Fridericia larix sp. nov. (Enchytraeidae, Oligochaeta) from Irish soils

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Abstract

A new species of Fridericia (Enchytraeidae, Oligochaeta) is described from soils in Ireland. It was found during sampling campaigns in the framework of a comprehensive taxonomic revision of the genus (Schmelz 2003). Fridericia larix sp. nov., named in reference to the type locality, belongs to the large and taxonomically difficult group of species with two diverticula per spermatheca. It is distinguished from all known congeners by the following combination of characters: (1) a maximum of four chaetae in ventral preclitellar bundles; (2) oesophageal appendages poorly branched; (3) no pharyngeal glands in segment VII; (4) coelomocytes without refractile vesicles; (5) clitellum girdle-shaped, cell distribution alike on all sides; (6) bursal slit of male copulatory organ mainly transverse; (7) no subneural glands; (8) spermathecal diverticula not stalked. Further distinguishing characters are: (9) an asymmetrical arrangement of chaetae in the first lateral postclitellar bundles, with one large chaeta and one small chaeta per bundle, (10) the length ratio of spermatozoa to spermatozoal nuclei (6:1 to 7:1), and (11) a wavy inner surface in parts of the epithelium of the spermathecal ampulla.

Keywords: Taxonomy; New species; Ireland; Biodiversity; Soil biology

Introduction

In the framework of a comprehensive taxonomic revision of the mainly terrestrial enchytraeid genus Fridericia (Schmelz 2003), several new species were discovered. Not all of them were included in that study, because the revision focused on already established nominal species; their rectification seemed more urgent than the description of all the new species. The complete revision will hopefully lay the foundation for future taxonomic studies in the genus and facilitate the recognition of member species. One new species, discovered in soils in Ireland, is described in the present work. It belongs to the group of Fridericia species with two diverticula per spermatheca, a group that has caused considerable trouble. Half of all Fridericia species belong to this group, and many of them are highly similar in morphological terms. The new species is no exception in this respect. It is distinguishable from its congeners only by a combination of characters; single diagnostic characters that would be unique in the genus are absent. The nonetheless clearcut and unequivocal diagnosis relies on two outcomes of the revision: the increase and refinement of species-distinguishing characters (see also Rota et al. 1998; Rota and Healy 1999), and the demonstration of narrow intra-specific variation ranges of these characters. Style and terminology of the description follow Schmelz (2003). Technical terms abandoned in the revision but still in use in other literature are added in brackets.

Material and methods

Enchytraeid worms were collected from the field by taking soil samples and extracting them in the labora-
twenty, using a standard hot/wet funnel extracting device. The soil samples were taken during two sampling campaigns in Ireland, in summer 1995 and autumn 1996. Twenty-five specimens of the new species were found, among much material of many other Fridericia species (see Discussion). Eionomical and anatomical details were scrutinized while the specimens were alive, using a dissecting microscope and a light microscope with interference contrast (Nomarski) optics. Nine specimens were fixed in hot Bouin’s fluid, stained with Pararcarmin and whole-mounted in Malinol. They were then reinvestigated. Observations referring to living specimens are marked by “viv” in the description, observations on fixed material are marked by “fix”. Further details regarding the collecting, extracting, preserving, examining and mounting of specimens are described in Schmelz (2003). Drawings from whole mounts were made with the help of a drawing tube; details as seen in living specimens were documented as freehand drawings. Holotype and four paratypes are deposited at the Zoological Museum and Institute Hamburg (ZIM).

Abbreviations

IV, VI, XL, etc. = 4th, 6th, 40th segment, respectively; ad = spermathecal ampulla, distal part; ap = spermathecal ampulla, proximal part; br = brain, supraoesophageal ganglion; bs = bursal slit of male copulatory organ, secondary male opening; cc = chloragocytes; ch = chylus cells; cl = clitellum; di = diverticulum of spermatheca; dl = dorsal lobe of pharyngeal gland; dp = segmental dorsal pore; ds = disseipimentum, septum; dv = dorsal blood vessel; ed = spermathecal ectal duct; eg = spermathecal ectal gland; er = layer of epidermis and body wall ring muscles; hp = head pore; in = intestine; lc = lateral chaetae; lm = longitudinal body wall muscles; mc = male copulatory organ; ne = nephridium; oo = oocyte; pp = pharyngeal pad; sf = sperm funnel; st = spermatheca; vc = ventral chaetae; vl = ventral lobe of pharyngeal gland; vn = ventral nerve cord.

Fridericia larix sp. nov.

Etyymology

From the Latin larix = larch, referring to the type locality, Larch Hill; to be treated as a noun in apposition.

Type material

Holotype: ZMB 111187; mature specimen, fixed in Bouin’s fixative, stained with Pararcarmin, whole-mounted in Malinol between 2 coverslips; IRELAND, Co. Dublin, Larch Hill, 53°14’N, 06°17’W, approx. 330 m a.s.l., deciduous wood, with Ulmus glabra, Acer pseudoplatanus, Ilex aquifolium and Corylus avellana, undergrowth Urtica dioica, Chrysosplenium sp., slope, soil pH 7.0-7.2 (Ca Cl<sub>2</sub>); coll. Schmelz, Healy and Collado, July 1995. Paratypes: eight specimens, fixed, stained and mounted in same way as holotype; ZMB 111188, 4 submature specimens from type locality, also a small grassland patch close to river at the same site, type locality of F. discifera and F. dozsae (Healy 1979: site No. 146; Schmelz 2003: sites IR9, IR12, IR13); ZIM OL 14280, 4 specimens from 3 localities: ZIM OL 14280a,b, 2 mature specimens, Co. Dublin, Killakee, 53°15’N, 6°19’W, approx. 220 m a.s.l., pasture lining brook, pH 5.5 (Schmelz 2003: site IR4; Healy 1979: sites No. 47/48), coll. Schmelz, Healy and Collado, July 1995; ZIM OL 14280c, 1 mature specimen, Co. Dublin, Boranaraltry, 53°13’N, 06°15’W, 246 m a.s.l., grassland, slope, exit from nearby road to wet pasture, deposit, pH 7.6 (Schmelz 2003: IR8), coll. Schmelz, Healy and Collado, July 1995; ZIM OL 14280d, 1 mature specimen, Co. Galway, “Dave’s Lawn”, private property of Dave Mc Grath, grassland, 53°15’N 9°13’W, 40 m a.s.l., at 750 m distance from the sea, coll. Schmelz, August 1996.

Diagnosis

Medium-sized Fridericia worms, approx. 12-15 mm long and 0.3 mm wide (viv). Segment number of specimens with clitellum 43-48. Chaetal formula 4,3 - (3),2 : 4,3 - 4,3,2; inner chaetae in bundles of four 1/2-2/3 as long as outer chaetae. Most lateral postclitellar bundles in anterior body half asymmetrical, consisting of one large and one small chaeta. Epidermal gland cells pale, in 3 conspicuous rows (preclitellar segments), cell outline irregular. Clitellum well-developed, girdle-shaped, cells in separate to dense rows; hyalocytes present on all sides, also ventrally. Body wall thick, cuticle variable (<1 µm or up to 3 µm thick). Brain broadly egg-shaped and thick. Oesophageal appendages short, with few branches. Pharyngeal glands in IV-VI; glands in IV widely connected dorsally, ventral lobes minute, separate from dorsal lobes; glands in VI dorsally separate and with large and long ventral lobes; glands in V intermediate. Chylus cells in XII-VI, occupying 2-3 segments. Dorsal blood vessel from XVII-XVIII. Nephridia in five preclitellar pairs,
from 6/7 to 10/11, anestepatele mostly 1/2-2/3 as long as postepatele, aseptal to medial rise of efferent duct, no terminal vesicle; postclitellar nephridia with medially to subterminal rise of efferent duct. Coelomocytes numerous, mucocytes type a/c, lenticytes small. No seminal vesicle, some cysts (morulae) free in XI dorsally. Spermatozoa with short nucleus (50-60 µm, viv, much shorter in preserved material) and very long flagellum (at least 350 µm). Sperm funnel 1/3-1/2 as long as body diameter, approx. 1.5x as long as wide, collar narrower than funnel body. Male coxopulatory organ rounded and compact, small to medium-sized, longer than wider than high, bursal slit mainly transverse. No subneural glands. Spermatheca: Ectal gland 1.5-2x as wide as ecal duct diameter, rounded, not floppy, often bilobed, finely granulated. Ectal duct approx. 1.5x as long as body diameter, proximally widened; inner (ampullar) surface of projection wavy. Ampulla subdivided into distal and proximal part; distal part with 2 sessile, oval and thin-walled diverticula oriented towards ecal duct; proximal inner epithelial surface of ampullar distal part wavy or pimpled; ampullar proximal part thick-walled, longer than wide, larger than diverticula. No ental duct. Separate attachments of spermathecae to dorso-lateral sides of oesophagus.

Description

Body colour yellowish-opaque. Viv: length of mature worms (i.e. with fully developed clitellum) approx. 12-15 mm, diameter 0.3(-0.35) mm, clitellar region only slightly wider than rest; fix: length 10-12 mm, diameter at V 0.3-0.35 mm, 0.4-0.45 mm in clitellar region (0.5 mm in 1 specimen). Body cylindrical, diameter decreasing slightly towards anterior and posterior ends. Living worms slow-moving, not forming open, irregular, three-dimensional coils (as in F. bisetosa, a morphologically similar species); no escape reflexes observed (= short and rapid body lashings). Segment number in logically similar species); no escape reflexes observed for hyalocytes, 7-10 µm for granulocytes. Cell colour pale, outline irregular. Often entire epidermis somewhat warty here, forming three rings around body near chaetae. Gland cells reduced in number mid-dorsally. Citellum (Fig. 1a) extending from XII to 1/2 XIII, referring to outer segment boundaries; or from 1/4 to 3/4 XIII, referring to inner segment boundaries (see Schmelz 2003: 25, fig. 8d). Foremost cell row at level of the dorsal pore of XII, hindmost cell row at level of chaetae of XIII. Citellum girdle-shaped, i.e. present on all sides, well-developed though not much elevated (fix: up to 20 µm). Cells arranged in about 30 separate or dense rows (viv); or rows dense or indefinite (fix). Hyalocytes and granulocytes present on all sides, also ventrally; number of hyalocytes reduced mid-ventrally between bursal slits in some specimens. Height : diameter ratio of cells approx. 3 : 2; hyalocytes up to twice as wide as granulocytes; cell diameter (fix) 10-15 µm for hyalocytes, 7-10 µm for granulocytes.

Body wall (Fig. 1a) about 1/10 as thick as body diameter (viv: approx. 30 µm; fix: up to 45 µm in contracted body regions), longitudinal muscle layer well-developed. Cuticula usually thin (<1 µm, i.e. barely distinguishable at 400x magnification), up to 3 µm in some specimens. Septa of anterior segments (4/5-9/10) not conspicuously thickened. Brain (Fig. 1a, “br”) thick and compact, broadly egg-shaped and rounded on all sides; anterior convexity not pronounced, sides merging anteriad. Viv: length 140-160 µm, diameter approx. 90 µm; fix: length 95-130 µm, width 80-90 µm, height/thickness 55-65 µm. Oesophageal appendages (= peptonephridia) (Fig. 1a,c, “oa”) short, not extending beyond pharyngeal glands of V. Main tube with wide lumen and few branches over its entire length; proximal branches short and simple, distal branches usually longer and often secondarily branched. Pharyngeal glands (Fig. 1a,c) in IV, V and VI. In IV, dorsal lobes widely connected mid-dorsally, ventral lobes minute, separate from dorsal lobes. In V, dorsal lobes with narrow posterior connection, ventral lobes continuous with dorsal lobes, extending straight forwards. In VI,
dorsal lobes separate or with a narrow connection, ventral lobes continuous with dorsal lobes, elongate, folded or meandering anteriorly. No pharyngeal glands in VII. Chloragocytes (Fig. 1a, “cc”) from V with few cells; from VI on, intestine covered with a dense and continuous layer, interrupted in reproductive segments. Cells flat (diameter 18-25 µm) and filled with small vesicles of various colour, from brown-green-gray over red-brown to russet. Stronger coloration of vesicles usually in anterior segments; colour fading out in posterior segments. Chylus cells (Fig. 1a, “ch”); Fig. 1d) in XII-XIV, occupying 2-3 segments. Intestinal epithelium at least twice as thick here as in adjacent anterior and posterior segments. Cell canals mostly straight, i.e. perpendicular to body axis, basal loop not marked. Conspicuous blood lacunae intervening between chylus cell rows. Dorsal vessel originating in XVII or XVIII. Anterior bifurcation in first segment T-shaped. Ventrally inflated gut epithelium (‘ventral intestinal ridge’ sensu Rota 1995) in XXIV-XXXVII, extending over 9-14 consecutive segments (N=6). Inflated epithelium inconspicuous in living specimens; in preserved material, cells mainly recognized by intracellular aggregations of non-staining apical vesicles; cells flat in anterior segments (not higher than adjacent epithelia), distinctly elevated only in hindmost two or three segments. Precitellar nephridia (Fig. 1a, “ne”) present in five pairs, from 6/7 to 10/11; length ratio of anteseptal and postseptal 1:2 - 2:3, rarely 1:1; funnel embedded obliquely in interstitial tissue of anteseptale. Nephridial body constricted at its attachment to septum, total length (without efferent duct) approx. 140 µm (fix). Efferent duct short, rising adseptally (= close to septum) to mediadly from postseptale and opening to exterior without terminal vesicle. Postclitellar nephridia beginning at 13/14, with medial to subterminal origin of efferent duct throughout, caudal segments included. In segments following clitellum, nephridial body elongate, usually larger than in precitellar segments (approx. 175 µm long in fixed specimens), and with little-marked septal constriction; nephridial body growing smaller in caudal segments (length 110-140 µm in fixed specimens) and septal constriction becoming more marked. Coelomocytes numerous, often aggregated to dense masses. Mucoocytes (= nucleated cells) oval and flat, 20-45 µm long (vit), outline slightly wavy. Cellular vesicles spherical, pale, not refractile, with clear outline or somewhat blurred (type a/c). Lenticytes (= anucleate bodies) 5-7 µm long (vit).

Varying amounts of developing sperm (cysts = morgulae) present in dorsal half of XI (Fig. 1a); no seminal vesicle proper (i.e., septa 10/11 and 11/12 not bulged in opposite directions to increase lumen of XI). Sperm funnel (Fig. 1a, “sf”; Fig. 1e) approx. 1.5x as long as wide, 1/3-1/2 as long as body diameter (fix: 110-140 µm long, 80-125 µm wide); collar flat, narrower than funnel body; funnel body barrel-shaped, tapering distally into vas deferens. Mature spermatozoa twice as long as funnel; nuclei 50-60 µm, flagella at least 350 µm long, probably longer (vit). Nuclei much shorter in fixed specimens (length 11-15 µm, apparently strongly contracted, bent or compressed, compare Figs. 1a and 1e). Vas deferens long and thin (diameter 7 µm, fix), often wound in dense coils ventro-laterally between sperm funnel and male copulatory organ. Glandular body of male copulatory organ (Fig. 1a, “mc”; Fig. 1f, g) rounded and compact, longer than wider than high (e.g. vit: 100-120 µm long, 60-73 µm wide; fix: 95 µm long, 63 µm wide, 53 µm high). An outer hyaline region often distinguishable from an inner region with a somewhat coarser texture (vit; Fig. 1g). Modiolus (i.e. a hub of secretory endpieces of cells that form the glandular body) usually present, small, surrounding primary male pore at its opening into the bursa. Bursa enclosed in glandular body, bursal slit mainly transverse (Fig. 1f, g: “bs”). No subneural (= copulatory) glands.

Spermathecae (Fig. 1a, h, i) with ectal gland, ectal duct, ampulla, and two diverticula. Ectal pores in intersegmental furrow of 4/5, slightly below line of lateral chaetae (common in Fridericia and many other enchytraeids). Proximally, spermathecal ampullae attached directly (i.e. without mediation of an ental duct) and separately to dorso-lateral sides of oesophagus; ental porus (connecting spermathecal and oesophageal lumina) not observed but probably present. Ectal gland (Fig. 1c, “eg”) 1.5-2x as wide as ectal duct diameter, rounded, sometimes bilobed, compact, not floppy, filled with fine granules. Ectal duct in living specimens longer than body diameter when relaxed (approx. 1.5x), much shorter when occasionally contracted (one measurement in a living specimen: 560 µm relaxed, 260 µm contracted); in fixed specimens, ectal duct usually relaxed (e.g. Fig. 1a, c: “ed”). Diameter of ectal duct approx. 18 µm (vit) or 13-16 µm (fix); ectal duct widened proximally at junction with ampulla, ectal duct canal not widened (Fig. 1i). Whole of ampulla and diverticula slightly longer than wide (vit: approx. 120 : 100 µm; fix: approx. 100 : 90 µm), with smooth outline. Ampulla subdivided into short distal part and thick-walled proximal part, the latter approx. 1.5x as long as wide; lumina of both parts separated by an inner epithelial thickening (Fig. 1h, i), leaving a central porus between lumina of distal and proximal part. Inner surface of thickened epithelium irregularly wavy (Fig. 1h), especially conspicuous in living specimens at ‘roof’ of ampullar distal part (Fig. 1i, arrow) opposite to ectal duct porus (vit, not seen in all specimens). Diverticula spherical or slightly ellipsoid, not stalked,
inserting on opposite sides of ampullar distal part. Ellipsoid diverticula (Fig. 1c, i) thin-walled, oriented or shifted towards ectal duct, spherical diverticula (Fig. 1h) thick- or thin-walled, not in contact with ectal duct. Wall thickness, shape and orientation of diverticula variable, even within an individual; variations probably related to amount of incorporated sperm. Sperm in diverticula, arranged as a thick circular cuff. Circular sperm movements or attachments of sperm heads to diverticular epithelium not observed. One mature egg at a time.

Discussion

About half of the Fridericia species described so far and accepted as valid in Schmelz (2003) have two diverticula per spermatheca. They are listed in Part 2 of this Electronic Supplement. Within this crowded group, F. larix sp. nov. is distinguished by the following combination of characters: (1) a maximum of four chaetae in ventral precitellar bundles; (2) oesophageal appendages poorly branched; (3) no pharyngeal glands in VII; (4) coelomocytes without refractile vesicles; (5) clitellum girdle-shaped, cell distribution alike on all sides; (6) bursal slit of male copulatory organ mainly transverse; (7) no subneural glands; (8) spermathecal diverticula not stalked. None of these characters is diagnostic for Fridericia species as well. Hence it is only their combination that is diagnostic for F. larix.

A so far unique character is (9) the asymmetrical arrangement of chaetae in the first lateral postclitellar bundles, with one large chaeta and one or two small chaetae (Fig. 1b, “lc XVI”). This condition is shared by all specimens investigated, and may be an excellent species-diagnostic trait. However, slight variation in the chaetal patterns cannot be excluded, and a larger series of specimens is necessary to confirm the intraspecific constancy of this character. Two further characters are uncommon, but can be difficult to observe or do not show in all specimens: (10) the length of the spermatozoa, especially the ratio of head length to total length (1:6 - 1:7) - this ratio is usually lower in Fridericia; (11) the pimpled inner surface of the “roof” of the spermathecal ampullar distal part (Fig. 1i, arrow). These traits show well only in living specimens.

The first eight characters listed above have been selected for their conspicuousness. Actually, all details of the description are to be understood as diagnostic in combination; any deviation in a specimen may indicate a different species. This note is important as the diversity of Fridericia species is still far from being known completely, even in comparatively well-studied regions such as Central Europe or Ireland.

Using the key to valid Fridericia species in Schmelz (2003: 70ff.), F. larix sp. nov. is placed within a group of four species: F. globuligera Rota, 1995, F. granosa Schmelz, 2003, F. maculata Issel, 1905, and F. ulrikae Rota & Healy, 1999. The main (i.e. most easily observed) differences between these species and F. larix are as follows. F. globuligera: five or six chaetae in ventral precitellar bundles; spermatozoa approx. 100 µm long; spermathecal ectal duct short, gradually widening proximad. F. granosa: not more than 43 segments; oesophageal appendages unbranched; coelomocytes with many refractile vesicles; clitellum nor developed ventrally; male copulatory organ large, bursa and glandular body separate; seminal vesicle large, brownish, extending over 2-3 segments. F. maculata: epidermal gland cells distinctly yellowish-brownish; clitellum ventrally composed of granulocytes only, hyalocytes absent; sperm in spermatheca forming a U-shaped bend comprising lumina of diverticula and ampullar distal part; spermathecal ental duct present. Furthermore, the cuticle is most often thick and the maximum number of chaetae varies between 2 and 4 among specimens. F. ulrikae: clitellum absent ventrally; nephridia absent at 10/11; glandular body of male copulatory organ twice as long as wide; bursal slit of male copulatory organ longitudinal; spermathecal ectal glands minute or absent; spermathecal diverticula stalked.

Most similar to the diagnosis of F. larix is the description of nine specimens from Italy in Rota (1995), labelled as “Fridericia cf. discifera Healy, 1975”. The congruence extends to such peculiarities as chloragocyte coloration (reddish brown), sperm head length (55-60 µm), and inner spermathecal surface (pimpled). Differences to F. larix are slight: (1) body and organs are somewhat larger (up to 0.5 mm wide, up to 51 segments, brain up to 177 µm long and 107 µm wide, coelomo-mucocytes up to 55 µm long, coelomo-lenticytes up to 9 µm long, sperm funnel up to 292 µm long, male copulatory organ up to 184 µm long; all dimensions refer to living specimens); furthermore, (2) 4, 3, or 2 chaetae are present in lateral postclitellar bundles, so the peculiar asymmetrical arrangement of chaetae in lateral postclitellar bundles of F. larix may not be present in the Italian material; (3) there is no size difference between the largest anterior and posterior chaetae; (4) the spermathecal diverticula are said to be discoidal when filled with sperm; (5) there are one or two mature eggs at a time. Several taxonomically important details are not described, e.g. subneural glands (presence/absence, size, location), clitellum ventrally (presence/absence, gland cell distribution pattern), and shape of bursal slits. The Italian specimens belong probably to F. larix sp. nov.; if so, the species diagnosis needs to be emended with respect to the above-stated
differences. However, further studies are necessary before the distribution range of *F. larix* can justifiably be extended to Italy. It is rather unlikely that “*Fridericia cf. discifera*” sensu Rota belongs to *F. discifera* Healy, 1975. The most conspicuous differences of the latter from *F. larix* are – after the emended redescription of *F. discifera* in Schmelz (1999) – as follows: oesophageal appendages unbranched, nephridia absent at 10/11, coelomo-mucocytes with peripheral granulation, spermathecal ectal duct short, seminal vesicle large, extending over 2-3 segments. Additional conspicuous differences of *F. discifera* from *F. larix* are: subneural glands in XIII-XIV-XV), bursal slits T- or Y-shaped; these traits are unknown in the Italian specimens (see above). Curiously, though, Larch Hill is the type locality of both *F. larix* and *F. discifera*.

*F. larix* sp. nov. is not only morphologically close to several other *Fridericia* species, it was also found at sites especially rich in congeneric species. The first author recorded the following *Fridericia* species (comp. Schmelz 2003: 19f.). Larch Hill (type locality of *F. larix*): *F. auritoides*, *F. bretschieri*, *F. connata*, *F. discifera*, *F. dozsae*, *F. galba*, *F. globuligera*, *F. healyae*, *F. perrieri*, *F. sylvatica*, *F. viridula*; Killakee: *F. auritoides*, *F. globuligera*, *F. isseli*, *F. perrieri*; Boranaraltry: *F. auritoides*, *F. benti*, *F. bisetosa*, *F. connata*, *F. dozsae*, *F. galba*, *F. hegemon*, *F. paroniana*, *F. striata*, *F. sylvatica*, *F. tuberosa*; Dave’s Lawn: *F. benti*, *F. discifera*, *F. galba*, *F. globuligera*, *F. isseli*, *F. paroniana*, *F. perrieri*, *F. tuberosa*, *F. viridula*. The majority of these species appear in Part 2 of this Electronic Supplement, i.e. they have two diverticula per spermatheca. Correct species identification may be extremely difficult at such sites unless unequivocal criteria are at hand. It is not daring to assume that *F. larix* sp. nov. has been overlooked and misidentified in previous studies, for example as *F. bisetosa*, the most often cited bidiverticulate *Fridericia* species (we counted 130 independent literature records worldwide). Its complicated taxonomic history is reviewed in Schmelz (2003: 130ff.). *Fridericia bisetosa* is clearly distinguished from *F. larix* by the following characters: (1) not more than 2 chaetae per bundle, (2) brain almost rectangular, (3) ellietllum absent or much reduced mid-ventrally, (4) spermathecal ectal duct shorter than body diameter, (5) spermathecal ampulla more than twice as long as wide. These characters were either not dealt with or considered variable in many of the earlier species diagnoses; therefore confusion of *F. bisetosa* and *F. larix* sp. nov. would seem to have been almost inevitable. This does not imply, however, that *F. larix* is a widespread species frequently misidenti-fied as *F. bisetosa*. In fact, among the approx. 300 sites sampled in the framework of the taxonomic revision of *Fridericia* (Schmelz 2003), *F. larix* was only found at the four Irish localities, whereas *F. bisetosa* was found at 45 sites in Europe and North America.

The description of *F. larix* sp. nov. adds one more species to the already long list of Irish *Fridericia* species. At present, 25 species are known from the island; they are listed in Part 3 of this Electronic Supplement. That species number is quite high compared to other countries (Britain: 18 species, Hungary: 24 species, Italy: 27 species; numbers refer to species accepted as valid in Schmelz 2003), all the more as the biotic diversity in Ireland is generally low in comparison with Britain or continental Europe. See Healy (1979) for possible explanations of Ireland’s generally low biotic diversity, e.g. incomplete post-glacial immigration and low natural habitat diversity, reduced further by intensive cultivation over two millennia. In fact, the species number may reflect more the thoroughness of studies carried out on Irish enchytraeids, mainly by Southern (e.g. 1907) and Healy (e.g. 1979). On the other hand, the mild climate with high precipitation rates and the absence of extended periods of drought and frost may provide conditions especially suitable for many *Fridericia* species and enchytraeids in general. Healy (1979: 68), after a thorough discussion of the factors that may be responsible for the high diversity of Irish enchytraeids, concludes that “Ireland has a rich enchytraeid fauna which it owes to its unique geographic position at the junction of north European, south European and north Atlantic regions and to its mild climate which allows representatives from all these regions to coexist”. It remains to be shown which of these regions *F. larix* sp. nov. may represent. Given its possible occurrence in Italy (“*F. cf. discifera*” in Rota 1995), and in view of the absence of finds in Central Europe despite intensive sampling (Schmelz 2003), it may be a mediterranean element in the Irish fauna.

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References


Fig. 1. Fridericia larix n. sp. (a) Anterior 17 segments, from whole mount, body interior, lateral view in preclitellar segments, shifted to dorso-lateral in postclitellar segments; male copulatory organ slightly everted; testes, ovaria and coelomocytes omitted. (b) Chaetae, whole mount, in top view (bundle of four, left) and side view (all others). (c) Segments IV-VI, from whole mount, dorso-lateral view, showing details of oesophageal appendages, pharyngeal glands and spermatheca. (d) Chylus cells, from whole mount, as seen in optical sagittal section of intestinal epithelium; intracellular canals in cross section; longitudinal arrays of cells separated by intervening intestinal blood sinus. (e) Sperm funnel, from living specimen, with dense mass of mature spermatozoa arranged in parallel on top of funnel; dark region = sperm nuclei. (f) Male copulatory organs, from whole mounts; organ to the right in ventral view, organ to the left in side view; scale as in Fig. 1g. (g) Male copulatory organ as seen in a living specimen; glandular body with hyaline outer region and a somewhat coarse inner region; modiolus small; bursal slit and rest of organ in different optical planes. (h) Spermathecae, from whole-mounts; organ to the left in oblique view, optically shortened, organ to the right in side view; note epithelial thickening between distal and proximal part of ampulla. (i) Spermatheca, from living specimen; arrow = wavy inner surface; scale as in Fig. 1h.
Fig. 1 Fridericia larix n. sp.; a) side view, anterior 17 segments; b) chaetae; c) segments IV-VI, dorso-lateral view; d) chylus cells, optical longitudinal section; e) sperm funnel; f) and g) male copulatory organ; h) and i) spermathecae. e), g) and i) from living specimens, all others from whole mounts. See text for legend.