. uralensis Romaniko, 1966 (nov. auct.)
P. variacaudatus Romaniko, 1977 (nov. auct.)

KEY TO *PRATYLENCHUS* SPECIES (FEMALES)

1. — Two (rarely three) lip annules 2
— More than two lip annules 16
2. — Striations completely around tail terminus 3
— Tail terminus smooth, indented or cleft 6
3. — Stylet less than 14 µm (mean) ..... *P. similis*
— Stylet greater than 14 µm (mean) 4
4. — V greater than 79 (mean) ..... *P. estoniensis*
— V less than 79 (mean) 5
5. — Tail annules = 18 to 24 ..... *P. flakkensis*
— Tail annules = 24 to 39 ..... *P. gibbicaudatus*
6. — Stylet greater than 18 µm (mean) 7
— Stylet less than 18 µm (mean) 8
7. — Stylet greater than 21 µm (mean) .... *P. macrostylus*
— Stylet less than 21 µm (mean) ..... *P. brachyurus*
8. — V less than 72 (mean) ..... *P. impar*
— V greater than 72 (mean) 9
9. — Average L = 580 µm (460-640) 10
— Average L = 458 µm (330-590) 11
10. — V = 78 (76-82); a = 25 (21-30) ..... *P. coffeae*
— V = 82 (79-85); a = 32 (28-36) ..... *P. loosi*
11. — Average stylet = 15 µm (13-16) 12
— Average stylet = 17 µm (17-18) 15
12. — Average L = 380 µm (330-440); V = 80 % (78-83); tail annules = 15-19 ..... *P. alleni*
— Average L = 440 µm or greater (360-590); V = 78 or less (75-82); tail annules = 18-23 13
13. — Lateral field with six incisures ..... *P. hexincisus*
— Lateral field with four incisures 14
14. — Tail terminus slightly indented; a = 29 (26-32) ..... *P. jordanensis*
— Tail terminus not indented, a = 24 (20-28) ..... *P. scribneri*
15. — V = 72-77; 12-15 tail annules ..... *P. crassi*
— V = 80-84; 16-21 tail annules ..... *P. neglectus*
16. — Usually three lip annules 17

— Usually four lip annules 29
17. — Stylet = 13 µm or less 18
— Stylet greater than 13 µm 19
18. — L = 530 µm (430-630); V = 80 (79-83) *P. ekrami*
— L = 390 µm (330-460); V = 76 (75-77) ..... *P. microstylus*
19. — L less than 400 µm ..... *P. emarginatus*
— L greater than or equal to 400 µm 20
20. — L greater than 560 µm (mean) 21
— L less than 560 µm (mean) 27
21. — Tail with a terminal projection ..... *P. morettoi*
— Tail without a terminal projection 22
22. — V = 80 or greater (mean) 23
— V less than 80 (mean) 24
23. — Less than 20 tail annules; L = 530-630 µm; stylet = 19 µm (17-20) ..... *P. bolivianus*
— More than 20 tail annules; L = 430-570 µm; stylet = 17 µm (16-18) ..... *P. crenatus*
24. — L greater than 700 µm (mean) ..... *P. cruciferus*
— L less than 700 µm (mean) 25
25. — More than 30 tail annules ..... *P. kasari*
— Less than 30 tail annules 26
26. — Stylet = 16 µm (15-17); tail annules = 14-25; a = 34 (28-42); c = 24 (20-31) ..... *P. sensillatus*
— Stylet = 15 µm (14-16); tail annules = 22-29; a = 30 (25-37); c = 20 (16-24) ..... *P. vulnus*
27. — V = 81-85; c = 27-28 ..... *P. andinus*
— V = 81 or less; c = 23 or less 28
28. — Lateral field with six incisures ..... *P. teres*
— Lateral field with four incisures " *pratensis* group "*
29. — Tail terminus clavate ..... *P. clavicaudatus*
— Tail terminus hemispherical to finely rounded 30
30. — Tail terminus annulated ..... *P. nizamabadensis*
— Tail terminus smooth 31
31. — V greater than or equal to 80 32
— V less than 80 33
32. — More than 22 tail annules; stylet = 15-17 µm ..... *P. typicus*
— Less than 22 : tail annules; stylet = 17-19 µm ..... *P. wescolagricus*
33. — Tail terminus finely rounded, sometimes almost digitate ..... *P. goodeyi*
— Tail terminus truncate to hemispherical; no males ..... *P. ranjani*

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