PERICARDIUM OF GARRA RUFA (PISCES: CYPRINIDAE) AS THE SITE OF INFECTION OF CUCULLANUS LARVAE (NEMATODA)

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An examination of fish samples taken by the junior author (Z. I. F. Rahemo) from the River Tigris at Mosul, Iraq, from June until December 1992 revealed a frequent occurrence of small-sized nematode larvae encysted in the pericardium of the cyprinid fish Garra rufa (Heckel); out of 35 fishes examined, 14 harboured the parasite (42 %). The infected fishes usually harboured less than ten almost spherical, thin-walled, white-coloured cysts of about 1 mm in diameter, each containing only one coiled nematode larva. A closer examination of the morphology of these larvae showed that they belonged to the genus Cucullanus Miller, 1777 (Seuratoidae, Cucullanidae), which includes numerous species parasitic in fishes and turtles. Since the present knowledge of the biology of nematodes of the family Cucullanidae is poor, we consider it useful to put this finding on record.

Fig. 1. Cucullanus sp. third-stage larva from Garra rufa from Iraq. A,B - anterior end of body, lateral and dorsal views; C,D - head end, lateral and dorsal views; E - tail. (Measurements in mm.)
Cucullanus sp. third-stage larva

**Description** (10 specimens): Larval body elongate, somewhat tapering to both ends, 2.37-2.50 mm long and 0.122-0.165 mm wide. Cuticle almost smooth, with very indistinct transverse striaation. Lateral alae well developed, extending from close to cephalic end to beyond middle of tail; these are relatively wide in cervical region, up to 0.024 mm in width posterior to level of oesophagus and very narrow in posterior half of body. Deirids finger-shaped, situated at short distance posterior to nerve-ring, 0.249 mm from anterior extremity; postdeirids not observed. Cephalic end rounded; mouth opening surrounded by two pairs of cephalic papillae. Small mouth cavity present. Oesophagus well developed, 0.426-0.435 mm long, almost cylindrical anteriorly but distinctly expanded near its posterior end; width of oesophagus at its anterior end, middle and near its posterior end 0.045-0.048, 0.024-0.027 and 0.063-0.069 mm, respectively. Anterior end of oesophagus with distinct, dark, broad duct of dorsal oesophageal gland. Large dorsal oesophageal cell nucleus typical of some cucullanid third-stage larvae absent. Nerve-ring encircling anterior oesophagus 0.174-0.198 mm from anterior end of body; excretory pore near level of nerve-ring, 0.195-0.210 mm from anterior extremity. Oesophagus opens into gut through small valve. Gut relatively narrow, opening through short hyaline rectum; small, round unicellular rectal glands present. Tail conical, 0.189-0.210 mm long, sharply pointed. Small oval genital primordium located in posterior third of body.

**Comments:** The generic identification (using a broad conception of *Cucullanus* - see Moravec and Malmqvist 1977; Folia Parasitol. 24: 323-329) of these larvae is mainly based on their morphological similarity to the third-stage larvae of *Cucullanus (Truttaeacnitis) truttae* (Fabricius, 1794), a Holarctic parasite of salmonids and lampreys, as described by Moravec 1979; Folia Parasitol. 26: 295-307. The presence of markedly wide lateral alae, typical also of *C. truttae* larvae, suggests that the larvae from *G. rufo* may belong to the subgenus *Truttaeacnitis* Petter, 1974; no lateral alae have so far been observed in third-stage larvae of other cucullanid species. However, in contrast to the third-stage larvae of *C. truttae*, the larvae of the present material are markedly larger (2.37-2.50 mm vs 0.84-0.92 mm), their excretory pore lies at the level of the nerve-ring, the large oesophageal cell nucleus is lacking, and the shape of the oesophagus is different.

The third-stage larvae encysted in internal organs of some marine and freshwater fishes were also described in *Cucullanus heterocorhis* Rudolphi, 1802, *C. longicolis* (Stoschich, 1899), *C. micropapillatus* Tomqrist, 1931, *Dichelyne minutus* (Rudolphi, 1819) and *D. cytyophora* (Ward et Magath, 1917) (Janiszewska J. 1939; Mém. Acad. pol. Sci., ser. B, 1-68; Janiszewska J. 1970; Zool. pol. 20: 339-343; Lomakin V.V. 1970; In: Voprosy morskoy parazitologii, Naukova Dumka, Kiev, pp. 68-69 [In Russian]; Gibson D.I. 1972: Bull. Brit. Mus. nat. Hist. (Zool.) 22: 153-170; Baker M.R. 1984; Can. J. Zool. 62: 2062-2073); all these are characterized by a much smaller body size (length about 1 mm), presence of a large oesophageal cell nucleus, and a much more posteriorly situated excretory pore in relation to the nerve-ring. In all these cases, the encysted cucullanid larvae were always located in the host's gut-walls or in the liver. Therefore, the site of location of *Cucullanus larvae in Garra rufo*, where the parasite's cysts were present only in the pericardium, is quite unusual in this group of nematodes and may be a characteristic biological feature of the species in question.

The life-cycles of cucullanids are poorly known and they have been experimentally demonstrated only rarely. Janiszewska (1972) - quoted by Ivashkin V.M. and Khromova L.A. 1976: Cucullanata and Gnathostomatata of animals and man and the diseases caused by them. Osnovy nematologii 27, Nauka, Moscow, 436 pp. [In Russian]) believed that cucullanids are homoxenous, developing in a single host, and the direct transmission of *Cucullanus chabaudi* Le-Van-Hoa et Pham-Ngoc-Khue, 1967 in *Pangasius pangasius* and *Truttaeacnitis stelmioides* (Vessichelli, 1910) (= *Cucullanus truttae* in lampreys were described by Le-Van-Hoa and Pham-Ngoc-Khue (1967; Bull. Soc. Pathol. Exot. 60: 315-318) and Pybus et al. (Pybus M.J., Uhazy L.S., Anderson R.C. 1978: Can. J. Zool. 56: 1420-1429), respectively, on the basis of their experimental studies. However, with regard to other species, the latter authors (Pybus et al. - op. cit.) speculated that "cucullanids are basically heteroxenous in that they use the immature stage of the host as an intermediate host". A direct development was also found by Kuzia (1979; Dissertation Abstracts 39B: 3193-3194) in *Dichelyne bulbolck* Stromberg et Crites, 1972 in *Fundulus heteroclitus*. On the other hand, Baker (op. cit.) experimentally demonstrated a heteroxenous transmission cycle in *Dichelyne cytolyphora* parasitic in *Perca flavescens*, using a small cypriinid, *Notropis cornutus*, as an intermediate host. Moravec (1979; op. cit.; 1980; Folia Parasitol. 27: 217-226) discovered two alternative cycles of development in *Cucullanus truttae*, a direct development (when the nematode matures in adult lampreys) and an indirect one (with larval lampreys as intermediate hosts, when the nematode matures in salmonids).

In view of this discussion, it is not possible to determine whether the cypriinid *Garra rufo* serves as an intermediate host for the *Cucullanus* species the larvae of which it harbours or if the larvae can mature in the same host. The only *Cucullanus* species hitherto reported from freshwater fish in Iraq (also from the R. Tigris) is *C. cyprini* Yamaguti, 1941 which occurs in the cypriinids *Cyprion macrostomus*, *Barbus luteus* and *Alburnus capito* (see Ali N.M., Salih N.E., Abdul-Ameer K.N. 1987: J. Biol. Sci. Res., Baghdad, 18: 35-45; Ali N.M., Al-Jafery A.R., Abdul-Ameer K.N. 1987; Ibid, 18: 163-180; Rahemo Z.I.F., Ami S.N. 1993: Dirasat Journal, Amman, Jordan - in press); the biology of this species is not known. However, since the helminth fauna of fishes in Iraq is little-known, it is possible that the *Cucullanus* larvae of the present material may belong to another species.

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