SKRJABINELAZIA RIZZOI N. SP. (NEMATODA: SEURATOIDEA) FROM A SICILIAN LACERTID, WITH COMMENTS ON SPECIFIC AND BIOLOGICAL DIVERSITY IN THE GENUS

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Summary:

Skrjabinelazia rizzoi n. sp. (Seuratoidea), from *Podarcis sicula* captured at Cammarata, Agrigento Province, Sicily, is distinct from the 13 known species of the genus, including *Skrjabinelazia* sp. Rizzo from Catania. It is identified with the following set of characters: in the male, short spicules and gubernaculum, thin body; in the female, buccal cavity with a crown of leaflets, body cuticle without internal ornamentation, presence of cephalic and caudal vesicles, tail with a terminal digitiform spike 42-48 µm long. The morphology of the new species supports our previous hypothesis of two *Skrjabinelazia* lineages, one with spicules and one without spicules, respectively linked to Lacertidae and Gekkonidae. In Palearctic lacertids, five named species are presently known, *S. taurica* from Crimea (Ukraine), *S. hoffmanni* from Beijing (China), *S. pyrenaica* from Pyrenees (Spain), *S. vozae* from Cevennes (France), *S. rizzoi* from Agrigento Province, Sicily (Italy), but analysis of some published works suggests a greater diversity. *S. rizzoi* infection, found in April-May in 1/5 lizards, was recent with young females in the host's stomach and intestine, and males in the stomach. One female contained four membranous-shelled eggs. The two other females contained a few hatched infective larvae, membranous-shelled eggs with developing embryos and, unexpectedly at this early stage, a few thick-shelled divided eggs. As in several other *Skrjabinelazia* species, the progeny of *S. rizzoi* are adapted for intra-host suprainfection and inter-host transmission, but in this species the production of resistant eggs appears in very young females.

KEY WORDS : *Skrjabinelazia*, oviparity, viviparity, biodiversity, Lacertidae, Sicily, biogeography.

Résumé : *SKRJABINELAZIA RIZZOI* N. SP. (NEMATODA : SEURATOIDEA), PARASITE DE LÉZARD EN SICILE, ET COMMENTAIRES SUR LA DIVERSITÉ SPÉCIFIQUE ET BIOLOGIQUE DU GENRE

Skrjabinelazia rizzoi *n. sp. (Seuratoidea), parasite de* Podarcis sicula *capturé à Cammarata, Province d'Agrigento, Sicile, est distinct des 13 espèces connues dans le genre,* Skrjabinelazia *sp. Rizzo, à Catane, inclus. La nouvelle espèce est identifiée par un ensemble de caractères : chez le mâle, spicules et gubernaculum courts, corps mince ; chez la femelle, cavité buccale avec coronule, cuticule du corps sans ornementation, vésicules céphalique et caudale présentes, queue terminée par une pointe digitiforme longue de 42-48 µm. La morphologie de la nouvelle espèce confirme notre hypothèse selon laquelle il existe deux lignées de* Skrjabinelazia, *l'une avec spicules et l'autre sans, liées respectivement aux Lacertidae et aux Gekkonidae. Chez les lézards paléarctiques, cinq espèces nommées sont reconnues,* S. hoffmanni *à Pékin (Chine),* S. taurica *en Crimée (Ukraine),* S. vozae *dans les Cévennes (France),* S. rizzoi *dans la province d'Agrigento en Sicile (Italie) et* S. pyrenaica *dans les Pyrénées (Espagne), mais l'analyse bibliographique suggère une plus grande diversité. L'infection par* S. rizzoi, *observée chez un des cinq lézards capturés en avril-mai, est récente avec les jeunes femelles situées dans l'estomac et l'intestin et les mâles dans l'estomac. Une femelle contient quatre œufs à coque membraneuse. Les deux autres femelles contiennent quelques larves infectantes, des œufs à coque membraneuse avec des embryons en développement et, inattendus à ce stade précoce, quelques œufs en division et à coque épaisse. Comme chez d'autres espèces de* Skrjabinelazia, S. rizzoi *est adapté à la surinfection de l'hôte et à la transmission inter-hôte, mais ici la production des œufs résistants apparaît déjà chez les très jeunes femelles.*

MOTS CLÉS : Skrjabinelazia, *oviparité, viviparité, biodiversité, Lacertidae, Sicile, biogéographie.*

INTRODUCTION

Skrjabinelazia Sypliaxov, 1930 (Seuratoidea) parasitizes some families of saurians, mainly Gekkonidae and Lacertidae, and has world-wide distribution. Several species are present in the Palearctic region. They are described from restricted geographic areas: one species from Spanish Central Pyrenees (Roca & Garcia-Adell, 1988), one from Cevennes in France (Lhermitte *et al.*, 2007), one from Crimea (Sypliaxov, 1930), and one on the eastern border of the Palearctic region, at Beijing (Li, 1934). The genus is also represented in Sicily (Rizzo, 1902) but the specific status of this material is debated.

Sharpilo (1976) showed that *Strongylus* sp. Rizzo (1902) must be transferred to *Skrjabinelazia*. He also collected several samples of *Skrjabinelazia* in different Soviet Russian areas from diverse lizards. He concluded that his material and that described by Rizzo belonged to the same species and were identical to *S. hoffmanni*

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Li, 1934, which would have a very wide distribution from Beijing to Sicily. However Lhermitte *et al.* (2007), who recently defined some morphological diagnostic characters during study of three new samples, judged that the differences between *Skrjabinelazia* sp. (Rizzo, 1902) and *S. hoffmanni* were sufficiently distinct to separate the two species.

It was not possible to study the specimens collected by Rizzo at Catania because they were not preserved (personal communication from the collection curator of the Istituto di Zoologia ed Anatomia comparata della R. Università di Catania). However we had the opportunity to examine a few lizards from Agrigento Province. Male and female *Skrjabinelazia* were recovered from one of them. This material resembled that described by Rizzo, but it was not identical. It also appeared distinct from all the other *Skrjabinelazia* species, as well as from *S. hoffmanni sensu* Sharpilo (1976).

The genus *Skrjabinelazia* is interesting for its complex biology. Worms are reported from the stomach as well as from the small and large intestine, and a given species may settle in these three places. Males are rare, probably short-lived, since several species are known only by the females. Females produce large larvae, with a fully formed digestive tract, which are interpreted as third infective stage larvae; they have an apical tooth of Ascaridida type (Chabaud *et al.*, 1988; Lhermitte *et al.*, 2007). Females are oviparous and show great specific diversity of egg-shells, sometimes coloured, decorated with vesicles or surrounded with spongy material. In some *Skrjabinelazia* species, oviparous females coexist with viviparous specimens (Chabaud *et al.*, 1964; Chabaud, 1973; Hasegawa, 1984). It has been shown for one species, *O. galliardi* Chabaud, 1973, that viviparity occurs in the physiologically young females; later, these become oviparous (Chabaud *et al.*, 1988). The viviparous and oviparous states are thought to ensure respectively host suprainfection and transmission to new hosts. Paratenic insect hosts are probably necessary for transmission, and egg ingestion might be facilitated in several species by the pigmented egg-shells (Chabaud *et al.*, 1988). We had available only fixed material collected during a single short period of the year, in spring, but its detailed morphological analysis revealed some features of the biology of these Seuratoidea from saurians.

MATERIAL AND METHODS

Five *Podarcis sicula* Rafinesque, 1810 were captured during April-May 2005 in the municipality of Cammarata (Agrigento Province), killed humanely and fixed in 10 per cent formalin. At dissection, *Skrjabinelazia* specimens of both sexes were found in one lizard; they were in the stomach (five males, two females) and

***Skrjabinelazia* species**	***S. rizzoi* n. sp.**			***S.* sp. (Rizzo, 1902)**	***S. hoffmanni***	***S. hoffmanni sensu* Sharpilo**
Reference	Present study			Rizzo, 1902	Li, 1934	Sharpilo, 1976
Type -host	*Podarcis sicula*			*Lacerta agilis*	*Eremias argus*	*Eremias nikolski*
Host family	Lacertidae			Lacertidae	Lacertidae	Lacertidae
Geographic origin	Agrigento Province, Sicily			Catania, Sicily	Peijing, China	Kirghizia
Site in host	Stomach	Stomach	Intestine	Anterior intestine	Intestine	Stomach, intestine
Females	Paratype 1	Paratype 2	Holotype	Several	n = 4	n = 8
Length (in mm)	5.7	6.8	6.5	11-15	14-20	14-16
Width	170	170	200	330	330-370	360-400
Nerve ring	210	250	165	ND	200-250	220-240
Excretory pore	250	270	175	ND	240-290	ND
Buccal cavity	11/10	12/12	11/12	ND	ND	ND
Oesophagus	540	615	600	850	600-720	700-820
Vulva	355	385	280	400	350-410	310-380
Tail (+ vesicle)	315 (330)	355 (380)	350 (430)	(920)	750-1100	(440-700)
Caudal spike	42	45	48	–	–	“small conical mucron”
Thick-shelled egg L/w	absent	80-90/50-60*	60-120/50-65*	75 × 45	ND	88-204 × 71-80
Larva L/w	absent	350/22	ND/22	ND	ND	33/38**
Buccal leaflet		+		ND	–	ND
Cephalic vesicle		+		+	+/–	+
Caudal vesicle		+		+	+/–	+
Cuticle corpuscles		–		ND	–	–
Glandular oesophagus		–		–		
Oesophageal onchia		3		ND	ND	ND
Other hosts				*L. viridis*		*E. przewalskii, E. argus*
				Seps chalcides		*L. agilis, L. saxicola*

* The great variation of sizes is due to the diverse orientations of eggs and the egg shell not rigid. ** original but erroneous.

Table I. – Female measurements and main qualitative characters of *Skrjabinelazia rizzoi* n. sp., *Skrjabinelazia* sp. Rizzo, 1902, *S. hoffmanni* Li, 1934 and *S. hoffmanni sensu* Sharpilo, 1976.

intestine (one female). Worms were cleared in lactophenol and drawn with the aid of a microscope equipped with a camera lucida. The posterior part of a male was dissected to determine the length and shape of the spicules, which are difficult to observe due to the presence of the thick gubernaculum. The cone ratio is its length/width at the base; it has recently been found to be a good discriminatory character (Lhermitte *et al.*, 2007). Hosts are named according to the internet site EMBL: (www.reptile-database.org). When authors described their material from several hosts species and did not identify any host type specimen (Rizzo, 1902; Roca & Garcia-Adell, 1988), we arbitrarily chose the first listed specimen as type-host. The authority names of the new species are Lhermitte and Bain.

RESULTS

DESCRIPTION OF *SKRJABINELAZIA RIZZOI* N. SP.

The morphological study was based on all the specimens recovered, three females and five males. Measurements of female holotype and male allotype are reported Table I and II, respectively.

• Female (Figs 1 & 2, Table I)

Body cuticle: thin, except at extremities; conspicuous transverse cuticular striae 2.5-3 µm apart; internal layer not distinct and not ornamented. Cephalic vesicle present, 60-100 µm long, thicker in large specimens, with an anterior fold forming a collar in the holotype. Head rounded; in apical view, head square and surrounded by a rhomboidal vesicle divided into four lobes by four submedian pedunculate pairs of papillae (four external-labial and four cephalic); internal labial papillae not identified; amphids with conspicuous pores. Mouth in a depression, subcircular; buccal cavity lined anteriorly with a crown of *c.* 40 leaflets; base of buccal cavity triangular. Short oesophagus, undivided, slightly thicker in the posterior half; at apex three conical teeth (onchia); Y-shaped oesophageal lumen. Tail: long, slightly bent ventrally; general shape cylindrical then conical and terminated with a digitiform spike, blunt at extremity. Caudal vesicle surrounding the posterior fourth of the tail; its distal extremity is folded, truncated and not longer that the tail spike (paratypes), or unfolded, conical and longer than the tail spike (holotype). Genital tract extending through the anterior two-thirds of the body only. Vagina simple, 120-140 µm long, lined with large epithelial cells; unpaired ovijector 800-1400 µm (paratype 1 & holotype); opisthodelphy; oviduct 50 (paratype 1) to 115 µm long (holotype); ovaries producing large ovulae, 80 µm in diameter; cytoplasm of ovulae filled with spherical vitellus-type granules, 2 µm in diameter, each with an excentric bright inclusion, 0.2 µm long. Uterine contents showing hatched larvae and one or both of the following two kinds of large eggs, very few in number. *i*) Thick-shelled eggs: shell 8-10 µm thick, not decorated, transparent, not rigid, containing segmented ova (four, eight or more cells); egg-shape oval when not compressed. *ii*) Thin-shelled eggs: thin membranous slightly pleated shell, ova increasing in size during the development of the embryo. *iii*) Hatched larvae: apical tooth, complete digestive tract, genital anlagen at mid-length, tail conical, extremity smooth.

• Male (Fig. 3, Table II)

Cephalic vesicle unconspicuous or slight, symmetrical or not. Posterior part of body bent ventrally or coiled. Head with thickened apical cuticle, four conspicuous pedunculated papillae (double pairs not identified due to their small size) and amphids. Leaflet crown in the

***Skrjabinelazia* species**	***S. rizzoi* n. sp.**					***S. hoffmanni***	***S. hoffmanni***
Reference	Present study					Li, 1934	Sharpilo, 1976
Type-host	*Podarcis sicula*					*Eremias argus*	*Eremias nikolskii*
Geographic origin	Agrigento Province, Sicily					Peijing, China	Kirghizia
Site in host	Stomach					Intestine	Stomach, intestine
Males	Paratype 1	Paratype 2	Paratype 3	Allotype	Paratype 5	n = 3	n = 6
Length (in mm)	1.54	1.75	2.4	1.87	1.18	2-2.45	1.9-2.4
Width	60	65	52	60	55	90-110	90-110
Nerve ring	130	150	140	130	120	140-160	140-160
Excretory pore	ND	165	ND	175	ND	180-190	230-240
Oesophagus	245	260	240	233	193	250-300	270-310
Tail	180	187	170	220	170	140-150	100-230
Left spicule	35	42	25	45	30*	80-90	93-99
Right spicule	47	52	30	45	35*	90-100	99-104
Gubernaculum	60	75	72	63	58	80-90	82
Cone L/w	20/27	22/26	20/26	22/30	17/25	17/20	17/24
Caudal points	4	6	3	5	5	ND	+

* Spicules dissected out.

Table II. – Male measurements of *S. rizzoi* n. sp., *S. hoffmanni* Li, 1934, *S. hoffmanni sensu* Sharpilo, 1976.

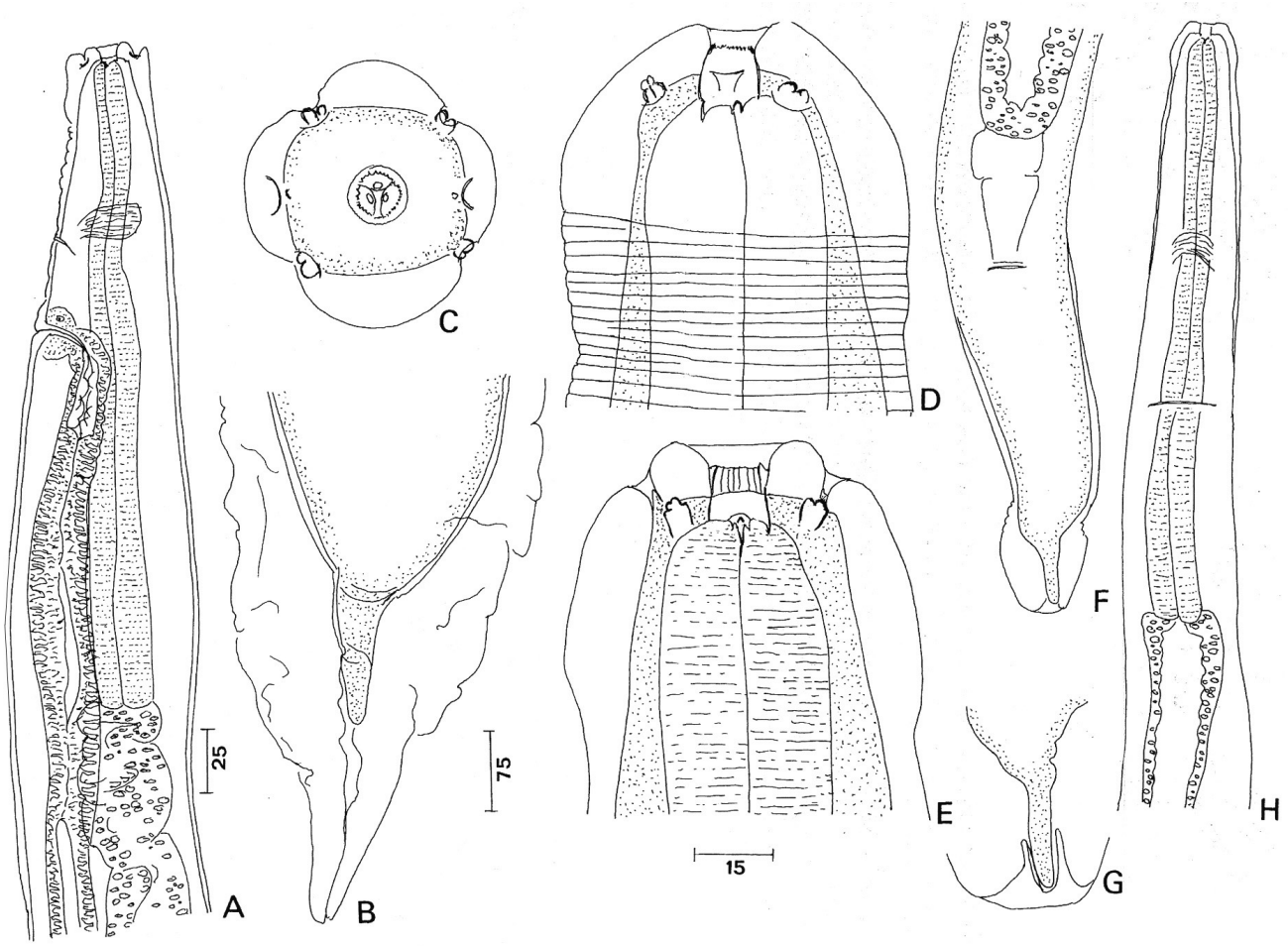

Fig. 1. – *Skrjabinelazia rizzoi* n. sp. Female. A. Anterior region, lateral view, holotype. B. Caudal extremity, lateral view, holotype. C-E. Head, paratype 1, apical, lateral and median views, respectively. F. Tail, ventral view, paratype 1. G. Tail extremity with the folded vesicle adhering to the digitiform spike, ventral view, paratype 1. H. Anterior region, ventral view, paratype 1. Scales in µm: A, H, F: 75; B, G: 25; C, D, E: 15.

buccal cavity not identified. Oesophagus without glandular part, almost cylindrical, with a slight dilation posterior to nerve ring and another bulbous-like one at junction with intestine. Excretory cell conspicuous. Large genital cone, slightly shorter than wide at its base, posterior aspect with an undulated surface; in ventral view, cone almost as wide as the body; two lateral small bosses on the posterior anal lip. Caudal papillae: two pairs on cone, one pre-cloacal, one post-cloacal; two pairs at mid-tail, symmetrically or asymmetrically arranged, distance between left papillae shorter or longer than the right ones. Subequal slightly sclerotized short spicules with blunt distal extremity; shape cylindrical or, sometimes, with a discernible wider anterior handle. Gubernaculum large, triangular, its attenuated distal extremity heavily sclerotized. Tail tip with three to six small irregular points.

• Taxonomic discussion

Our specimens have the characters listed by Chabaud (1978) for the genus *Skrjabinelazia* Sypliaxov, 1930 (syn. *Salobrella* Freitas, 1940, in Chabaud, 1973), Skrjabinelaziinae Chabaud, Campana-Rouget & Brygoo, 1959, Seuratidae (Hall, 1916) Railliet, 1906: oesophagus cylindrical; vulva opening near middle of oesophagus, eggs embryonated; in male, gubernaculum large, spicules simple, preanal sucker absent, oral opening with leaf crown.

Among the 13 species recognized in *Skrjabinelazia* according to Lhermitte *et al.* (2007), eight are described including the males. The four first species differ from our material because they have no spicules, only a gubernaculum; these are *S. intermedia* (Freitas, 1940), type-host *Tropidurus spinulosus* (Cope, 1862), Mato Grosso, Brazil; *S. machidai* Hasegawa, 1984, type-host *Gekko japonicus* Schlegel, 1836, Okinawa, Japan; *S. galliardi*, type-host *Gonatodes humeralis* Guichenot, 1855, Para, Brazil; and *S. boomkeri* Lhermitte, Bain et Hering-Hagenbeck, 2007, type host *Pachydactylus turneri* (Gray, 1864), Transvaal, Rep. of South Africa. The next four species possess spicules in addition to the guberna-

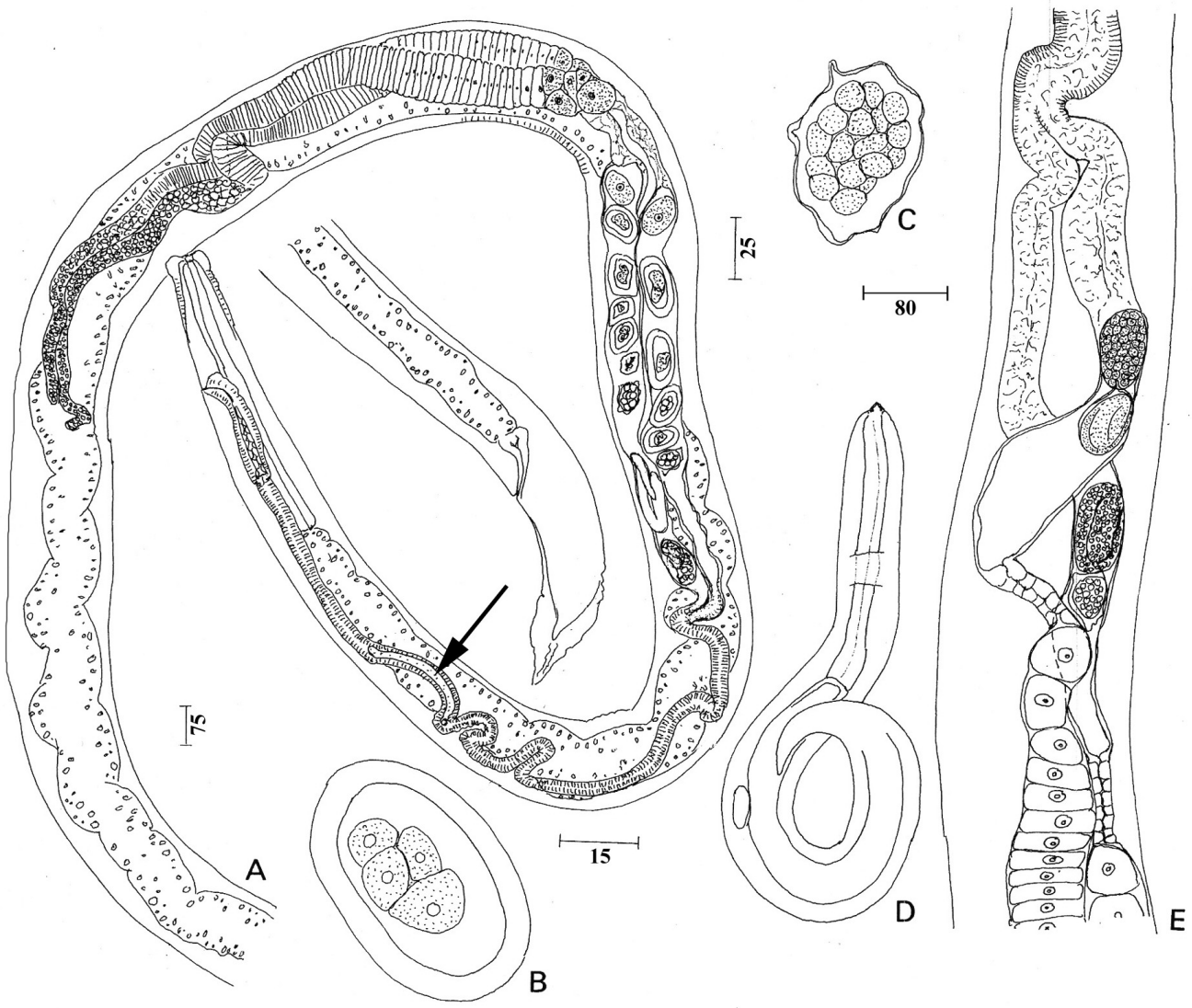

Fig. 2. – *Skrjabinelazia rizzoi* n. sp. Female. A. Figure, lateral view, holotype: entire worm drawn in two parts; a hatched larva (arrow) is half way along the ovijector. B. Thick-shelled egg, holotype. C. Thin-shelled egg, holotype. D. Infective larva hatched in uterus, paratype 2. E. End of ovaries, oviducts, uteri and beginning of ovijector, youngest specimen with thin-shelled eggs, paratype 1. Scales in µm: A: 75; B, C: 25; D: 15; E: 80.

culum; these are *S. taurica* Sypliaxov, 1930, type-host *Podarcis taurica* (Pallas, 1814) (= *Lacerta taurica*), Crimea; *S. hoffmanni* Li, 1934, type-host *Eremias argus* Peters, 1869, Beijing, China; *S. vozae* Lhermitte, Bain et Hering-Hagenbeck, 2007, type-host *Lacerta vivipara* Jacquin, 1787, Cevennes, France; and *S. pyrenaica* Roca & Garcia-Adell, 1988 from *Podarcis hispanica* (Steindachner, 1870), Pyrenees, Spain. The first three species differ from our specimens as the spicules are twice as long (ranging from 80-122 *vs* 35-52 µm), and the male body is thicker (90-150 *vs* 55-65 µm); moreover, in *S. taurica* and *S. hoffmanni*, the gubenaculum is longer (about 80-90 *vs* 58-75 µm). The females of these three species also differ, having a reduced caudal vesicle and attenuated tail (Sypliaxov, 1930; Li, 1934; Lhermitte *et al.*, 2007); in addition, Li (1934) noted that the buccal crown of leaflets was absent from *S. hoffmanni,* contrary to the present material. In *S. pyrenaica,* the spicules and gubernaculum lengths were described with an exceptionally large range (30-92 µm and 56-91 µm, respectively) and the smallest values are similar to those of our specimens. However, distinctive characters of *S. pyrenaica* are, in the male, the body wider and the genital cone larger (30/40 *vs* 17-22/25-30 µm) and, in the female, the internal cuticle decorated with bosses, the tail lacking a spike and regularly attenuated (Roca & Garcia-Adell, 1988).

The present material is also distinct from the *Skrjabinelazia* species known only from females. These are *S. ornata* Chabaud, Caballero & Brygoo, 1964, type-host *Phelsuma lineata* Gray, 1842 in Madagascar; *S. hemidactyli* Shamim & Deshmukh, 1982, type-host *Hemi-*

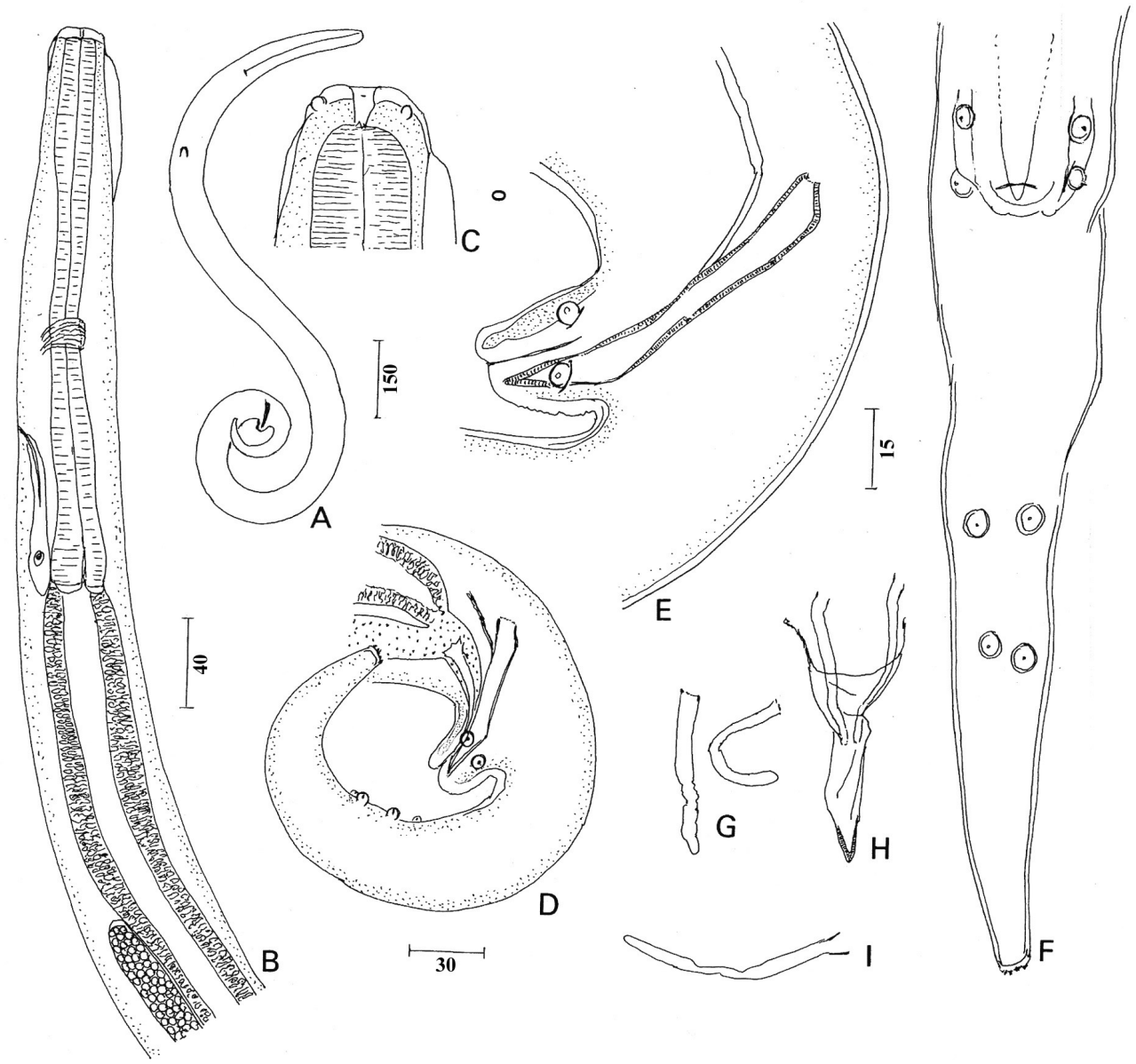

Fig. 3. – *Skrjabinelazia rizzoi* n. sp. Male. A. Figure, allotype (internal cuticular lining of oesophagus and apex of testis are indicated). B. Anterior region, left lateral view, paratype 2. C. Head, lateral view, same paratype. D. Caudal region, left lateral view, allotype. E. Genital cone, gubernaculum and spicules, left lateral view, paratype 2. F. Tail, ventral view, paratype 5. G. Spicules, dissected out from paratype 5. H. Gubernaculum & spicules, dorsal view, paratype 5. I. Left spicule with discernible handle, holotype. Scales in µm: A: 151; B: 40; C, E, F, G, H, I: 15; D: 30.

dactylus brookii Gray, 1845 in Marathwada, India; *S. mawsangelae* Lhermitte, Bain & Hering-Hagenbeck, 2007, and *Skrjabinelazia* sp. Angel & Mawson, 1968, type-hosts *Christinus marmoratus* Gray, 1845 (= *Phyllodactylus marmoratus*), from two South Australian places (Mawson, 1971); *Skrjabinelazia* sp. (Rizzo, 1902), type host *Lacerta agilis* Linnaeus, 1758 (other host *L. viridis* Laurent, 1768), in the eastern region of Sicily, at Catania. The first four species have cuticular ornamentation and certain other morphological differences. *S. ornata* has a convex head with voluminous bulbous papillae and a caudal vesicle interrupted before the caudal extremity (Chabaud *et al.,* 1964). *S. hemidactyli* has an anterior vesicle extending to the vulva with several constrictions and a regularly attenuated tail (Shamim & Deshmukh, 1982). The two Australian species, *S. mawsangelae* and *Skrjabinelazia* sp., have a longer caudal spike, 70 and *c.* 110 µm respectively (Lhermitte *et al.*, 2007; Angel & Mawson, 1968) vs 42-48 µm. *Skrjabinelazia* sp. (Rizzo, 1902) resembles our specimens with the cephalic and caudal vesicles. The specimens of Rizzo are larger but this can be attributed to their being older, since the females contain numerous eggs. The caudal vesicle is conical, and a similar

shape is observed in one of our specimens (holotype), in which the vesicle extremity is unfolded. However the tail end, under the vesicle, is different: it is regularly attenuated in Rizzo's figure, and with a distinct spike in our specimens. In addition, Rizzo described radiating lines on the caudal vesicle, that we did not observe. Because the hosts and geographic regions differ and some important characters are lacking in Rizzo's description (crown of leaftlet present or absent in the female) we prefer to consider, at least provisionally, that our material is distinct from that of Rizzo.
Our material also differs from that collected from *Eremias nikolskii* Nikolski, 1905, in Kirghisia by Sharpilo (1976) and identified by him as *S. hoffmanni*. The spicules and gubernaculum are longer; the eggs are surrounded by a spongy substance; in the female, which has a caudal vesicle like our specimens, the tail ends with a "small conical mucron" (see figure A of Sharpilo, 1976), instead of a spike. This mucron, when measured on the figure of Sharpilo, is approximately 20 µm long, that is only half the length of that in our material, females of which are much shorter.
We conclude that the present material from Sicily represents a new species.

• Taxonomic summary of *Skrjabinelazia rizzoi* n. sp.
Type host: *Podarcis sicula* Rafinesque, 1810, Lacertidae.
Location in host: males in stomach, females in stomach and intestine.
Type locality: Cammarata, Agrigento Province, Sicily, Italia.
Collection date: April-May 2005.
Specimens deposited: female holotype 156 CE 3, male allotype 156 CE 4, two female paratypes and four male paratypes 156 CE, all deposited in the Muséum National d'Histoire Naturelle Paris collection.
Prevalence: 1/5 *P. sicula*.
Etymology: dedicated to A. Rizzo who discovered the first representatives of the genus *Skrjabinelazia* in 1902 in Sicily, long before the creation of the genus.

DISCUSSION

At present, fourteen species are morphologically identifiable in the genus *Skrjabinelazia* (see Lhermitte *et al.*, 2007). The new species supports the view of Lhermitte *et al.* (2007), who recognized a lineage of species with spicules, linked to Lacertidae, and a lineage of species without spicules linked to Gekkonidae. The Sicilian species is remarkable in the small size of its copulatory organs.
It is possible that *S. rizzoi* n. sp. will be shown to be identical to *Skrjabinelazia* sp. (Rizzo, 1902) when material from the same host and geographic origin becomes available for study. However, several reports written by Rizzo (1902), by Sharpilo (1976), by Roca & Garcia-Adell (1988), Roca *et al*., 1990 and Sanchez Gumiel *et al.*, 1993 suggest an unsuspected specific diversity in the genus *Skrjabinelazia*.
Rizzo (1902) had recovered specimens from the Scincidae *Chalcides chalcides* Linnaeus, 1758 (= *Seps chalcides*) that he thought identical to those recovered from *Lacerta* spp. However he noted that "l'estremità caudale non presenta l'expansione membranosa".
Sharpilo (1976) identified as *S. hoffmanni* specimens which had a well developed caudal vesicle; but the caudal vesicle was not noted in the original description of the species. Li (1934) did not draw the female tail, but he wrote that his specimens were similar to *S. taurica*, which has no caudal vesicle. The single character that Li found to distinguish his material from *S. taurica* was the absence of a leaftlet crown in the buccal cavity. *S. hoffmanni sensu* Sharpilo, 1976 is very likely a distinct species. The specimens that Markov *et al.* (1972) recovered from *L. saxicola* Eversmann, 1834 in Dagestan and erroneously identified as *S. taurica* seem similar, as concluded by Sharpilo (1976); the female tail has a terminal "projection" 22-30 µm long. Material from *Podarcis* spp. in Spain has been assigned to *S. pyrenaica* and two subspecies of *S. hoffmanni* (Roca & Garcia-Adell, 1988; Roca *et al.*, 1990). *S. pyrenaica* was described with an unusual variation in spicular and gubernaculum sizes. The same species from Madeiro has short spicules and gubernaculum (Sánchez Gumiel *et al.*, 1993). The type specimens of *S. pyrenaica*, kindly deposited by Prof. Roca at the MNHN collection, differ from the original description by several characters of both sexes, and by the female tail that has a vesicle like *S. h. hoffmanni sensu* Roca *et al.,* 1990. Further studies will be necessary to clarify this complex situation.
With regard to biology, several remarks can be made concerning *S. rizzoi*. The morphology of the larvae produced confirms that in the genus *Skrjabinelazia* they are third infective stages of Ascaridida type, with an apical tooth. The infected *P. sicula* captured in April-May was obviously recently colonized by *S. rizzoi*, since the genital tract was not extending through the whole body length of the females. Males were present, with a sex ratio 5/3. It was noted that they were all in the stomach and that first matings occurred there, as a gravid female was present in this organ. The single female which had migrated into the intestine was not particularly large (holotype 6.5 mm long) but contained more eggs.
As in some species of *Skrjabinelazia, S. rizzoi* is viviparous and oviparous. In the new species, the two types of eggs were observed in the same small female. The membranous eggs (Fig. 2C) increase in size during embryo development until larvae hatch *in utero*. The second type of egg is thick-shelled, but not rigid as often noted in the genus (*e.g.* Freitas, 1940; Roca &

Garcia-Adell, 1988). In our material it contains segmented ova (Fig. 2B); the thick-shelled eggs are not decorated or pigmented; however their mature morphology is not known.

The new species shows two particularities. *i*) The thick-shelled eggs are produced by very young females, in contrast to *S. galliardi* and *S. machidai* (Chabaud *et al.*, 1988; Hasegawa, 1984). However the shortest female, 5.8 mm long (paratype 1), contained only membranous eggs. In the two others, the membranous eggs were clearly anterior to the thick-shelled eggs, and thus must have been produced first in the uteri. *ii*) The shell of the oviparous eggs is thick (8-10 µm) very early, when the ova are at the beginning of segmentation (Fig. 2B). In contrast, in *S. galliardi*, the egg-shell thickens, and also becomes pigmented, when larvae are already formed and motile; *S. galliardi* larvae become nonmotile during the delayed process of shell maturation (Chabaud *et al.*, 1988).

Viviparity was previousy described in *S. ornata, S. machidai, S. galliardi, S. boomkeri* Lhermitte *et al.*, 2007 and *S. mawsangelae,* all parasitic in Gekkonidae. The new species *S. rizzoi* belongs to the lineage parasitic in Lacertidae. The diversified life-cycles of the *Skrjabinelazia* species are the results of adaptations to the local environmental conditions, as exemplified by the diverse egg ornamentation, structure and coloration. Convergence is to be expected between lacertid and gekkonid lineages of *Skrjabinelazia*.

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