

*Pratylenchus subranjani* n. sp. (Nematoda: Pratylenchidae)  
from Maize in Thailand

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*Pratylenchus subranjani* n. sp. is described and illustrated. Taken from the roots and rhizosphere of *Zea mays* in Saraburi province, Thailand, it is distinguished from the closely related *P. ranjani* by the presence of 3 lip annules, mostly indented spear knobs, hemizonid position (one to 3 annules anterior to excretory pore), and higher E.P. value (14.3-18.1%). SEM observation shows a plain undivided *en face* and sparsely areolated lateral fields.

#### INTRODUCTION

Crop damage by *Pratylenchus* spp. has not been sufficiently documented in Thailand. However, as many as 11 species of the genus along with 3 species originally described in Thailand have been recorded from more than 30 kinds of crops, including vegetables, fruit trees and ornamental plants (CHUNRAM, 1972; BOONDUANG and PLIANSINCHAI, 1980; PLIANSINCHAI and BOONDUANG, 1978, 1986 a, b). Above all, *P. zae* GRAMAM, 1951 which has the widest host range and distribution in Thailand, has been considered a fairly important cultivated crop pest.

A new *Pratylenchus* nematode was found in maize at the Phraphutthabat district of Saraburi province. This species had been taken as *P. zae* until TOIDA and KEEREEWAN investigated the effects of organic matter amendments on the densities of some nematode parasites, including *Pratylenchus* species, in the maize fields where several kinds of organic matter or urban composts have been systematically applied for the last decade. They noticed that the *Pratylenchus* species investigated may not have been *P. zae*. We found it to be a new species by morphological investigations in Japan.

#### METHODS

Specimens were killed by gentle heating, fixed in TAF and mounted in dehydrated glycerin by SEINHORST's rapid method (1959).

For examination under the scanning electron microscope (SEM), specimens stored in glycerin were processed from 100% glycerin to water, re-fixed by 2.5% glutaralde-

hyde, processed from 20% to 100% ethanol, critical-point dried, coated with platinum-vanadium (200 Å), and examined by Hitachi X-6500 SEM at 15 kV.

*Pratylenchus subranjani* n. sp.  
(Fig. 1, A-Q; Fig. 2; Fig. 3, A-E)

*Measurements.* Female: see Table 1.

Holotype (female): L=470 µm; L'=438 µm; a=27; b=6.5; b'=3.8; c=14.5; c'=3.2; V=74.9%; V'=80.5%; spear=16.5 µm; MB=73%; G<sub>1</sub>=25%; G<sub>2</sub>=7.3%; U=2.2; Tail/V-a=37.8%; E.P.=17.0%; Ph.=66.3%.

*Description.* Females (n=40): Body curved ventrally when heat-relaxed (Fig. 1, A). Annules fine, 1.1 µm±0.14 (0.9-1.4) wide at mid-body. Lip region medium height, 3.0 µm±0.37 (2.3-3.6) high, 8.8 µm±0.66 (7.6-10.6) wide, rounded and barely

Table 1. Comparison of measurements of *Pratylenchus subranjani* n. sp. with *P. ranjani*

Criteria	<i>P. subranjani</i> n. sp.		<i>P. ranjani</i>			
	mean±SD	(range)	paratypes		holotype	Drw <sup>1</sup>
			mean	(range)		
<i>n</i>	40		12			
L (µm)	506±43.8	(386-572)	520	(470-610)	600	620
L' (µm)	473±42.2	(359-537)	489 <sup>2</sup>	—	—	586
a	27.2±1.50	(23.4-31.5)	28.3	(24.5-32.1)	31.5	26.5
b	6.5±0.63	( 5.4- 8.1)	4.3	( 3.5- 5.3)	—	8.0
b'	4.1±0.35	( 3.3- 4.8)	—	—	5.3	5.2
c	15.6±1.14	(13.2-18.3)	16.5	(11.7-21.4)	21.4	18.1
c'	2.9±0.25	( 2.5- 3.5)	>2	—	—	2.5
V (%)	74.7±0.99	(73.0-77.0)	74.1	( 74 - 80 )	75	75.1
V' (%)	79.8±1.03	(78.0-82.2)	78.7 <sup>2</sup>	—	—	79.5
VL (µm)	378±33.9	(282-433)	385 <sup>2</sup>	—	—	465
Spear (µm)	16.9±0.42	(16.2-18.5)	15	( 15 - 17 )	16	15.5
D.g.o. <sup>3</sup> (µm)	3.3±0.56	( 2.6- 5.3)	3	—	—	3.7
MB (%)	68.1±4.42	(59.1-76.9)	—	—	—	68.5
Ex. pore <sup>4</sup> (µm)	79.7±4.91	(70.0-91.7)	—	—	—	87.4
E.P. <sup>5</sup> (%)	15.8±0.90	(14.3-18.1)	—	—	—	13.4
V-a <sup>6</sup> (µm)	95.3±10.0	( 77 - 118)	104 <sup>2</sup>	—	—	116
Tail (µm)	32.5±2.7	(27.1-38.3)	31.5 <sup>2</sup>	—	—	34
Tail annules	26.6±3.1	( 21 - 33 )	—	( 25 - 35 )	—	34
Tail/V-a (%)	34±3	( 26 - 43 )	30.2 <sup>2</sup>	—	—	29.6
P.u.b. (µm) <sup>7</sup>	40.1±5.56	(29.0-53.5)	—	—	—	47
U	2.3±0.30	( 1.6- 3.0)	2	—	—	2.0
G <sub>2</sub> (%)	8.0± 1.1	( 5.4-10.7)	—	—	—	7.6
Ph. <sup>8</sup> (%)	56.0± 7.9	(39.6-77.4)	—	—	—	33.8

<sup>1</sup> Calculated from the drawings. <sup>2</sup> Calculated from the means of other available dimensions. <sup>3</sup> Dorsal esophageal gland orifice from knobs of spear. <sup>4</sup> Excretory pore from anterior body end. <sup>5</sup> Excretory pore from anterior body end as percentage of body length. <sup>6</sup> Vulva-anus distance. <sup>7</sup> Postvulval uterine branch. <sup>8</sup> Phasmids from tail terminus as percentage of tail length.

flattened anteriorly, mostly continuous to body contour or very slightly off-set. Labial framework well developed, expanding laterally, highly arched and extending into body at 2 annules. Lip annules 3 in transmitted light, although it is occasionally difficult to determine whether there are 3 or 4 lip annules due to continuous lip and highly arched labial framework (Fig. 1, B-E); the 4th annule from anterior body end observed by SEM (Fig. 3, B) is apparently the 1st body annule. SEM *en face* view, though distorted (Fig. 3, A), showed no division between sub-median and lateral segments, classified into "Group 1" of CORBETT and CLARK (1983). Six inner labial sensilla are observed. No Cephalids are seen. Spear moderately long, 1.9 times  $\pm 0.13$  (1.6-2.2) the head dia. Spear knobs massive,  $5.0 \mu\text{m} \pm 0.33$  (4.0-5.6) wide,  $1.9 \mu\text{m} \pm 0.23$  (1.4-2.3) high; shape varies from flattened anteriorly to acutely indented, calculated  $8.5 \pm 0.75$  (7-10;  $n=40$ ) using knob indices (Fig. 4), i.e. mostly in the indented conditions and by no means rounded (Fig. 1, B-G). Dorsal esophageal gland orifice at  $3.3 \mu\text{m} \pm 0.56$  (2.6-5.3) from spear base. Metacarpus oval,  $12.5 \mu\text{m} \pm 0.88$  (10.6-13.9) long,  $8.5 \mu\text{m} \pm 0.78$  (6.9-9.9) across, length 1.5 times  $\pm 0.13$  (1.2-1.8) ( $n=30$ ) of width, occupying about half of the corresponding body diameter; valve conspicuous,  $52.6 \mu\text{m} \pm 3.56$  (38.0-58.1) from anterior body end, or  $68.1\% \pm 4.42$  (59.1-76.9) of esophagus length. Esophageal gland (Fig. 1, B) thin and short, extending  $123.1 \mu\text{m} \pm 10.2$  (97.4-155.1) from anterior body end, ventrally overlapping the intestine  $45.6 \mu\text{m} \pm 8.61$  (28.4-67.3) or a distance of 2.5 times  $\pm 0.43$  (1.6-3.4) the corresponding body diameter; esophageal glands nuclei line up. Excretory pore  $103.2\% \pm 7.74$  (90.8-119.8) of esophageal length or at the  $75\text{th} \pm 4.35$  (65-85) ( $n=26$ ) body annules from anterior body end; annules between anterior body end and excretory pore  $1.1 \mu\text{m} \pm 0.11$  (0.9-1.3) in average width. Hemizonid flat, 2.5 to 4 annules long, immediately to 3 annules anterior to excretory pore; hemizonion lenticular,  $7.2 \pm 2.24$  (4-12) annules posterior to excretory pore.

Gonad outstretched,  $126.7 \mu\text{m} \pm 24.1$  (90.4-214.5) ( $n=39$ ) long or  $25.1\% \pm 4.3$  (17.4-43.5) ( $n=39$ ) of body length; ovary with oocytes in single row; spermatheca empty, rarely observed (Fig. 1, H). Post-uterine branch long, twice as long as body diameter or longer (Fig. 1, H, I), in which only the columnar part of the uterus can be recognized. Vulva plane; vulval lips slightly protruding; vagina tubular, perpendicular to body axis, rarely slightly bent anteriorly,  $8.1 \mu\text{m} \pm 0.80$  (6.6-9.9) ( $n=38$ ) long or  $45.6\% \pm 4.44$  (36.7-56.6) ( $n=29$ ) of vaginal body diameter (Fig. 1, H, I). Annules between vulva and anus  $81.6 \pm 6.0$  (67-91) in number,  $1.1 \mu\text{m} \pm 0.11$  (0.9-1.3) in average width.

Tail variable in shape (Fig. 1, J-Q, Fig. 2); sorting 40 individuals according to tail tip shape codes of FREDERICK and TARJAN (1989), their frequencies are: bluntly pointed (BLP)=53%, subhemispherical (SHM)=30%, subdigitate (SBD)=15% and truncate (TRC)=3% respectively. Presence of tail tip annules is also determined using codes of FREDERICK and TARJAN (1989) with tails in the exact lateral orientation (28 individuals); the frequencies then are: annulated (ANN)=71% (including evidently ANN=50% and barely ANN=21%), smooth (SHM)=18% and cleft (CFT)=11% respectively. Tail terminal cuticle or hyaline part  $3.0 \mu\text{m} \pm 0.6$  (1.5-4.3) thick; phasmids pore-like, centered in lateral field,  $14.2 \mu\text{m} \pm 2.64$  (7.9-19.1) behind anus or  $18.2 \mu\text{m} \pm 3.34$  (12.5-27.7) from tail tip, i.e.  $56.0\% \pm 7.9$  (39.6-77.4) of tail length.

Lateral fields  $5.2 \mu\text{m} \pm 0.52$  (4.0-6.3) wide, i.e.  $27.9\% \pm 2.54$  (23.0-33.3) of widest body diameter. In transmitted light, this structure appears to have weakly crenate margins and 3 equally spaced plain bands, which gives impression of 4 incisures. The

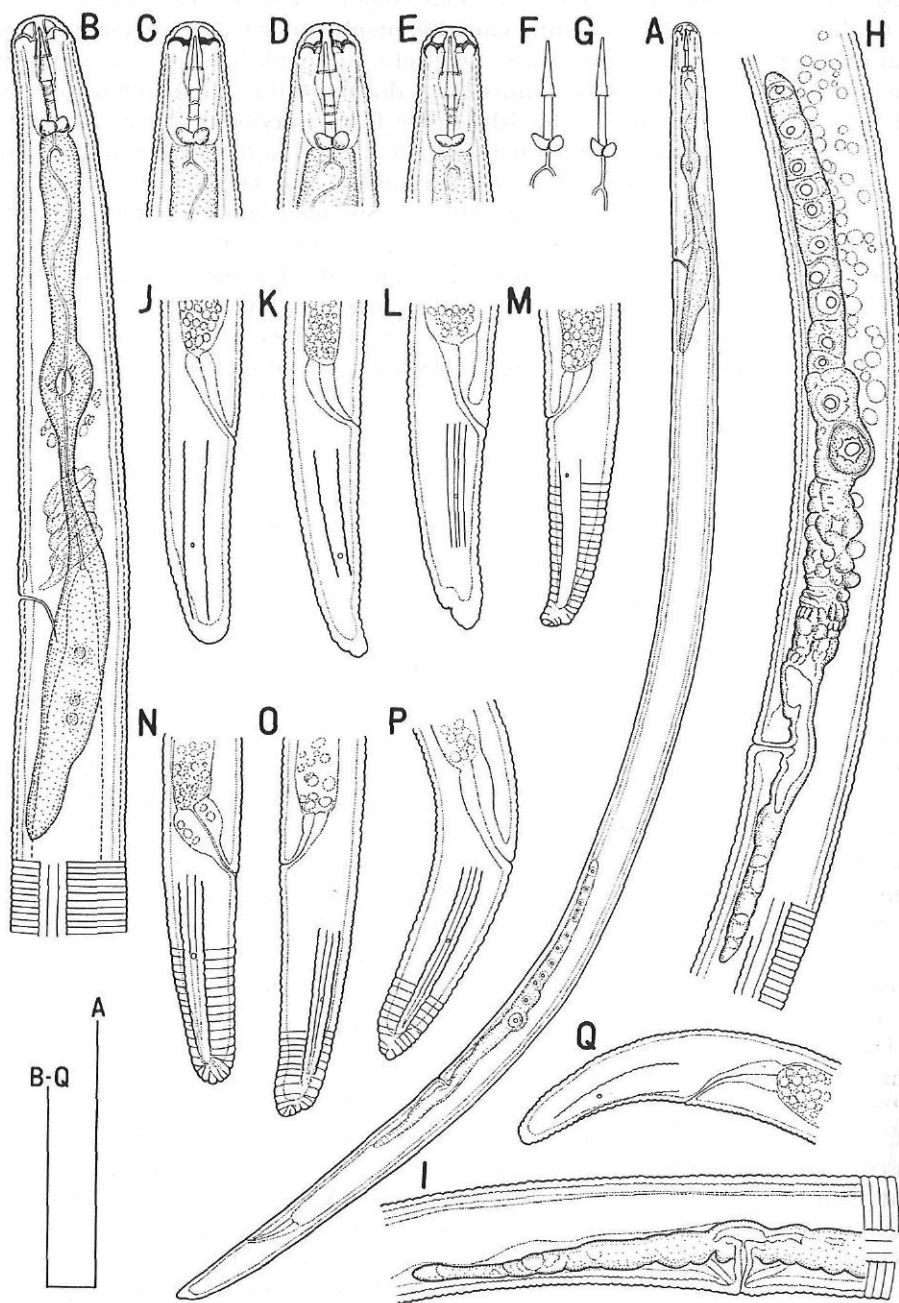


Fig. 1. *Pratylenchus subranjani* n. sp. Female. A, full length; B, esophageal region; C-E, cephalic region of other individuals (E, holotype); F-G, spears of other individuals; H, full gonads; I, longer post-uterine branch; J-Q, tail variations. Scale bars: A, 100  $\mu$ m; B-Q, 30  $\mu$ m.

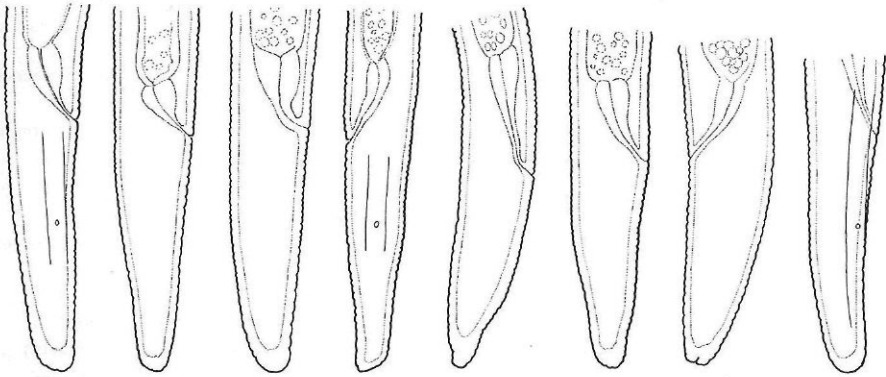


Fig. 2. *Pratylenchus subranjani* n. sp. Female. Tail variations. Scale bar: 30  $\mu$ m.

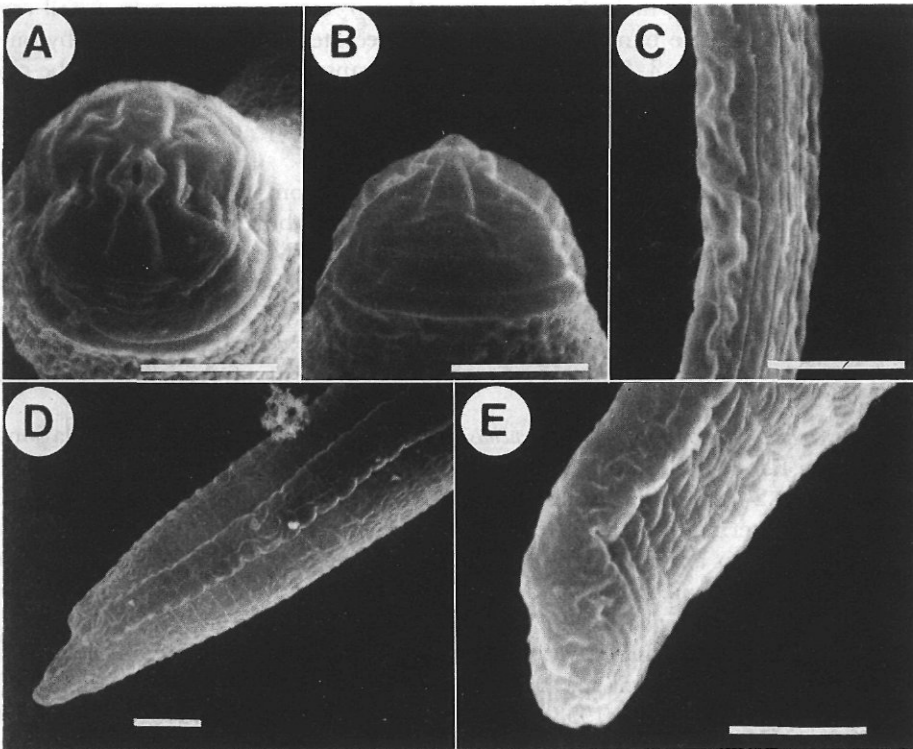


Fig. 3. SEM micrograph of *Pratylenchus subranjani* n. sp. Female. A, en face view (Scale bar=3  $\mu$ m); B, lip region in lateral view (Scale bar=3  $\mu$ m); C, lateral fields (Scale bar=3  $\mu$ m); D, E, tail (Scale bar=3  $\mu$ m).

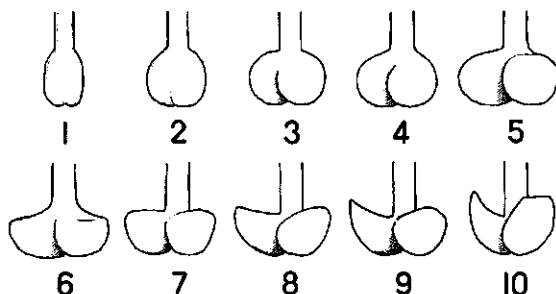


Fig. 4. Assumed transition of the spear knobs indexed as: 1) high, narrow; narrowly rounded; fused to shaft. 2) high, rounded; spherical. 3) rounded. 4) rounded sloping. 5) broadly rounded; well separated; concave. 6) laterally directed. 7) flattened anteriorly; broadly flattened; cup-shaped; rounded posteriorly. 8) sub-indentated; forwardly directed. 9) indented anteriorly; angular; tulip shaped. 10) acutely indented; forwardly pointing.

SEM photograph, however, shows that the outer bands are areolated at intervals of 2, 3 or even more annules in mid-body region (Fig. 3, C) and completely in tail region (Fig. 3, D). The middle band is often sparsely areolated and accompanied by one or 2 accessory incisures (Fig. 3, C). Lateral fields in transmitted light appear to be closed shortly before the tail tip, but they may extend to tail tip and continue around the tail terminus (Fig. 3, E).

Males: Unknown.

*Type host and locality.* Specimens were collected from roots and rhizosphere of maize, *Zea mays* at Pukae, Phraphutthabat district, Saraburi province, Thailand.

*Type material.* Collected on January 12, 1989 and May 23, 1989 by Y. TODA and S. KEEREEWAN. Holotype (female: Type no. 28-1) and paratypes (30 females and 10 juveniles) are at the Herbarium and Insect Museum of the National Institute of Agro-Environmental Sciences, Tsukuba City, Ibaraki, Japan. Paratypes (10 females) are also at the Nematology Section, Department of Agriculture, Bangkok, Thailand.

*Diagnosis and relationships.* *Pratylenchus subranjani* n. sp. shows a close relationship with *P. ranjani* KHAN and SINGH, 1975 by having rather low V-value (73–77%), rather low c-value (13.2–18.3), fine annule (0.9–1.3  $\mu\text{m}$ ), numerous tail annules (21–32), and a long post-uterine branch (29–54  $\mu\text{m}$ ). The new species can be distinguished by the presence of 3 lip annules (4 in *P. ranjani*), indented spear knobs (flattened in *P. ranjani*), position of hemizonid (1–3 annules vs. 5 annules anterior to excretory pore), E.P. value (14.3–18.1% vs. 13.4%).

The other species sharing V-values close to 73–77% or the lip regions bearing 3 or 4 annules with *P. subranjani* n. sp. are *P. barkati* DAS and SULTANA, 1979; *P. dasi* FORTUNER, 1985; *P. delattrei* LUG, 1958; *P. exilis* DAS and SULTANA, 1979; *P. goodeyi* SHER and ALLEN, 1953; *P. morettoii* LUC et al., 1986; *P. mulchandi* NANDAKUMAR and KHERA, 1970; *P. nizamabadensis* MAHARAJU and DAS, 1981; *P. pratensis* (DE MAN, 1880); *P. pseudopratensis* SEINHORST, 1968; *P. singhi* DAS and SULTANA, 1979; *P. thornei* SHER and ALLEN, 1953; and *P. zaeae* GRAHAM, 1951.

On the basis of the ranges in the measurements, the new species cannot be con-

Table 2. Characters differentiating *P. subranjani* n. sp. from relatives

Species	V	Spear ( $\mu\text{m}$ )	U	c	Knob idx <sup>1</sup>	Lip ann.	Tail ann.	Tail code <sup>2</sup>	Males code <sup>3</sup>
<i>subranjani</i> n. sp.	75 <sup>4</sup>	17	2.3	16	8.4	3	27	bip-shm/	UK
	73-77 <sup>5</sup>	16-19	1.6-3	13-18	6-10	3-4	21-33	ann-smo	
<i>barkati</i>	—	—	<b>1</b>	—	<b>9</b>	3	—	shm-sbd/	UK
	74-79	18-19	—	17-21	—	—	<b>18</b>	ann	
<i>dasi</i>	—	—	—	—	—	3	—	shm/	UK
	72-78	18-19	<b>1-1.5</b>	14-21	<b>4-5</b>	—	<b>20</b>	smo	
<i>delattrei</i>	75	—	—	—	7	3	—	shm-blp/	UK
	73-80	16-18	<b>1.3</b>	<b>18-22</b>	—	—	< <b>20</b>	smo	
<i>exilis</i>	—	—	—	—	—	3	—	shm-blp	<b>K</b>
	73-76	17-18	<b>0.9-1</b>	15-20	6-7	—	<b>17-20</b>	smo	
<i>goodeyi</i>	—	—	<b>1</b>	—	7	<b>4</b>	22	<b>fnp-dig/</b>	<b>K</b>
	73-75	16-17	—	16-18	—	—	19-24	smo	
<i>morettoii</i>	76	16	2.7	15	—	—	—	<b>fnp-dig/</b>	<b>K</b>
	73-80	14-19	2-3.4	13-19	<b>3-4</b>	3-4	—	—	
<i>mulchandi</i>	<b>77</b>	—	—	<b>22</b>	6	3	—	trc-shm	UK
	75-78	16-20	1.8	<b>17-27</b>	—	—	16-22	bip/smo	
<i>nizamabadensis</i>	—	—	—	—	<b>3</b>	<b>4</b>	—	<b>hem/</b>	UK
	67-79	17-19	<b>1.3</b>	17-27	—	—	15-24	ann	
<i>pratensis</i>	75	16	—	19	5	3	—	shm-blp/	<b>K</b>
	74-78	<b>14-16</b>	>1	14-27	—	—	20-28	smo-ann	
<i>pseudopratensis</i>	<b>79</b>	<b>14</b>	<b>1</b>	<b>22</b>	7	3	<b>15</b>	<b>hem-shm/</b>	<b>K</b>
	76-80	<b>13-15</b>	—	<b>19-27</b>	—	3-4	<b>12-19</b>	smo	
<i>ranjani</i>	75	16	2.0	17	<b>5-6</b>	<b>4</b>	—	<b>hem-shm/</b>	UK
	73-78	15-17	—	12-21	—	—	25-35	smo	
<i>singhi</i>	—	—	—	—	6	3	—	shm/	(UK)
	75-77	17-18	< <b>1</b>	<b>18-23</b>	—	—	—	smo	
<i>thornei</i>	76	17	—	<b>20</b>	—	3	23	<b>trc/</b>	R
	73-80	15-18	>1.5	<b>19-25</b>	5-7	—	19-26	smo	
<i>zeae</i>	<b>73</b>	16	<b>1</b>	16	—	3	25	blp/	UK
	69-75	15-17	—	17-21	6-9	—	21-26	smo-ann	

<sup>1</sup> Knob indices: refer to Fig. 4.

<sup>2</sup> Tail code: refer to FREDERICK and TARJAN (1989).

<sup>3</sup> Male code: K (known); R (rare); UK (unknown); (UK) (males unknown but spermatheca of females filled with spermatozoa).

<sup>4</sup> Mean.

<sup>5</sup> Range.

veniently separated from some of these other species, especially those assigned to the "*pratensis* group" by FREDERICK and TARJAN (1989). Differences between *P. subranjani* n. sp. and these species are indicated in bold letters (Table 2).

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