

REDESCRIPTION OF FOUR SPECIES OF *MEHDIELLA* FROM TESTUDINIDAE, WITH A KEY TO THE SPECIES AND DISCUSSION ON THE RELATIONSHIPS AMONG THE SPECIES OF THIS GENUS

BOUAMER S.*, MORAND S.** & KARA M.***

Summary:

Four species of the genus *Mehdiella* Seurat, 1918 are redescribed: *M. cristata* Petter, 1966 and *M. stylosa dollfusi* Petter, 1966, parasite of *Pyxis arachnoides* Bell, 1827 from Madagascar, *M. s. stylosa* (Thapar, 1925) and *M. uncinata* (Drasche, 1884), parasite of *Testudo graeca* Linnaeus, 1758, *Testudo hermanni* Gmelin, 1789 and *Testudo horsfieldii* (Gray, 1844) from Palaearctic region. Light microscopy and scanning electron microscopy (SEM) studies revealed new informations on the morphology of these species. On the basis of this morphological study, the sub-species *Mehdiella stylosa dollfusi* and *M. s. stylosa* are raised to level of species. The position of *Mehdiella cristata* among the species of the genus *Mehdiella* and the relationships among the species of the genus *Mehdiella* are discussed. A key to the eight valid species *Mehdiella* is given.

KEY WORDS : Oxyurida, *Mehdiella*, Testudinidae, Palaearctic, Madagascar, SEM, redescription, relationships, key of determination.

Résumé : REDESCRIPTION DE QUATRE ESPÈCES DE *MEHDIELLA* DE TESTUDINIDAE, AVEC UNE CLÉ DE DÉTERMINATION DE TOUTES LES ESPÈCES DU GENRE *MEHDIELLA*

Quatre espèces du genre *Mehdiella* Seurat, 1918 sont redécrites: *M. cristata* Petter, 1966 et *M. stylosa dollfusi* Petter, 1966 parasites de *Pyxis arachnoides* Bell, 1827 de Madagascar, *M. s. stylosa* (Thapar, 1925) et *M. uncinata* (Drasche, 1884), parasites de *Testudo graeca* Linnaeus, 1758, *Testudo hermanni* Gmelin, 1789 et *Testudo horsfieldii* (Gray, 1844) de la région paléarctique. L'utilisation du microscope photonique et du microscope électronique à balayage (MEB) fournit de nouvelles informations sur la morphologie des ces espèces. En se basant sur ces nouvelles données morphologiques, les sous-espèces *Mehdiella stylosa dollfusi* et *M. s. stylosa*, sont élevées au rang d'espèces. La position de *Mehdiella cristata* Petter, 1966 au sein du genre est discutée ainsi que les relations morphologiques entre les espèces de ce genre. Une clé de détermination de toutes les espèces du genre *Mehdiella* est donnée.

MOTS CLÉS : Oxyurida, *Mehdiella*, Testudinidae, paléarctique, Madagascar, MEB, redescription, relations, clé de détermination.

INTRODUCTION

The species of the genus *Mehdiella* are parasites of Testudinidae from Palaearctic region and Madagascar. This genus was established by Seurat (1918) for *Oxyuris microstoma* Drasche, 1884 and *O. uncinata* Drasche, 1884. Petter (1966) described *M. grassei* Petter, 1966 parasite of *Astrochelys radiata* (Shaw, 1802) and *M. cristata* Petter, 1966 parasite of *Pyxis arachnoides* Bell, 1827 both from Madagascar and *M. longissima* Petter, 1966 parasite of *Testudo horsfieldii* Gray, 1844 from Iran. Petter (1966) split the species *Mehdiella stylosa* in two sub-species, *M. s. dollfusi* para-

site of *Pyxis arachnoides* Bell, 1827 from Madagascar and *M. s. stylosa* parasite of *Testudo graeca* Linnaeus, 1758 from Palaearctic region. Isfan (1972) described *M. dobrogicus* Isfan, 1972 parasite of *T. graeca* from Italy; we question the validity of this species with its diagnosis based only on the description of the females. Bouamer *et al.* (2001b) revised the genus and described the species *M. petterae* Bouamer *et al.*, 2001.

This paper is the second part of a redescription of the species of *Mehdiella* and complements a revision of oxyuroids in Palaearctic tortoises (Bouamer & Morand, 2000, Bouamer *et al.*, 2001a and Bouamer *et al.*, 2001b, Bouamer & Morand, 2002). We give redescrptions of four species *M. cristata*, *M. dollfusi*, *M. stylosa* and *M. uncinata* and a key of determination to all species of the genus *Mehdiella*.

MATERIALS AND METHODS

The nematodes were recovered from *Testudo graeca* Linnaeus, 1758, collected in Morocco by S. Bouamer, from *Testudo hermanni* Gmelin, 1789, collected in Spain by Dr Carlos Feliu

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(University of Barcelona), from *T. hermanni* Gray, 1844 collected by Dr Annie Petter (coll. n° 157 Q, Muséum National d'Histoire Naturelle, Paris) and from *Testudo horsfieldii* Gray, 1844 of Iran collected by Dr Annie Petter (coll. n° 64 Q, Muséum National d'Histoire Naturelle, Paris). The nematodes of *Pyxix arachnoides* Bell, 1827 were collected by Dr Annie Petter (coll. n° 82 Q, Muséum National d'Histoire Naturelle, Paris). Nematodes were preserved in 70 % ethanol before being cleared with lactophenol for study. Nematodes were prepared for SEM by dehydrating them in progressive ethanol concentrations up to absolute ethanol. Residual humidity was extracted to the critical point (M scope 500). The scan-

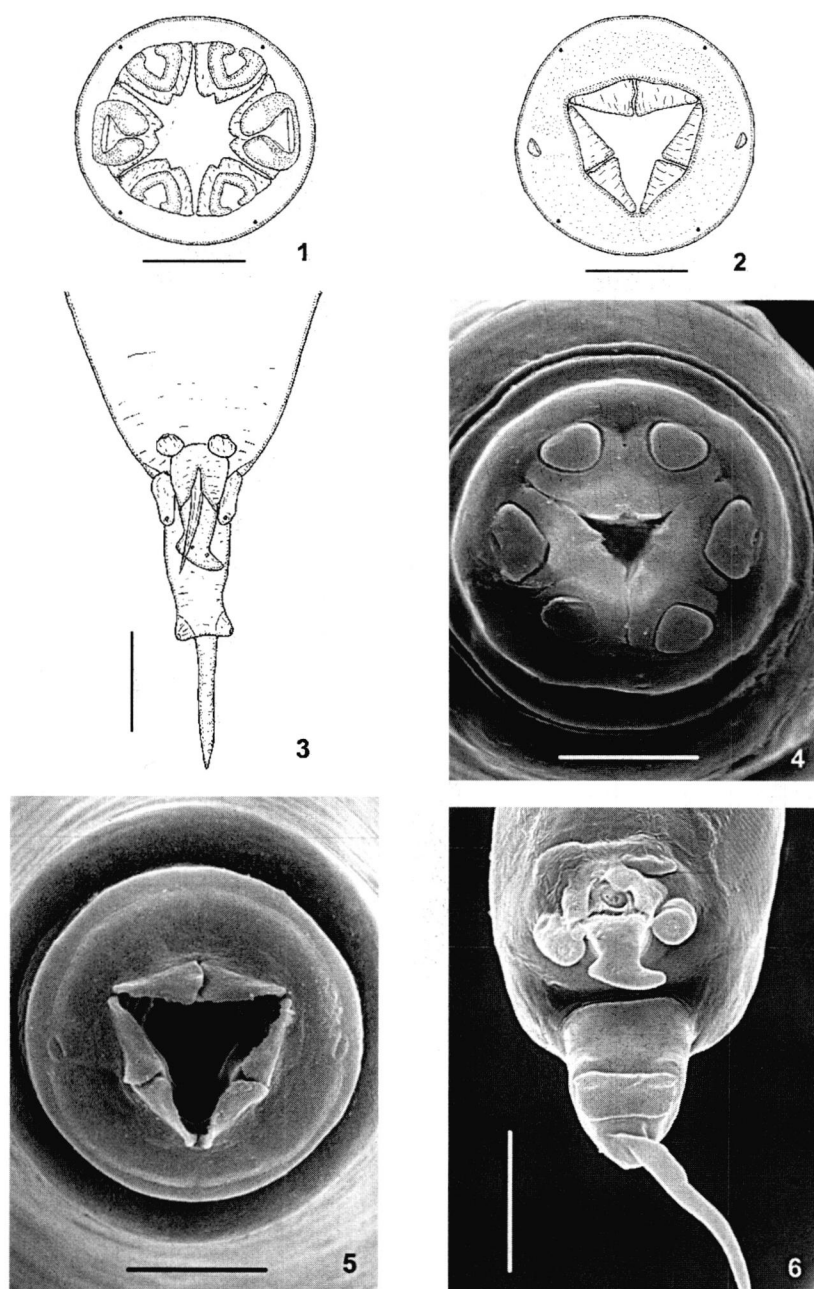
ning electron microscope used was a Hitachi S 520 under 20 KV. Measurements are given in micrometers unless otherwise stated.

RESULTS

MEHDIELLA CRISTATA PETTER, 1966

Redescription (Figs 1-6)

General: Middle-sized body with lateral alae, straight in females, curved ventrally in males. Oesophagus thin and elongate. The cuticle forms in the anterior end series of vesicular rings.



Figs 1-3. – *Mebdiella cristata*. 1. Cephalic end, en face of female. 2. Cephalic end, en face of male. 3. Caudal extremity, ventral view of male. Scale-bars: 1, 2, 8 μ m; 3, 30 μ m.

Figs 4-6. – *Mebdiella cristata*. Scanning electron micrograph (SEM). 4. Cephalic end of female. 5. Cephalic end of male. 6. Caudal extremity of male, ventral view. Scale-bars: 4, 8 μ m; 5, 10 μ m; 6, 20 μ m.

Female: triangular oral opening with three transparent, simple large lips. Eight cuticularized pieces projecting without any nerve ending at the cephalic end, with four medio-lateral triangular shaped (two dorso-lateral and two ventro-lateral) and four lateral pieces, the two pieces of each side joined, so forming one large piece with two tiny humps. Sessile, external amphids situated at the external side of these two pieces. Cephalic sense organs formed by an outer circle consisting of four sub-lateral papillae, situated at the external side of the four dorso-lateral and ventro-lateral cuticularized pieces (the inner circle of nerve endings, not observed). Short buccal cavity armed with teeth.

Measurements of four specimens: length 3.75-4.00 (3.90) mm. Maximum width 345-365 (350) near mid-body. Nerve ring 247-255 (250) and excretory pore 1.435-1.455 (1.470) mm from anterior end. Oesophagus 1.112-1.210 (1.150) mm long. Tail 280-295 (289) long. Vulva 2.35-2.50 (2.40) mm from anterior end. Eggs asymmetrical, measuring 51×121 (49×119 - 53×124).

Male: body thinner than that of the female. The head is separated from the body by a constriction. Ventral side with several crests on cuticle. Triangular oral opening with six transparent and prominent, elongate lips bearing a pointed hyaline projection at internal side of each lip. Cephalic sense organs formed by an outer circle of four sub-lateral papillae, an inner circle of papillae not observed; sessile and external amphids. Eight elongate cuticularized pieces without any nerve ending, form a circle surrounding oral opening. Short buccal cavity armed with three small simple teeth. Cloaca with two pairs of genital papillae: one elongate pre-anal, middle-sized pair, and one long and pedunculate post-anal pair of papillae, each papilla with one nipple; two latero-ventral pairs of papillae on the tail. Long, slender and needle-shaped spicule. Two lobes of pre-anal membrane. Anterior anal lip formed by two tiny lobes; post-anal lip with one left branch and two ventral nipples. Long tail, with a long and robust caudal point, tiny caudal alae absent.

Measurements of four specimens: length 2.6-2.7 (2.68) mm, with maximum width 195-205 (200) near mid-body. Nerve ring 195-200 (197) from anterior end. Excretory pore 850-862 (857) from anterior end. Oesophagus 790-810 (796) long. Tail 162-176 long. Spicule 165-172 (169) long.

Material examined: eight female specimens and five male specimens.

Host: *Pyxix arachnoides* Bell, 1827, Coll. n° 82 Q, Muséum d'Histoire naturelle, Paris.

Site: large intestine.

Geographical region: Madagascar, collected by Dr Annie Petter.

Specimens deposited: three females and three males deposited at the Muséum National d'Histoire Naturelle, Paris: number 65 HG.

Remarks: our redescription gives new information on buccal structure of the female and male and caudal structure of male. Petter (1966) mentioned three lips in male and female, each lip of male having a slit in its middle. In our study males have six lips (Fig. 2). We have observed that the large cuticularized pieces forming one circle, described by Petter (1966) as papillae, are without any nerve ending. Petter (1966) mentioned two nipples on each post-anal papilla, the use of a scanning microscope allowed verification that the previously described two nipples are a simple nipple, which is confirmed by optical observation. Finally, our redescription gives a new description of pre-anal membrane and of post-anal lip. This formation is similar to that of *T. conica* Drasche, 1884 (see Bouamer & Morand 2002), but differs by possessing a single branch while *T. conica* possesses two.

Sexual dimorphism is marked in the size of body, with the female longer and larger than the male, and by the cephalic end.

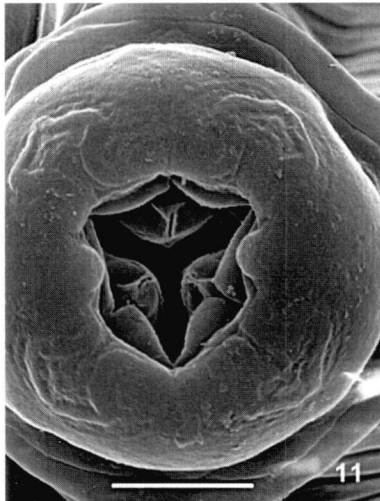
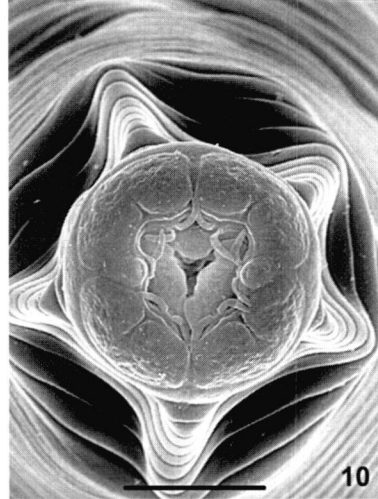
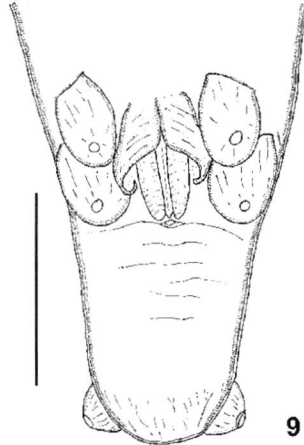
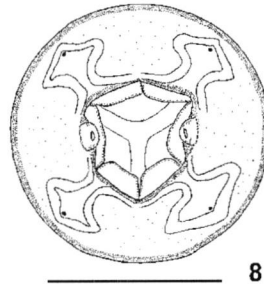
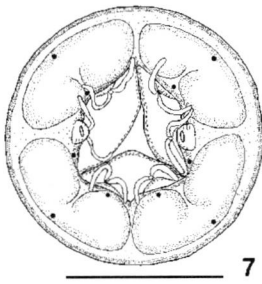
MEHDIELLA STYLOSA (THAPAR, 1925)

Synonyms: *Mebdiella dubinini* Skjabin et Schikhobalova, 1951, *M. hamosa* Forstner, 1960, *M. cordata* Forstner, 1960 by Petter (1966).

Redescription (Figs 7-12)

General: small sized body, tapering at the anterior end. Straight in females, slender and slightly curved ventrally in males. Head distinct from body. Transversely striated cuticle, striation less distinct at the anterior end. Thin and long oesophagus. Excretory pore situated behind the oesophageal bulb.

Female: middle-sized, spindle-shaped body. At the anterior end the cuticle forms two small vesicular swellings. Oral opening dodecagonal with three large and transparent lips and cuticle at cephalic end thick with four lightly prominent plates with winding lines; buccal cavity short without teeth. Cephalic sense organs consisting of an inner circle of six not prominent nerve endings, situated as follows: two latero-dorsal, two latero-ventral and two lateral at level of amphids and an outer circle consisting of four sub-lateral not prominent nerve endings (each papilla situated on middle of the external side of each plate). Two internal and slightly prominent amphids. A crown formed by six pairs of symmetrical apical spines around the oral opening situated at level of inner circle of nerve endings: two lateral pairs situated at the level of amphids, two latero-ventral pairs and two latero-dorsal pairs. Conical, robust and middle sized tail.



Figs 7-9. – *Mebdiella stylosa*. 7. Cephalic end, en face of female. 8. Cephalic end, en face of male. 9. Caudal extremity, ventral view of male. Scale-bars: 7, 9, 20 μ m; 8, 15 μ m.

Figs 10-12. – *Mebdiella stylosa*. Scanning electron micrograph (SEM). 10. Cephalic end of female. 11. Cephalic end of male. 12. Caudal extremity of male, ventral view. Scale-bars: 10, 20 μ m; 11, 12, 10 μ m.

Measurements of four specimens: length 4.80-5 (4.9) mm. Maximum width 290-305 (297) near midbody. Nerve ring 195-202(198) and excretory pore 1.50-1.59 (1.55) mm from anterior end. Oesophagus 1.25-1.33 (1.30) mm long. Tail 345-355 (348) long. Vulva 2.88-3.01 (3) mm from anterior end. Eggs asymmetrical, measuring 69 \times 110 (67 \times 108-70 \times 111).

Male: smaller and thinner than female. Hexagonal oral opening bordered by six transparent and thin lips, two laterals, two sub-dorsal and two sub-ventral. Cephalic sense organs consisting of an outer circle of four sub-lateral papillae, an inner circle of papillae not observed. Two lateral prominent amphids. Short buccal cavity

armed with three triangular-shaped teeth at the anterior end; each tooth formed by three cuticularized pieces (same shape as the teeth of *Tachygonetria robusta* (Drasche, 1884) (see Bouamer & Morand, 2002). Two pairs of genital papillae: one elongated pre-anal pair and one elongated post-anal pair; one latero-ventral pair of caudal papillae. Pre-anal membrane with two large lobes. Anterior lip of the anus formed by two robust and curved lobes; posterior lip conical-shaped with two lateral nipples. Fork-shaped spicule with two branches, the ventral branch shorter than the dorsal. Tail not truncate and curved with a robust and short point; tiny caudal alae present.

Measurements of four specimens: Length 2.40-2.45 (2.41) mm, with maximum width 145-152 (148) near midbody. Nerve ring 95-100 (97) from anterior end. Excretory pore 945-955 (949) from anterior end. Oesophagus 689-697 (693) long. Tail 37-42 (39) long. Spicule 50-55 (53) long.

Material examined: 30 female specimens and 25 male specimens.

Host: *Testudo graeca* Linnaeus, 1758, *Testudo hermanni* Gmelin, 1789.

Site: large intestine.

Geographical region: Settat, Morocco, 32° 30' 45" N, 7° 45' 30" W, 22 July 1999, collected by S. Bouamer. South Catalona, Spain, longitude 2° 11' 17" E, 41° 23' 14" N, 17 December, 1993 by Dr C. Feliu.

Specimens deposited: four females and four males from *Testudo graeca*, deposited at the Muséum National d'Histoire Naturelle, Paris: number 66 HG.

Remarks: *Mehdiella stylosa* is distributed only in the Palaearctic Region in *Testudo graeca* from Europe, North Africa, Turkey, Afghanistan and Iran (Thapar 1925; Ryšavč, 1958; Forstner, 1960; Petter, 1962, 1966 and Roca *et al.*, 1988). In *Testudo graeca* and *T. horsfieldii* from Dagestan, Kazakhstan and Tadzhikistan (Dubinina 1949, Sharpilo 1976). Finally Petter (1966) and Johnson (1973) cited this species in *T. hermanni* respectively from Italy and Albania.

Our redescription gives new information on cephalic structure in both sexes and caudal structure in the male of *Mehdiella stylosa*, there are two pairs of elongate genital papillae, one pair pre-anal, and one pair post-anal, Petter (1962) mentioned three genital pairs: one pair pre-anal, one pair ad-anal and one pair post-anal. Sexual dimorphism is marked in the presence of apical spines in female, and in the number of cephalic lips.

MEHDIELLA DOLLFUSI PETTER, 1966

Redescription (Figs 13-18)

General: small body, oesophagus thin and long; tail robust and conical in females, short and curved dorsally in the males. Two slightly prominent amphids. Excretory pore situated behind the oesophageal bulb.

Female: at the anterior end the cuticle forms two small vesicular swellings. Oral opening dodecagonal with three large, transparent lips and cuticle at cephalic end thick with four slightly prominent plates with winding lines. Short buccal cavity, with three robust teeth. Cephalic sense organs formed by an outer circle of four sub-lateral papillae (each papilla situated on middle of the external side of each plate), an inner circle of papillae not observed. A crown formed by six pairs of symmetrical and rectangular apical spines. Long tail.

Measurements of four specimens: length 2.68-2.75 (2.7) mm. Maximum width 198-205 (201) near midbody. Nerve ring 197-200 (199) and excretory pore 0.995-1(0.98) mm from anterior end. Oesophagus 0.998-1.01(1.001) mm long. Tail 115-122 (119) long. Vulva 1.6-1.67 (1.63) mm from anterior end. Eggs asymmetrical, measuring 51 × 121 (49 × 119-53 × 124).

Male: small body, tail curved; hexagonal oral opening with six transparent lips of conical shape and cuticle at cephalic end thick with four slightly prominent plates with winding lines. Cephalic sense organs formed by an inner circle consisting of six non prominent nerve endings (difficult to observe): two latero-dorsal, two latero-ventral and two lateral, and by an outer circle of four sub-lateral papillae; large, sessile and slightly prominent amphids. Short buccal cavity armed with three robust teeth, each tooth formed by three cuticularized pieces (Fig. 17). Two pairs of genital papillae: one rosette-shaped pre-anal pair and one elongated post-anal pair; latero-ventral pair of caudal papillae. Short pre-anal membrane with 14 lobes, the two external with a globular shape. Anterior lip of the anus formed by two robust lobes; posterior lip projecting in conical shaped form with two lateral nipples. Fork-shaped spicule with two branches almost of same length (Fig. 18). Tiny caudal alae present.

Measurements of four specimens: length 2.08-2.1 (2.95) mm, with maximum width 145-151 (147) near midbody. Nerve ring 98-102 (99) from anterior end. Excretory pore 840-850 (847) from anterior end. Oesophagus 695-700 (698) long. Tail 55-61 (58) long. Spicule 45-49 (48) long.

Material examined: 18 female specimens and 12 male specimens.

Host: *Pyxix arachnoides* Bell, 1827, 82 Q, Muséum National d'Histoire Naturelle, Paris.

Site: large intestine.

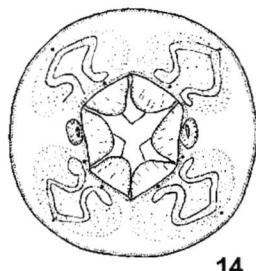
Geographical region: Madagascar, collected by Dr A. Petter.

Specimens deposited: four females and four males deposited at the Muséum National d'Histoire Naturelle, Paris: number 67 GH.

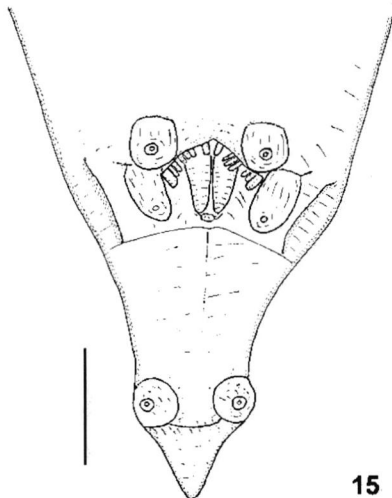
Remarks: *Mehdiella dollfusi* is distributed only in the Ethiopian region in *Pyxix arachnoides* and *Astrochelys radiata* (Shaw, 1802) from Madagascar (Petter 1966). Our redescription gives new information on cephalic structure in both sexes and caudal structure in male. We did not find any formation in the male which resembles the apical spines in the female. Two pairs of elongate genital papillae are observed in the male, one pair pre-anal, and one pair post-anal. Petter (1962) mentioned three genital pairs: one pair pre-anal, one pair ad-anal and one pair post-anal. Sexual dimorphism



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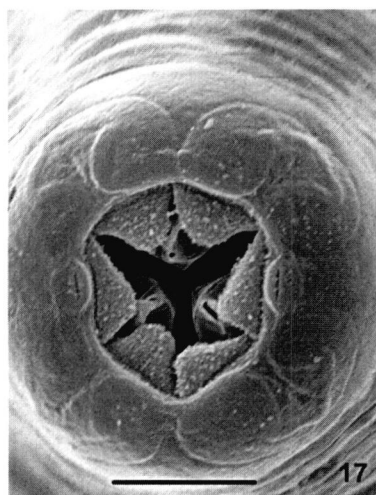
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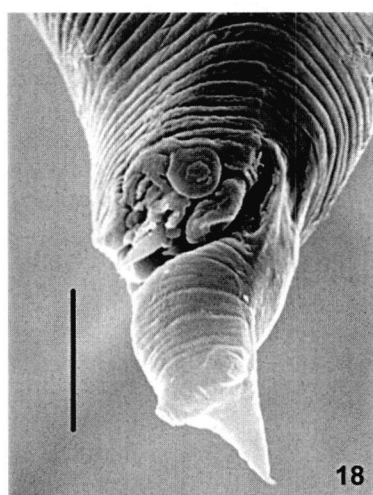
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Figs 13-15. – *Mebdiella dollfusi*. 13. Cephalic end, en face of female. 14. Cephalic end, en face of male. 15. Caudal extremity, ventral view of male. Scale-bars: 13, 14, 8 μ m; 15, 12 μ m.

Figs 16-18 – *Mebdiella dollfusi*. Scanning electron micrograph (SEM). 16. Cephalic end of female. 17. Cephalic end of male. 18. Caudal extremity of male, ventral view. Scale-bars: 16-18, 10 μ m.



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is marked in the presence of the apical spines in female and the number of cephalic lips.

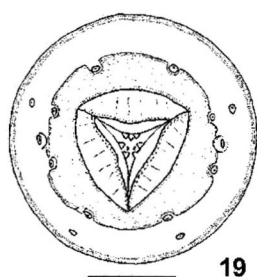
MEBDIELLA UNCINATA (DRASCHE, 1884)

Synonyms: *Oxyuris uncinata* Drasche, 1884; *O. inflata* Drasche, 1884 (see Yorke & Maplestone, 1926); *O. albanica* Stossich, 1898 (see Yorke & Maplestone, 1926); *Tachygonetria uncinata* (Drasche, 1884); *T. inflatocervix* Akhtar, 1937 (see Petter, 1966); *Mebdiella inflata* Forstner, 1960 (see Petter, 1966); *M. uncinata albanica* Johnson, 1973 (see Baker, 1987).

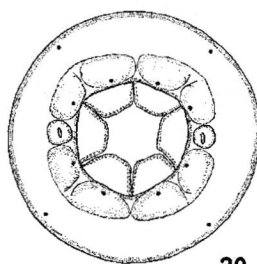
Redescription (Figs 19-24)

General: body thick, medium-sized, straight in female and slightly curved in male. Cuticle thick, transversely striated and forming at the anterior end vesicular swellings, differing by the size and the number between sexes; head distinct with cuticle not striated. Oesophagus relatively short. Excretory pore situated behind bulb.

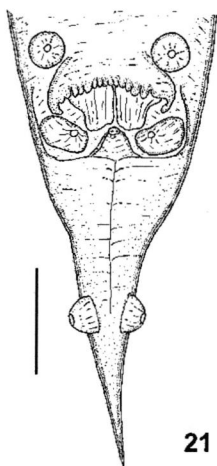
Female: at anterior end the cuticle forms three vesicular swellings, the first of small size, the third larger than the first, the second is largest, the form and the



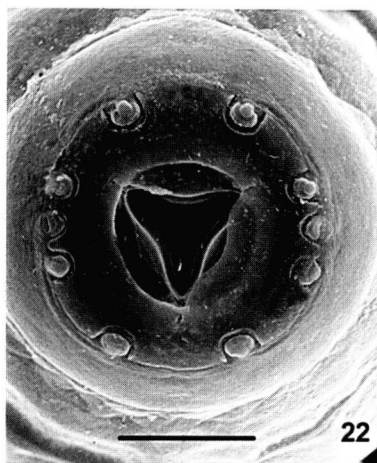
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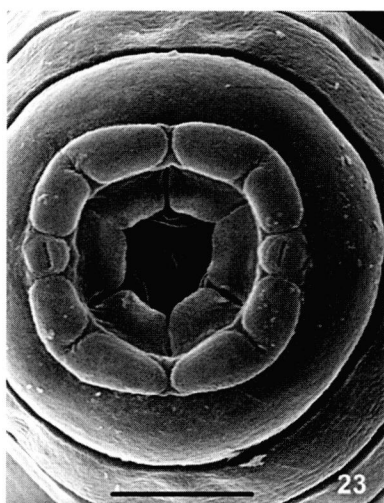
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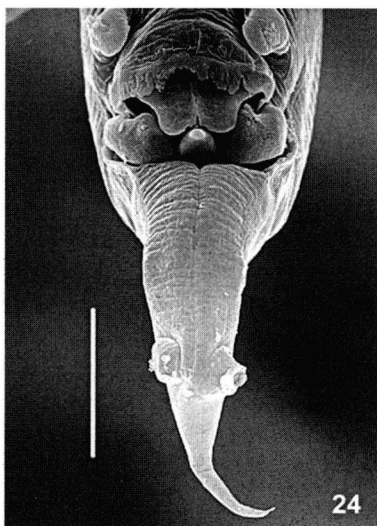
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Figs 19-21. – *Mebdiella uncinata*. 19. Cephalic end, en face of female. 20. Cephalic end, en face of male. 21. Caudal extremity, ventral view of male. Scale-bars: 19-21, 8 μ m.

Figs 22-24. – *Mebdiella uncinata*. Scanning electron micrograph (SEM). 22. Cephalic end of female. 23. Cephalic end of male. 24. Caudal extremity of male, ventral view. Scale-bars: 22, 24, 20 μ m; 23, 10 μ m.



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size of the second vesicular swelling varying slightly according to individuals. Oral opening circular, surrounded by three transparent and simple lips. Buccal cavity short, oesophagus armed with nine small teeth situated as follows: six at anterior end with two teeth of different size on each lobe of oesophagus, three teeth situated about seven μ m of the anterior end, with one tooth on each sector of oesophagus. Cephalic sense organs consisting of an inner circle of eight nerve endings on prominent papillae, four on the lateral side, two on the ventral side and two the on dorsal side. The outer circle not observed; two large prominent lateral amphids. Tail robust, long and conical.

Measurements of four specimens: Length 5.90-6 (5.95) mm. Maximum width 390-398 (395) near midbody. Nerve ring 350-356 (354) and excretory pore 1.6-1.615 (1.607) mm from anterior end. Oesophagus 1.27-1.285 (1.8) mm long. Tail 348-355 (351) long. Vulva 3.24-3.3 (3.26) mm from anterior end. Eggs asymmetrical, measuring 81 \times 140 (78 \times 138-82 \times 141).

Male: at the cephalic end cuticle forming several (at least seven), small vesicular swellings (the second is largest, same size as the female), situated just behind the head. Oral opening sub-hexagonal, surrounded by six transparent and simple lips. Buccal cavity short, oesophagus not armed with teeth at anterior end. Cephalic

sense organs consisting of inner circle of eight nerve endings, on prominent papillae, four on the lateral side, two on the ventral side and two on dorsal side. The outer circle of four large submedian papillae, and two large prominent lateral amphids. Cuticle thick at cephalic end with four prominent cuticularized plates without nerve endings surrounding the lips at the same level as the amphids, each plate formed by two prominent elongated bumps; this plates situated as follows: two latero-dorsal and two latero-ventral. Cloaca with two elongate pairs of genital papillae: one pair pre-anal and one pair post-anal. Pre-anal membrane present with ten lobes. Anterior lip of anus with two robust, and trapeziform lobes, the extremity of spicule visible between them, posterior lip conical-shaped with two lateral nipples. Spicule short, needle-shaped. Long, not truncate and curved dorsally tail with two latero-ventral caudal papillae situated at level of the 2/3 of tail and with a robust and long point. Tiny caudal alae present. Measurements of four specimens: length 3.12-3.15 (3.143) mm, with maximum width 250-260 (256) near midbody. Nerve ring 222-230 (227) from anterior end. Excretory pore 901-9.07 (9.05) from anterior end. Oesophagus 782-790 (786) long. Tail 112-117 (114) long. Spicule 97-101 (98) long.

Material examined: 50 female specimens and 40 male specimens.

Host: *Testudo graeca* Linnaeus, 1758, *Testudo hermanni* Gmelin, 1789 and *Testudo horsfieldii* (Gray, 1844)

Site: large intestine.

Geographical region: Settat, Morocco, 32° 30' 45" N, 7° 45' 30" W, 22 July 1999, collected by S. Bouamer. South Catalona, Spain, longitude 2° 11' 17" E, 41° 23' 14" N, 17 December, 1993, collected by Dr C. Feliu and *Testudo horsfieldii* from Iran, 64 Q Muséum National d'Histoire Naturelle, Paris.

Specimens deposited: four females and four males from *Testudo graeca*, deposited at the Muséum d'Histoire Naturelle (Paris): number 68 HG.

Remarks: this species is distributed only in the Palaearctic region in *Testudo graeca* from Europe, North Africa, Afghanistan and Iran (Drasche, 1884, Stossich, 1898, Seurat, 1918, Thapar, 1925, Ryšavč, 1958, Forstner, 1960, and Petter, 1961, 1966), in *Testudo kleinmanni* Lortet, 1833 in Egypt (Baylis, 1923), in *Testudo horsfieldii* in Turkestan and Iran (Rees, 1935, Akhtar, 1937, Dubinina, 1949 and Petter, 1966), Volga Delta and Caspian steppe (Markov *et al.*, 1962), and Dagestan Sharpilo, 1976); and *T. hermanni* in Albania (Johnson, 1973) and in Italy (Petter, 1966).

Our redescription gives new information on buccal and caudal structure of *Mehdiella uncinata*. In female three transparent lips surrounding the oral opening, Petter (1962) citing six lips. Buccal cavity armed with teeth

in females (nine teeth). Four cuticularized plates surrounding the lips are observed in the male. Similar formations are observed in *Tachygonetria dentata* Wedl, 1862, see Bouamer & Morand (2002). Finally there are two pairs of elongate genital papillae in the male, one pair pre-anal, and one pair post-anal.

Sexual dimorphism is marked, with the female longer and larger than the male and with a different structure of cephalic end between sexes. The buccal cavity is armed with teeth only in the female.

DISCUSSION

According to our redescriptions, *Mehdiella dollfusi* and *M. stylosa* show important differences: in males of *M. dollfusi* large cephalic lips with a conical internal side, whereas in males of *M. stylosa* small cephalic lips with a straight internal side. The apical spines are robust and short in *M. dollfusi* whereas in *M. stylosa* they are thin and long. In *M. dollfusi* the fork-shaped spicule has two branches of almost the same length, whereas in *M. stylosa* the ventral branch is shorter than the dorsal branch. The shape of pre-anal membrane shows a real difference in males of the two species: in *M. dollfusi*, the membrane is divided into several tiny lobes, whereas in *M. stylosa* this membrane is composed of two large overlapping lobes. The shape of pre-anal lip is also different, straight in *M. dollfusi* and curved in *M. stylosa*. In the female of *M. dollfusi*, the vulva is prominent whereas not so in *M. stylosa*. Finally the oesophagus is longer in *M. dollfusi* than in *M. stylosa*. We propose to raise these two sub-species to level of species.

Mehdiella cristata shows a great morphological divergence with the other species of the genus *Mehdiella*; the presence of a lateral alae, a prominent genital cone in males, the structure of cephalic end similar to structure observed in the genus *Thelandros* Wedl, 1862, (see Petter, 1966 and Caballero, 1968) and the position of the caudal papillae and the shape of the tail. In males of all the other species of the genus *Mehdiella*, tiny caudal alae are present (Bouamer *et al.*, 2001b), but absent in *M. cristata*; a similar structure is observed in some species of the genus *Thelandros*, see Caballero (1968). These observations question the position of *M. cristata* among the genus *Mehdiella*.

The oxyurid parasites of herptiles is a group with complex morphological structures. Our new observations using light microscope and SEM, allow us to improve descriptions and reveal unnoticed characters, which may have a potential interest in systematic and phylogenetic reconstruction.

The apical and caudal end morphology allows us to distinguish four groups in the genus *Mehdiella*. The first group is formed by *Mehdiella stylosa*, *M. dollfusi* and

M. petterae. These species seem to be related by sharing the following characters in the males: the number and similarity of the shape of the cephalic lips, the presence of a buccal cavity armed with teeth and the shape of the tail. The second group contains *M. microstoma* and *M. longissima*. They resemble by the shape of the bodies in both sexes and by shape of caudal end in the male. They differ by the shape of the mouth in the female and the length of the oesophagus. In *M. microstoma* the oral opening in the female is longitudinal with unequal lips, whereas in *M. longissima* the oral opening is triangular and the oesophagus is short. *M. uncinata* and *M. grassei* are included in the third group. The shape of caudal tail in the male of *M. uncinata* resembles that of *M. grassei* (see the description of Petter, 1966), but these two species differ by the structure of cephalic end, with four prominent cuticularized plates in the male of *M. uncinata*, absent in *M. grassei*. The fourth group is formed by one species *M. cristata*.

KEY TO THE SPECIES OF THE GENUS *MEHDIELLA*

This includes *Mehdiella longissima* Petter, 1966 and *M. grassei* Petter, 1966, although not redescribed here.

- 1 Vesicular swellings in anterior extremity present....2
Vesicular swellings in anterior extremity absent.....6
- 2 Spicule extremity simple3
Spicule with fork-shaped extremity4
- 3 Post-anal lip with one left branch, buccal cavity armed with three teeth.....*M. cristata* Petter, 1966
Post-anal lip globular, buccal cavity of female armed with nine teeth.....*M. uncinata* (Drasche, 1884)
- 4 Tail straight.....*M. petterae* Bouamer *et al.*, 2001
Tail curved dorsally5
- 5 Pre-anal membrane with two large lobes.....*M. stylola* (Thapar, 1949)
Pre-anal membrane with several tiny lobes...*M. dollfusi* Petter, 1966
- 6 longitudinal oral opening.....*M. microstoma* (Drasche, 1884)
Triangular oral opening7
- 7 Short oesophagus and oral opening in the male with three lips*M. longissima* Petter, 1966
Long oesophagus and oral opening in the male with six lips.....*M. grassei* Petter, 1966

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