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THE SYSTEMATIC POSITION
OF *PRATYLENCHOIDES RITTERI* SHER WITH OBSERVATIONS
ON ITS EMBRYOGENIC DEVELOPMENT

by

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Sher (1970) described *Pratylenchoides ritteri* from soil around an unknown grass and weeds collected near Cap Antibes, France. At that time he differentiated the genus *Pratylenchoides* Winslow from the genus *Radopholus* Thorne by the presence of deirids, oesophagus overlapping the intestine ventrally and dorsally « with at least one oesophageal gland nucleus above the oesophageal intestinal valve », less sexual dimorphism, and the gubernaculum not projecting from the body. Seinhorst (1971) separated *Pratylenchoides* from the genus *Radopholus* by the arrangement of the oesophageal glands. He included the former in the generic group with asymmetrical oesophagus (the oesophageal lumen is shifted laterally and situated between the dorsal and the shorter subventral gland) and the latter in the generic group with symmetrical oesophagus (the oesophageal lumen is ventrally shifted and situated between the subventral glands). In this paper we discuss the systematic position of *P. ritteri* according to the diagnosis of Sher and Seinhorst, report on the embryogenesis and biology of this species, and describe a case of intersexuality.

MATERIALS AND METHODS

The specimens used in this study were collected from wheat (*Triticum durum* Desf.) roots near Tavernazza (Foggia), Italy. Nema-

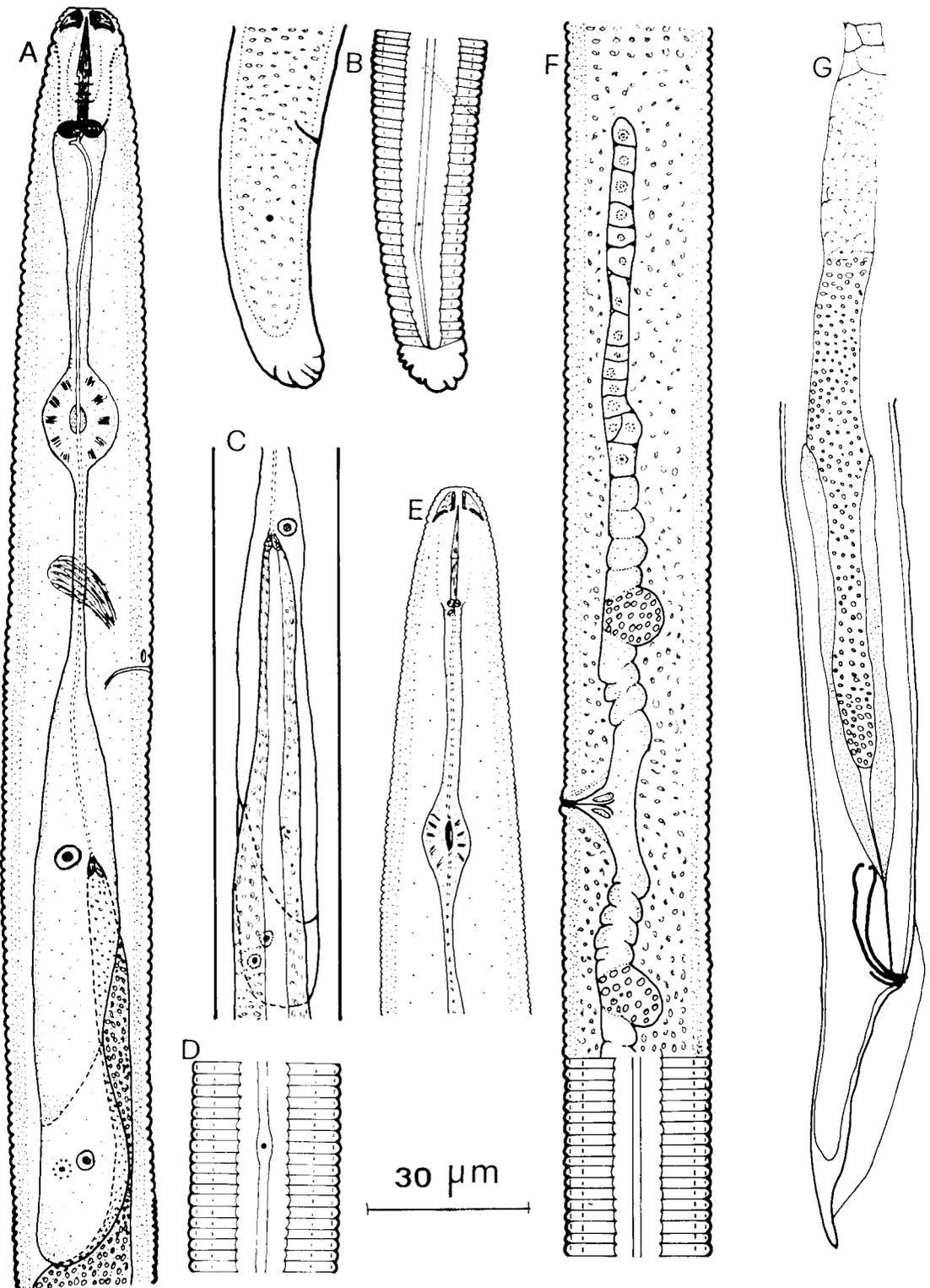


Fig. 1 - *Radopholus ritteri*: A) Anterior portion of the female body with lateral view of the oesophageal glands; B) lateral view of female tail; C) subventral view of the female oesophageal glands arrangement; D) deirid; E) lateral view of the anterior portion of the male body; F) female reproductive system; G) male reproductive system.

todes were extracted from roots by the Young incubation method (1954), fixed in a 4% formalin + 1% propionic acid hot aqueous solution, dehydrated slowly in an alcohol-saturated chamber, and mounted in dehydrated glycerine (Seinhorst, 1966).

The embryogenesis was studied using freshly-deposited eggs which were washed and mounted in distilled water in shallow cavity slides. To avoid abrupt water evaporation, the slides with eggs were enclosed in Petri dishes with the bottom covered by moist filter paper and maintained at 20-24 °C.

RESULTS AND DISCUSSION

Analysis of the data collected indicates that *P. ritteri* is more closely related to the genus *Radopholus* than to *Pratylenchoides*, even though some characters of this species, such as the presence of deirids and the gubernaculum not projecting from the body, are similar to *Pratylenchoides* (Fig. 1 D, F, G). The arrangement of the oesophageal glands and the accentuated sexual dimorphism are typical of *Radopholus* (Fig. 1 A, E). Also the position of the oesophageal gland nuclei is closer to that of *Radopholus* than *Pratylenchoides*. According to Sher's (1970) diagnosis of *Pratylenchoides*, « has at least one oesophageal gland nucleus above the oesophageal intestinal valve ». In *P. ritteri*, the dorsal gland nucleus anterior to the subventral gland nuclei (Fig. 1 A) does not have a stable position. In 13 out of 50 specimens examined, the dorsal gland nucleus was posterior to the oesophago-intestinal junction, as in *Radopholus*; and in the others this nucleus was at the same level or slightly anterior to the junction. Furthermore, the structure of the oesophagus is symmetrical (Seinhorst, 1971) and, as in *Radopholus*, the oesophageal lumen of this species is ventrally shifted between the subventral glands, with an anterior shift of the oesophago-intestinal junction (Fig. 1 A, C). In *Pratylenchoides*, the oesophageal lumen is shifted laterally and located between the dorsal and the shorter subventral gland. In our specimens the dorsal gland, is shorter than the subventral glands, which are the same length and overlap the intestine about two and a half times the body width. The more important taxonomic value of the oesophageal structure compared to other characters leads us to propose: *Radopholus ritteri* (Sher, 1970) n. comb. syn. *Pratylenchoides ritteri* Sher, 1970.

Morphometrical characters given in the original description of the species (Sher, 1970) and those of a population collected in southern Italy are reported as follows:

Paratypes (collected by Sher at Cape Antibes, France, from soil around an unknown grass and weeds); 14 females: L = 0.78 mm (0.65-0.93); a = 29 (25-31); b = 5.6 (4.8-6.7); b' = 4.0 (3.1-5.5); c = 16 (13-17); V = 57 (54-61); stylet = 23 μm (21-24); 10 males: L = 0.71 mm (0.61-0.90); a = 31 (28-35); b = 7.1 (5.4-8.6); b' (overall body length/oesophagus length from the lips to the end of the oesophageal glands) = 5.7 (4.8-6.2); c = 14 (12-15); stylet = 20 μm (18-21); gubernaculum = 7 μm (6-9); spicules = 26 μm (23-28).

Population collected at Tavernazza (Foggia), Italy, from durum wheat; 20 females: L = 0.81 mm (0.73-0.94); a = 33 (29-37); b = 5.7 (5.4-6.2); b' = 3.8 (3.5-4.2); c = 16 (13-17); c' (tail length/body width at anus) = 2.8 (2.4-3.4); V = 55 (53-57); stylet = 23 μm (22-25); anterior end-excretory pore distance = 110 μm (103-125); 10 males: L = 0.73 mm (0.63-0.82); a = 29 (26-32); b = 6.6 (5.0-7.5); b' = 5.4 (4.3-6.2); c = 13.2 (11.6-15.0); c' = 3.4 (3.2-3.6); stylet = 19 μm (18-20); gubernaculum = 6 μm (6-8); spicules = 26 μm (24-27).

Measurements of the specimens collected in Italy were slightly larger than those from France, but otherwise very close to those of the type population.

An intersex was found in a population collected also in the same locality. The measurements of the specimen were: L = 0.74 mm; a = 33; b = 4.8; b' = 3.7; c = 11.1; c' = 3.9; V = 55; stylet = 21 μm ; gubernaculum = 7 μm ; spicules = 26 μm . The specimen (Fig. 2 A) had a well-developed female gonad and a male reproductive system with atrophied testes. The female gonad had a well defined vulva and a spermatheca filled with round sperm (Fig. 2 B). The male gubernaculum and spicules were of normal size, but no caudal alae were present (Fig. 2 C). The tail in this specimen had 32 annules and had the same conformation as that of a female.

Embryogenesis

Eggs of *R. ritteri* are oblong, about 78 μm long and 34 μm wide, and with a clear nucleus surrounded by granular cytoplasm. They are laid at the one cell stage. The first cleavage was completed in about 8-10 hours after deposition, was equatorial and produced two

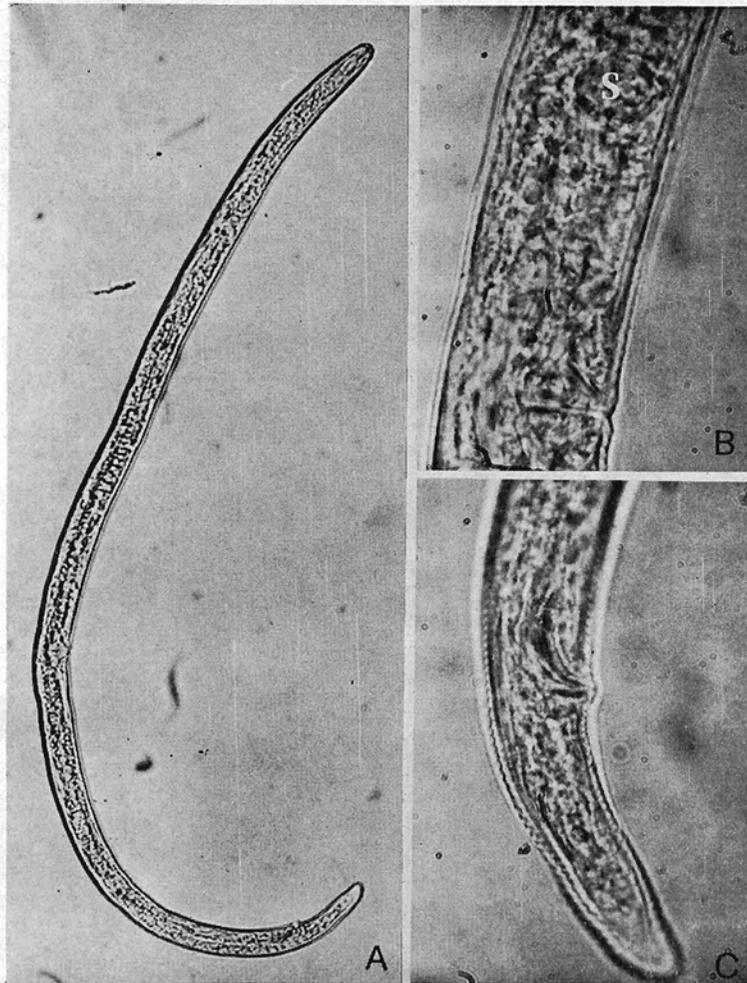


Fig. 2 - A) Intersex of *Radopholus ritteri*; B) vulvar area with anterior spermatheca (S); C) posterior portion of the body showing the copulatory organs.

equal size blastomeres (fig. 3 B). It was not possible to distinguish the anterior from the posterior blastomere. The second cleavage, also transverse, was completed 20-24 hours after the first cleavage and divided the egg into four cells that appeared in rhomboid arrangements (Fig. 3 C). During the second cleavage we missed the first division with the formation of the three-cell stage of the egg. Sixteen

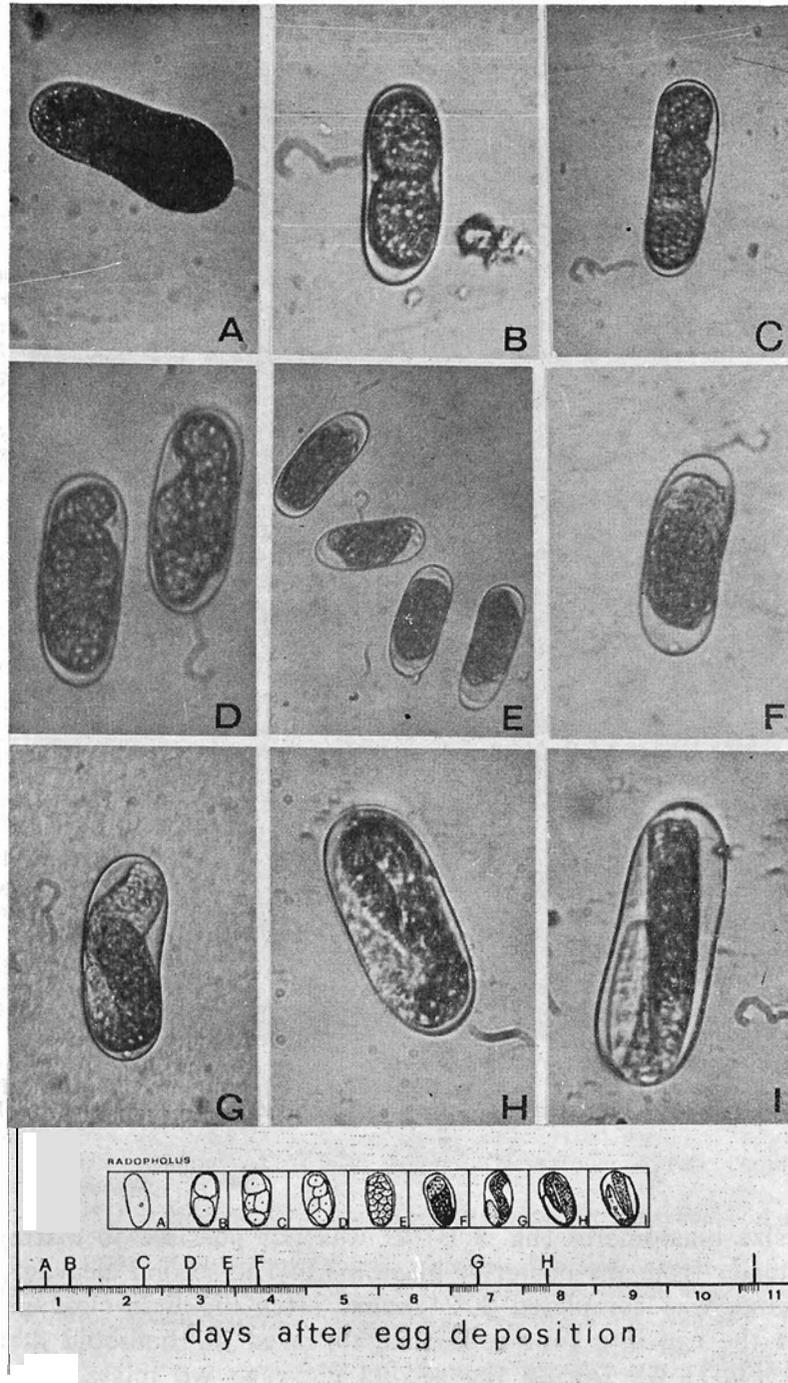


Fig. 3 - Embryogenic development of *Radopholus ritteri*. A) one-cell stage; B) two-cell stage; C) four-cell stage; D) five-cell stage; E) multicellular stage; F) gastrula; G) first-stage larva; H) moulting first-stage larva; I) second-stage larva.

hours later the third cleavage was completed with the egg at the five-cell stage (Fig. 3 D). It was impossible to follow the division beyond this stage. However, 16 hours after the third cleavage, the eggs were at the multicellular stage (Fig. 3 E) and the gastrula (Fig. 3 F) appeared 10 hours later, a total time lapse of 3 to 4 days after egg deposition. The first stage larva (Fig. 3 G) was found 3 days after the gastrula stage and the first moult (Fig. 3 H) occurred 1 day later, giving rise to the second-stage larva (Fig. 3 I) in 3 days. Thus, the time required from egg deposition to hatching of the second stage larva was about 10 to 11 days. Studies by Van Weerd (1960) have shown that *Radopholus similis* (Cobb) Thorne from citrus requires a shorter time; from 4 to 11 days depending on temperature.

Field and glass observations indicate that *Radopholus ritteri* is a migratory endoparasitic species that invades and reproduces in the root tissues. Cereals are apparently the most common hosts of this nematode. It has been reported on oat (*Avena sativa* L.) and wheat (*Triticum* spp.) in France (Ritter, 1974). In Italy this species was found on durum wheat and oat. The population densities observed ranged from 200 specimens per g of fresh root on durum wheat to 1,400 specimens per g of fresh root on oat. *Radopholus ritteri* is often associated with *Pratylenchus penetrans* (Cobb) Filipjev et Schuurmans Stekhoven and *P. neglectus* (Rensch) Filipjev et Schuurmans Stekhoven on cereals with decline symptoms. The economic role of this nematode as a causal agent of growth retardation of cereals is not known.

SUMMARY

The systematic position of *Pratylenchoides ritteri* is discussed. On the basis of the arrangement of the oesophageal glands and pronounced sexual dimorphism the species is redesignated *Radopholus ritteri* (Sher, 1970) n. comb. The study of the embryogenic development indicates that the average time required from egg laying to hatching is about 11 days at a temperature of 20-24° C. An intersexual specimen is also reported.

RIASSUNTO

Posizione sistematica di *Pratylenchoides ritteri* e osservazioni sul suo sviluppo embrionale.

Viene discussa la posizione sistematica del nematode endoparassita migratore *Pratylenchoides ritteri*. In base alla disposizione delle ghiandole esofagee

e all'accentuato dimorfismo sessuale mostrato, questa specie viene trasferita al genere *Radopholus*, sotto il nome *Radopholus ritteri* (Sher, 1970) n. comb. Osservazioni sullo sviluppo embrionale indicano che il periodo di tempo richiesto dalla deposizione dell'uovo all'emergenza delle larve di secondo stadio è di circa 11 giorni, alla temperatura di 20-24° C. Un caso di intersessualità viene, inoltre, riportato.

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Accepted for publication on 25 January 1978.