

RESEARCH NOTE

# Two thousand parasites on a single ray: An infection with two species of skin monogeneans on a blotched fantail ray kept in an aquarium

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## Abstract

A blotched fantail ray, *Taeniurops meyeri* (Müller et Henle, 1841), was captured in New Caledonia, South Pacific, and kept in a tank for quarantine before exhibition at the Nouméa public aquarium. After 24 days, the ray exhibited a heavy infection with two species of skin monogeneans. A freshwater bath allowed the collection of 1,914 monogeneans, including 1,453 capsalids, *Neoentobdella taiwanensis* Whittington et Kearns, 2009, on the ventral surface, and 461 monocotylids, *Dendromonocotyle pipinna* Chisholm et Whittington, 2004, on the dorsal surface. More than 300 monogeneans were prepared on slides to allow precise measurements. Capsalids and monocotylids occupied about 6% and 0.2% of the total ventral and dorsal ray surfaces, respectively.

## Résumé

Une raie, *Taeniurops meyeri* (Müller et Henle, 1841), a été capturée en Nouvelle-Calédonie, Pacifique Sud, et gardée dans un bac en quarantaine avant exposition à l'Aquarium de Nouméa. Après 24 jours, la raie a montré une forte infection par deux espèces de monogènes de la peau. Un bain d'eau douce a permis la récolte de 1914 monogènes, dont 1453 Capsalidae, *Neoentobdella taiwanensis* Whittington et Kearns, 2009 sur la surface ventrale, et 461 Monocotylidae, *Dendromonocotyle pipinna* Chisholm et Whittington, 2004 sur la surface dorsale. Plus de 300 monogènes ont été montés en lames pour permettre des mesures précises. Les Capsalidae et les Monocotylidae occupaient approximativement 6% et 0,2% des surfaces ventrale et dorsale de la raie, respectivement.

## Keywords

Monogenea, *Neoentobdella taiwanensis*, *Dendromonocotyle pipinna*, ray, *Taeniurops meyeri*, public aquarium

Monogeneans are common ectoparasites of fishes. Their intensity is generally low on wild fish, but in special conditions, such as confined fish in aquaculture or aquaria, monogeneans can be observed in high numbers (Euzet and Raibaut 1985, Thoney and Hargis 1991, Whittington and Chisholm 2008) and may become pathogenic. Reports of *Dendromonocotyle* spp. infections in aquaria are increasing internationally (Vaughan and Chisholm 2009) and have been responsible for skin damage and disease in stingrays kept in captivity. We report here an infection on a blotched fantail ray, which was exceptional in two ways: two species of monogeneans were

involved, and almost 2,000 monogenean specimens were counted.

A female blotched fantail ray, *Taeniurops meyeri* (Müller et Henle, 1841) (weight 8 kg, disk length 59 cm, disk width 63 cm, tail 50 cm) was caught on 25 March 2009 (near Récif Crouy, off Nouméa, New Caledonia, 22°22'S, 166°21'E) for inclusion in the Nouméa public aquarium. It was transferred to a 3,500 l tank for examination and quarantine before being introduced into the display tank. When a heavy infection with monogeneans was noticed, the ray was caught with a net, transported to a 2,500 l tank filled with tap water to a depth of

15 cm for 3–5 min. After the treatment, the water of the freshwater tank was filtered through a 300-mesh (50  $\mu\text{m}$ ) filter and monogeneans were collected. Dead monogeneans were immediately transferred to seawater, fixed with cold 70% ethanol or cold 4% formalin, stained with carmine and prepared on permanent slides mounted in Canada balsam, according to routine methods (Justine 2005, Marie and Justine 2005, 2006). Slides were sent to specialists for identification (Ian Whittington and Leslie Chisholm, South Australian Museum, Adelaide, Australia). Measurements were taken on parasites mounted on slides. For capsalids, the slides were scanned with a tabletop scanner. For monocotylids, specimens were drawn with pencil with a BH2 Olympus microscope equipped with Nomarski DIC and a camera lucida, and drawings were scanned. Measurements were taken with ImageJ (Rasband 1997–2009) on digital files. Linear measurements (Fig. 1) were taken with the straight line selection tool. The outline of the body was drawn, the interior was filled in black and the body surface area was then measured. The haptor surface area was estimated from the diameter as the surface of a circle. The total surface area of the ray was estimated using ImageJ on a digital photograph. The total surface area of haptors and monogenean bodies was calculated by adding all surfaces measured on specimens (151 capsalids and 173 monocotylids) multiplied by an appropriate factor according to the total number of monogeneans collected (1,453:151 and 461:173 for capsalids and monocotylids, respectively, see Table I). Voucher slides were deposited in the following collections: MNHN, Muséum National d'Histoire Naturelle, Paris; BMNH, Natural History Museum, London; USNPC, United States National Parasite Collection, Beltsville; SAMA AHC, South Australian Museum, Australian Helminthological Collection, Adelaide, South Australia, Australia; HCPI, Helminth Collection of the Parasitological Institute, České Budejoviče, Czech Republic;

MPM, Meguro Parasitological Museum, Tokyo, Japan. Slides deposited: *Neoentobdella taiwanensis* Whittington et Kearns, 2009, BMNH 2009.9.18.5; USNPC 102290; SAMA AHC 29808–9; HCPI M-501; MPM A5383; MNHN JNC2911C; *Dendromonocotyle pipinna* Chisholm et Whittington, 2004, BMNH 2009.9.18.6; USNPC 102291; SAMA AHC 29807; HCPI M-502; MPM A5384; MNHN JNC2911M.

At day 24 after capture (temperature of the water ca. 25°C), large white monogeneans were noticed on the margin of the dorsal surface, where they were easily visible on the dark background. Monogeneans were collected from the bath water. Although only large white monogeneans were seen with the naked eye on the ray and in the freshwater bath, examination with a binocular microscope revealed that there were two species, one large and white and one small and dark. The large white monogenean species, a capsalid, was probably confined to the ventral surface of the ray and it was only due to an exceptionally high infection that several white monogeneans were noticed on the edges of the dark dorsal surface. The small dark monogenean species, a monocotylid, was probably confined to the dorsal surface. A total of 1,914 monogeneans, including 1,453 capsalids and 461 monocotylids were collected from the freshwater bath but it cannot be excluded that a few specimens were lost, so probably more than 2,000 monogeneans (not 1,914) were present. Monogeneans (151 capsalids and 173 monocotylids) were mounted on permanent slides and measured.

Identification of parasites on slides revealed that the white large capsalids were *N. taiwanensis* Whittington et Kearns, 2009 and that the smaller dark monocotylids were *D. pipinna* Chisholm et Whittington, 2004. Capsalids (Table I) included many large animals (5–7 mm in length) and smaller immature individuals including very small specimens (0.68 mm in length). Monocotylids (Table I) included large, mature ani-

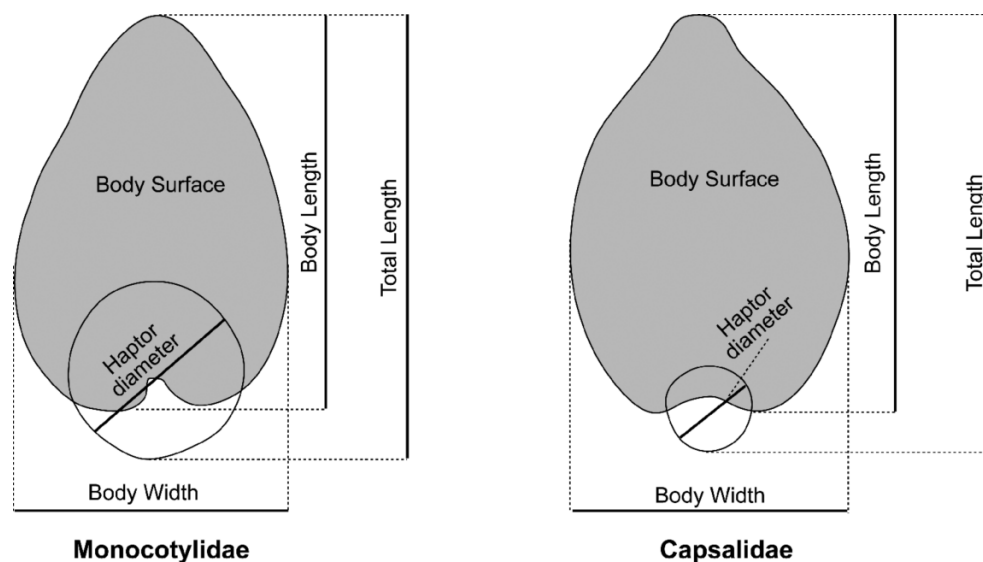


Fig. 1. Measurements of monogeneans

**Table I.** Measurements of capsalids, *Neoentobdella taiwanensis*, and monocotylids, *Dendromonocotyle pipinna*, collected from a freshwater bath of the ray

Measurements	<i>N. taiwanensis</i>	<i>D. pipinna</i>
	n = 151 mean ± SD (min.-max.)	n = 173 mean ± SD (min.-max.)
Total length (mm)	5.49 ± 1.72 (0.68–7.5)	1.69 ± 0.59 (0.59–4.32)
Body length (mm)	4.90 ± 1.59 (0.59–6.77)	1.48 ± 0.55 (0.49–3.98)
Body width (mm)	3.12 ± 1.10 (0.23–4.45)	0.98 ± 0.42 (0.30–2.93)
Body surface area (mm <sup>2</sup> )	13.03 ± 5.93 (0.14–21.86)	1.26 ± 1.16 (0.11–8.96)
Haptor diameter (mm)	1.15 ± 0.30 (0.21–1.51)	0.68 ± 0.22 (0.27–1.66)
Haptor surface area (mm <sup>2</sup> )	1.12 ± 0.44 (0.03–1.79)	0.40 ± 0.29 (0.06–2.16)

**Table II.** Surface areas and percentages of the total ray surface area occupied by monogeneans. Ray disk surface area: 3,116,000 mm<sup>2</sup> (0.3116 m<sup>2</sup>) on one face

Monogeneans	Haptor surface area	Body surface area
Capsalids		
<i>N. taiwanensis</i>	1,625 mm <sup>2</sup> 0.52% of ventral ray surface	18,935 mm <sup>2</sup> 6.04% of ventral ray surface
Monocotylids		
<i>D. pipinna</i>	184 mm <sup>2</sup> 0.06% of dorsal ray surface	579 mm <sup>2</sup> 0.18% of dorsal ray surface
All monogeneans	0.29% of total disk surface	3.11% of total disk surface

mals (up to 4.32 mm in length) and smaller specimens. The total length, body length, body width, body surface area, haptor diameter and surface area were measured (Table I). The total surface area of the two monogenean species could be evaluated (Table II). The total surface area of capsalids was approximately 190 cm<sup>2</sup>, representing ca. 6% of the ventral disk surface area of the ray, and that of monocotylids was about 6 cm<sup>2</sup>, representing 0.2% of the dorsal disk surface area. If we consider only the principal attachment organ of the monogenean body, the haptor, which is in direct contact with the ray body, capsalids accounted for approximately 16 cm<sup>2</sup> (0.5% of the ventral disk surface area) and monocotylids accounted for approximately 2 cm<sup>2</sup> (0.06% of the dorsal disk surface area). All monogeneans together occupied 3% of the total disk surface area (ventral and dorsal) and their haptors occupied 0.3% of the total disk surface area.

*Neoentobdella* Kearn et Whittington, 2005 currently includes 10 species (Kearn and Whittington 2005, Whittington and Kearn 2009a). *N. taiwanensis* Whittington et Kearn, 2009 has been described from the skin of *T. meyeri* of unknown source kept in an aquarium in Taiwan. Whittington and Kearn (2009a) considered that specimens collected from the same host in an aquarium in Japan also belonged to the same species. So far, this species seems to have only been recorded, including the present report, from a single host, *T. meyeri*, and only from aquarium rays. New Caledonia is a new geographical record for this species. Records of capsalid monogeneans from New Caledonia include several species from teleost fishes (Justine 2005, Hinsinger and Justine 2006, Perkins *et al.* 2009), but this is the first capsalid recorded from a ray. *Dendromonocotyle* Hargis, 1955 currently includes 17 species

(Chisholm and Whittington 2004, 2009; Chisholm *et al.* 2004; Vaughan and Chisholm 2009). *D. pipinna* Chisholm et Whittington, 2004 has been described from the skin of *T. meyeri* born in captivity in an aquarium in Queensland, Australia. The species has not been recorded from other hosts; the ray studied by us was never in contact with other rays in the Nouméa aquarium, and our record confirms that the host in the wild is *T. meyeri*. It is the first member of the genus recorded from New Caledonia, and New Caledonia is a new geographical record for the species. Records of monocotylid monogeneans in New Caledonia include five species, four from the spotted eagle ray *Aetobatus cf. narinari*, and one from the deep-sea shark *Squalus melanurus* Fourmanoir et Rivaton (Marie and Justine 2005, 2006; Justine 2009, 2010).

It is the first time that a double infection with both capsalids and monocotylids is reported for this ray species.

It is known that gill monogeneans can be numerous: more than 1,400 polyopisthocotyleans, *Zeuxapta seriolae* (Meserve, 1938), have been counted on a reared amberjack, *Seriola dumerili* (Risso, 1810) (Montero *et al.* 2004). On wild fish, small gill monogeneans such as diplectanids can be found at numbers reaching hundreds or even thousands (e.g., (Poulin and Justine 2008)). Skin monogeneans as the invasive monopisthocotylean species *Gyrodactylus salaris* Malmberg, 1957 can infect salmon with numbers reaching 10,000 per fish (Whittington and Chisholm 2008). However, the literature only reports small numbers for capsalids on rays (Kearn 1978, Whittington and Kearn 2009b), monocotylids on rays (Euzet and Maillard 1967, Chisholm *et al.* 2001, Chisholm and Whittington 2005), or capsalids on teleost fish (Ogawa 1984, Horton and Whittington 1994, Kritsky and Fennessy 1999), with

a maximum reported of 400 *Benedenia lutjani* (Whittington et Kearns, 1993) on an aquarium specimen of *Lutjanus carponotatus* (Richardson, 1842) (Whittington and Kearns 1993). Most descriptions of the currently known *Dendromonocotyle* species (Chisholm and Whittington 2004, Chisholm et al. 2004, Vaughan and Chisholm 2009) indicate that monogeneans were “numerous” without indicating precise figures.

We believe that the present report is the first to precisely quantify the intensity of infection in a captive ray. We also provide the first estimate of the percentage of the total body surface area of the ray occupied by monogeneans in a heavy infection.

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