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VERSITA

Falcaustra sanjuanensis sp. nov. (Nematoda: Kathlaniidae) from *Odontophrynus* cf. *barrioi* (Anura: Cycloramphidae) from Argentina

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Abstract

Here, we describe a new kathlaniid nematode, *Falcaustra sanjuanensis* sp. nov., from the large intestine of *Odontophrynus* cf. *barrioi* (Anura: Cycloramphidae), from San Juan Province, Argentina. The new species belongs to the *Falcaustra* group that possesses a pseudosucker. It resembles *F. andrias* in the distribution pattern of caudal papillae (six precloacal, four adcloacal, 12 postcloacal, one unpaired median anterior to the cloaca) but differs from *F. andrias* in the following characters: the longer size of males and females (11.17–13.45 mm and 10.1–15.5 mm, respectively); the longer size and form of the gubernaculum (0.17–0.23 mm, triangular form); the arrangement of postcloacal papillae (three pairs on the ventral side, two pairs on the lateral side, one pair on the subventral side) and unpaired papilla anterior to the cloaca located on the protuberance. The species description is based on light microscopy and scanning electron microscopy (SEM). *Falcaustra sanjuanensis* sp. nov. represents the 12th Neotropical species assigned to the genus. Also, we added a key to Neotropical species of *Falcaustra*.

Keywords

Nematoda, *Falcaustra sanjuanensis* sp. nov., Kathlaniidae, *Odontophrynus* cf. *barrioi*, Argentina

Introduction

Studies on the helminth parasites of the herpetofauna of San Juan Province, Argentina, are scarse. Up to the moment, the only record is *Oochoristica travassosi* (Rego et Ibañez, 1965) (Cestoda, Linstowiinae) found in the lizard *Liolaemus vallecurensis* Pereyra, 1992 from Iglesia Department (Goldberg *et al*. 2004). To our knowledge, there are no reports of nematode parasites from amphibian in this province.

In the present study, we report a new kathlaniid species parasitizing the digestive tract of an anuran belonging to the genus *Odontophrynus* Reinhardt et Lütken, 1862, collected in Caucete Department.

The adult stages of *Falcaustra* Lane, 1915 parasitize mainly turtles, less frequently amphibians and fish, and even one species of bird (Baker 1987). Its life cycle is unknown but third-stage larvae have been found in snails and fishes, and it is also agreed that snails and fish are paratenic hosts in the life cycle of *Falcaustra* species (Bartlett and Anderson 1985, Moravec *et al*. 1995). Twelve out of the 89 nominal species found in different Realms (Bursey and Rivera 2009, Liu *et al*. 2011) occur in the Neotropical region.

Materials and methods

Thirty *Odontophrynus* cf. *barrioi* (17 females, 13 males) were collected between November 2006 and November 2007 in the Quebrada de Las Flores (31º42´2.8″S, 68º05´68.5″W, 726 m), 55 km east of San Juan city, in the Caucete Department, Argentina. Toads were examined for nematode parasites. Intestinal nematodes were fixed and preserved in 70% ethanol and cleared with lactophenol for light microscopic examination. Illustrations were made using a Zeiss microscope with the aid of a camera lucida. For examination in scanning electron microscope (SEM), the nematodes were postfixed in 1% OsO_4, dehydrated through an ethanol and an acetone series and then subjected to critical point drying. The specimens were coated

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with gold and examined with a JSM-5800 scanning electron microscope. All measurements are given in micrometers unless otherwise indicated as the mean and standard deviation with the range in parentheses. Amphibian taxonomy follows Frost (2011). Specimens were deposited in the Helminthological Collection of the Museo de La Plata, La Plata, Argentina, and the Helminthological Collection of the Centro de Ecología Aplicada del Litoral, Corrientes, Argentina. Symbiotypes are stored in the Colección Herpetológica Fundación Miguel Lillo (FML).

Results

Eleven (36.6%) of the toads were found to harbour 9 males and 11 females of an undescribed species of *Falcaustra*.

***Falcaustra sanjuanensis* sp. nov.**

General: Large nematodes. Cuticle with irregular transverse striations. Lateral alae absent. Mouth bounded by three lips; rim of each lip with narrow membranous flange (Fig. 1A). Dorsal lip with two larger elevated cephalic papillae, each ventrolateral lip with two larger, elevated cephalic papillae and one flat amphid (Fig. 1B). Excretory pore conspicuous, longitudinally elongate, situated in a conspicuous depression at the level of the posterior half of oesophagus (Fig. 1C). Oesophagus with elongate isthmus and spherical bulb. Oesophagus opening into intestine through valve. Oviparous. Females with vulva in the posterior half of the body; uteri opposed. Tail short in both sexes and sharply pointed in males.

Male (9 specimens, holotype and 8 paratypes; mean ± 1 SD and minimum and maximum; measurements of holotype in brackets): Length 12.2 ± 0.74 mm (11.17–13.45) [1.24 mm]; width 345.5 ± 40.2 (270–415) [365] at level of oesophageal-intestinal junction. Pharynx length 95.7 ± 7.6 (86–110) [100], pharynx width 61.3 ± 7.5 (50–72) [52], oesophagus length (excluding isthmus and bulb) 1.77 ± 0.13 mm (1.55–1.94) [1.95 mm], oesophagus width 75.5 ± 15.9 (50–98) [90], isthmus length 168.8 ± 20.7 (150–200) [200], isthmus width 119.7 ± 20.1 (90–150) [110], bulb length 179.4 ± 16.8 (160–215) [195], bulb width 183.7 ± 15.5 (170–215) [190]. Nerve ring 391.6 ± 42.8 (350–460) [415] and excretory pore 1.28 ± 0.16 mm (1.06–1.55) [2.10 mm] from anterior end, respectively. Tail short, conical, length 315.0 ± 35.8 (270–360) [310]. Preanal single pseudosucker with sclerotized rim, length 351.4 ± 69.6 (250–450) [370] (Figs. 1D, 1E). Posterior lip of pseudosucker 1.53 ± 0.12 mm (1.34–1.75) [1.44 mm] from tip of tail and 1.22 ± 0.13 mm (0.99–1.45) [1.13 mm] from anterior lip of anus. Single median papilla immediately anterior to cloaca located on a protuberance (Fig. 2A, B). Eleven pairs of sessile caudal papillae: three pairs precloacal (distance from first to second pair: 110–200; distance from second to third pair: 75–130), two pairs adcloacal (1 pair anterior, 1 pair posterior to cloaca), six pairs postcloacal (first ventral pair located immediately behind the cloaca; second lateral pair in the first third of the tail; third subventral pair in the middle of the tail; one lateral and two ventral pairs in the posterior third of the tail) (Figs 2B, C). Spicules similar in .shape, 570.2 ± 75.6 (450–675) [600] in length, curved, alate; distal end pointed, proximal end slightly expanded (Fig. 1F). Gubernaculum length 201.6 ± 27.5 (175–230) [210], sclerotized, elongated, triangular in ventral view; posterior end pointed (Fig. 1G). Caudal alae absent. Preanal caudal musculature divided into posterior group of 18–32 pairs of diagonally directed muscles and 16–22 pairs of muscles terminating in pseudosucker rim.

Female (11 specimens, allotype and 10 paratypes; mean ± 1 SD and minimum and maximum; measurements of allotype in brackets): Length 13.4 ± 1.5 mm (10.1–15.5) [13.2 mm]; width at level of oesophageal-intestinal junction 412.7 ± 44.9 (310–485) [485]. Pharynx length 99.0 ± 7.1 (85–110) [98], pharynx width 64.7 ± 6.6 (53–73) [57], oesophagus length (excluding isthmus and bulb) 1.81 ± 0.95 mm (1.67–1.98) [1.8 mm], oesophagus width 75.2 ± 12.7 (60–100) [63], isthmus length 176.1 ± 24.0 (125–200) [180], isthmus width 122.2 ± 15.1 (100–150) [117], bulb length 198.8 ± 23.0 (160–250) [205], bulb width 194.5 ± 22.3 (160–230) [160]. Nerve ring 410.5 ± 22.7 (370–450) [450], excretory pore 1.43 ± 0.14 mm (1.18–1.64) [1.25 mm] from anterior end, respectively. Tail length 406.4 ± 76.2 (280–500) [310] (Fig. 1I). Vulva, transverse slit, slightly salient, 4.11 ± 0.76 mm (3.0–5.4) [5.4 mm] from posterior end; vagina directed anterodorsally, giving rise to two opposing uteri. Egg oval, length 67.9 ± 3.2 (63–72) [70], width 54.2 ± 3.3 (50–58) [50], thick shelled unembryonated (Fig. 1H).

Site of infection: Large intestine.

Type locality: Pie de Palo, Quebrada de las Flores, San Juan Province, Argentina (31º42´2.8˝S, 68º05´68.5˝W, 726 m)

Deposition of types: Holotype (male), allotype (female) and paratypes (4 males, 5 females) in Helminthological Collection of the Museum of La Plata (Holotype: MLP-He 6615; allotype: MLP-He 6616; paratypes: MLP-He 6617); paratypes (5 males, 5 females) in Helminthological Collection of Centro de Ecología Aplicada del Litoral (CECOAL 12100501).

Symbiotype: *Odontophrynus* cf. *barrioi* (Anura, Cycloramphidae), Herpetology Collection FML 25048-25051.

Etymology: The new species is named in reference to its province of collection.

Remarks: In the subfamily Kathlaniinae Lane, 1914, Family Kathlaniidae (Lane, 1914 subfam.) Travassos, 1918, there are nine genera that parasitize different groups of hosts: *Kathlania* Lane, 1914 parasite of marine turtles, *Tonaudia* Travassos, 1918 parasite of marine turtles and selachians, *Chabaudinema* Díaz-Ungría, 1968 parasite of Neotropical fish, *Falcaustra* parasite of fish, amphibians and reptiles, *Megalobatrachonema* Yamaguti, 1941 parasite of anurans and urodeles, *Amblyonema* Linstow, 1898 parasite of Australian ceratodiform fish, *Cissophyllus* Raillet et Henry, 1922 parasite of her-

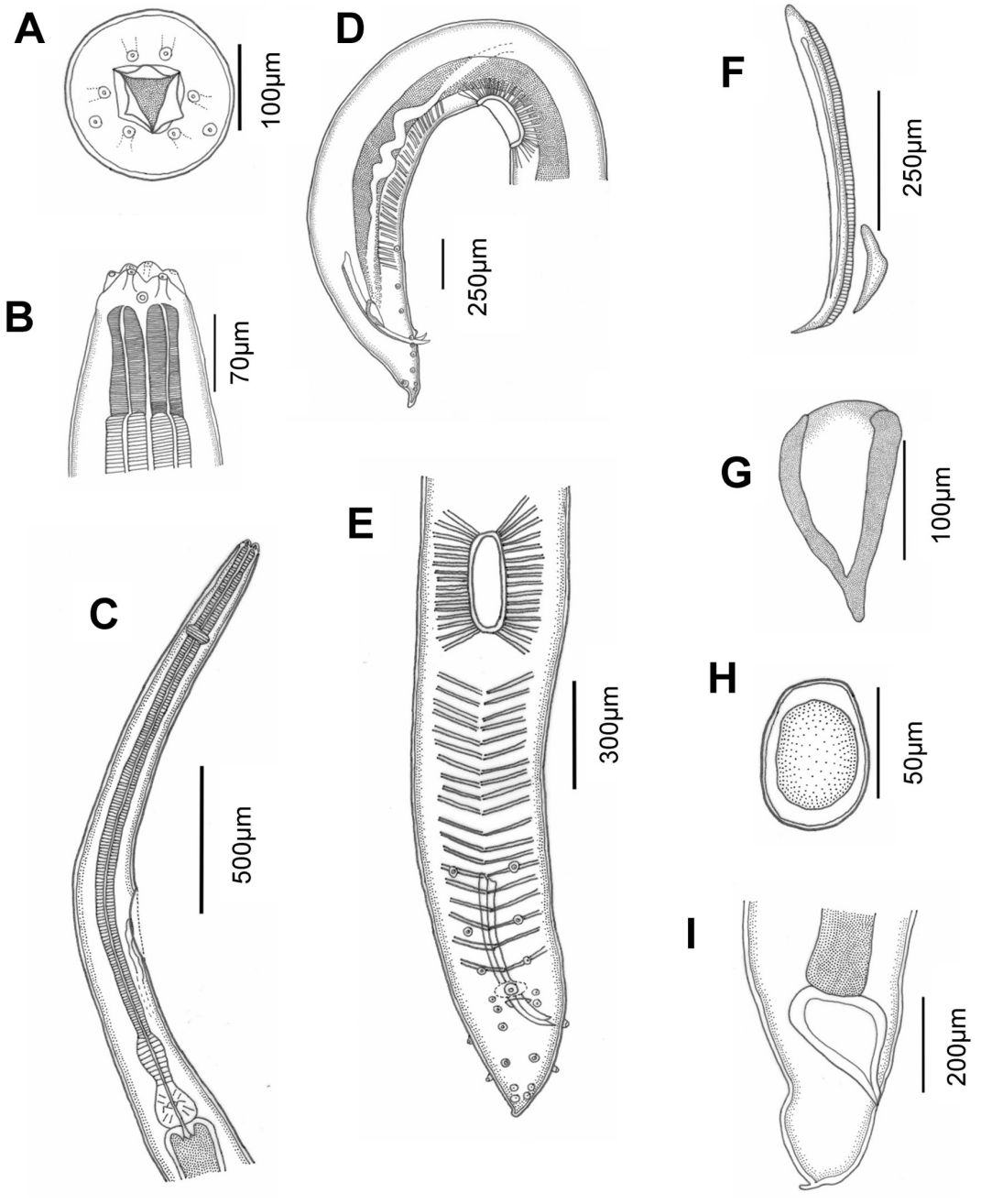

Fig. 1. *Falcaustra sanjuanensis* sp. nov.: **A**. Cephalic end of female, apical view. **B**. Cephalic end of female, ventral view. **C**. Anterior end of female, lateral view. **D**. Posterior end of male, lateral view. **E**. Posterior end of male, ventral view. **F**. Spicules and gubernaculum, lateral view. **G**. Gubernaculum, ventral view. **H**. Egg. **I**. Posterior end of female, lateral view

bivorous reptiles, *Urodelnema* Baker, 1981 parasite of salamanders, and *Myleusnema* Moravec et Thatcher, 1996 parasite of characoid freshwater fish (Chabaud 2009, Gibbons 2010). *Falcaustra* and *Megalobatrachonema*, the two genera that parasitize anurans are different in the development of lips and in the oesophageal isthmus and bulb; in the former, there are three well-developed lips present and the oesophageal isthmus is generally spherical and the oesophageal bulb is well differentiated, with well-developed valves, whereas, in the latter, lips are poorly developed and the oesophageal isthmus and bulb atrophied or much reduced.

Specifically, species of *Falcaustra* are distinguished on the basis of male characteristics: number and arrangement of caudal papillae, length of spicules, and presence or absence of a pseudosucker (Bursey and Rivera 2009, Bursey and Brooks 2011, Liu *et al*. 2011). Forty-two species possess one pseudosucker, *F. simpsoni* (Johnston et Mawson, 1944) Chabaud et Golvan, 1957; *F. papuensis* Bursey, Goldberg et Kraus, 2007;

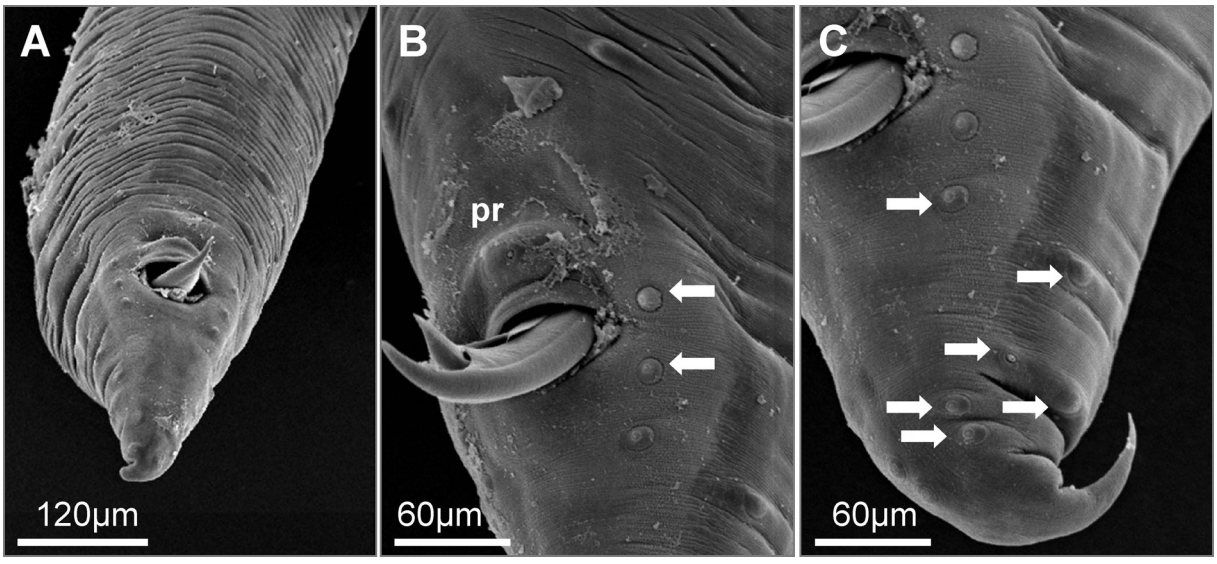

Fig. 2. SEM of *Falcaustra sanjuanensis* sp. nov.: **A.** Posterior end of male, ventral view. **B**. Posterior end of male, ventrolateral view, showing unpaired papilla anterior to anus located on protuberance and adcloacal papillae. **C**. Posterior end of male, ventrolateral view, showing the disposition of postcloacal papillae. Abbreviations: pr – protuberance. In Figure B, arrows indicate the adcloacal papillae; in Figure C, arrows indicate postcloacal papillae

F. guiersi Vassiliades, 1973; *F. hexapapillata* (Khalil, 1962) Vassiliades et Troncy, 1973; *F. petrei* (Khalil, 1970) Vassiliades, 1973; *F. straeleni* Campana-Rouget, 1961; *F. sudanensis* (Khalil, 1962) Vassiliades et Troncy, 1973; *F. tchadi* Vassiliades et Troncy, 1973; *F. catesbeianae* Walton, 1929; *F. chabaudi* Dyer, 1973; *F. chelydrae* Harwood, 1932; *F. concinnae* Mackin, 1936; *F. lowei* Bursey et Goldberg, 2001; *F. mexicana* Chabaud et Golvan, 1957; *F. wardi* (Mackin, 1936) Freitas et Lent, 1941; *F. condorcanqui* Ibañez et Cordova, 1976; *F. intermedia* (Caballero, 1939) Freitas et Lent, 1941; *F. mascula* (Rudolphi, 1819) Freitas et Lent, 1941; *F. pumacahuai* Ibanez et Cordova, 1976; *F. tiahuanaquensis* Ibanez et Cordova, 1976; *F. annandalei* (Baylis et Daubney, 1922) Chabaud et Golvan, 1957; *F. barbi* Baylis et Daubney, 1922; *F. dubia* Yuen, 1963; *F. kalasiensis* (Karve et Naik, 1951) Vassiliades et Troncy, 1973; *F. kaveri* (Karve et Naik, 1951) Vassiliades et Troncy, 1973; *F. kempi* (Baylis et Daubney, 1922) Chabaud et Golvan, 1957; *F. manouriacola* Bursey et Rivera, 2009; *F. onama* (Karve, 1927) Freitas et Lent, 1941; *F. pahangi* Yuen, 1963; *F. purchoni* Yuen, 1963; *F. purvisi* (Baylis, 1933) Chabaud et Golvan, 1957; *F. rangoonica* (Chatterji, 1936) Freitas et Lent, 1941; *F. afghana* (Barus, Kullman et Tenora, 1972) Baker, 1987; *F. ararath* (Massino, 1924) Chabaud et Golvan, 1957; *F. armenica* Massino, 1924; *F. putianensis* (Wang, 1981) Baker, 1987; *F. tannaensis* Bursey, Goldberg, Hamilton et Austin, 2010; *F. andrias* (He, Liu et Ma, 1992) Liu, Zhang et Zhang, 2011; *F. chengguensis* (He, Liu et Ma, 1992) Liu, Zhang et Zhang, 2011; *F. fopingensis* (He, Liu et Ma, 1992) Liu, Zhang et Zhang, 2011 and *F. sinensis* Liu, Zhang et Zhang, 2011.

Only one of the aforementioned species has the caudal papillae pattern present in *Falcaustra sanjuanensis* sp. nov. *Falcaustra andrias* (He, Liu et Ma, 1992) Liu, Zhang et Zhang, 2011, described from the Chinese giant salamander *Andrias davidianus*, presents three pairs of precloacal papillae, two pairs of adcloacal papillae, six pairs of postcloacal papillae and one unpaired papilla anterior to the cloaca (He *et al*. 1992). However, *F. sanjuanensis* sp. nov. differs from *F. andrias* mainly in the following characters: (1) the longer size of males (11.17–13.45 mm vs 5.47–7.78 mm, respectively); (2) the longer size of females (10.1–15.5 mm vs 7.60–8.08 mm, respectively); (3) the longer size and form of the gubernaculum (0.17–0.23 mm, triangular form vs 0.100–0.109 mm, fish form, respectively); (4) the arrangement of postcloacal papillae (three pairs on the ventral side, two pairs on the lateral side, one pair on the subventral side vs three pairs on the ventral side, the other three pairs on the lateral side); (5) the unpaired papilla anterior to the cloaca located on the protuberance (present in *F. sanjuanensis* sp. nov. vs absent in *F. andrias*).

The difference with Neotropical species with one pseudosucker is the length of the gubernaculum (175–230 µm): longer than that of *F. condorcanquii*, *F. mascula*, *F. pumacahuai*, and *F. tiahuanaquensis* and shorter than that of *F. intermedia* and, the length of spicules (450–670 µm): longer than those of *F. mascula*, *F. pumacahuai*, and *F. tiahuanaquensis* and shorter than those of *F. condorcanquii* and *F. intermedia.* Also, none of these species has the unpaired papilla anterior to the anus located on a protuberance.

Discussion

Five out of the 12 species of *Falcaustra* that occur in the Neotropical Realm (Table I) (*F. caballeroi* Chabaud et Golvan, 1957, *F. condorcanqui*, *F. costaricae* Bursey, Goldberg and

Table I. Characteristics of species of *Falcaustra* found in Neotropical Realm. Measurements in mm

***Falcaustra* spp.**	**Locality**	**Male length**	**Female length**	**Spicule length**	**Gobernaculum length**	**Papillae pattern***	**Pseudosucker**	**Reference**	**Other reports**
F. sanjuanensis sp. nov. Host: *Odontophrynus* cf. *barrioi*	Argentina	11.17–13.45	10.1–15.5	0.45–0.67	0.17–023	6–4–12 + 1	1	Present study	–
F. belemensis Host: *Neusticurus bicarinatus*	Brazil	6.8	8.7	0.31	0.082	6-0–17 + 1	Absent	Baker and Bain (1981)	**a**
F. caballeroi Host: *Lithobates montezumae*	Mexico	10.5	12.6–12.7	1.06	–	8–0–6	Absent	Caballero (1935)	–
F. condorcanquii Host: *Telmatobius peruvianus*	Peru	6.9–9.9	7.7–13.0	0.77–1.13	0.069–0.083	62–12 + 1	1	Ibañez and Córdova (1976)	–
F. costaricae Host: *Norops tropidolepis*	Costa Rica	5.7–7.9	6.9–9.7	0.51–0.56	0.10–0.11	10–0–12 + 1	Absent	Bursey *et al.* (2004)	**b**
F. guanacastensis Host: *Rhinolemmys annulata*	Costa Rica	10.4–12.5	10.7–12.4	0.24–0.26	0.17–0.20	6–6–8 + 1	Absent	Bursey and Brooks (2011)	–
F. guatamalana Host: *Rana* sp.	Guatemala	9.5–10.9	10.6–12	0.77–0.80	0.14–0.52	10–0–8	Absent	Caballero (1953)	–
F. intermedia Host: *Kinosternon hirtipes*	Mexico	10.0	7.6	1.07	0.30	6–6–6 + 1	1	Caballero (1939)	–
F. mascula [£] Host: *Coluber* sp.	Brazil	8.3–9.3 (9.1–10.5) [6.2–10.2]	8.6–9.7 (8.7–14.0)	0.43–0.47 (0.45–0.53) [0.56–0.60]	0.10 (0.07–0.11) [0.10]	6–2–12	1	Gomes and Vicente (1966)	**c**
F. pumacahuai Host: *Orestias luteus*	Peru	7.9–8.3	9.2–10.3	0.29–0.36	0.057–0.069	6–2–12 + 1	1	Ibañez and Córdova (1976)	–
F. tiahuanaquensis Host: *Orestias luteus*	Peru	5.9–7.5	6.5–7.9	0.28–0.37	0.078–0.093	6–4–4	1	Ibañez and Córdova (1976)	–
F. tikasinghi Host: *Geomyda punctularia*	Trinidad	13.0–14.0	15.0–15.7	0.53–0.57	0.31–0.34	10–0–12 + 1	Absent	Schoenecker *et al.* (1977)	**d**

* Precloacal + adcloacal + postcloacal + median; [£]Measurements based on Gomes and Vicente (1966), Fahel (1952) in parentheses, Freitas and Lent (1941) in brackets.

a. Brazil: *Potamites ecpleopus* (Goldberg *et al*. 2007); Ecuador: *Potamites strangulatus* (McAllister *et al*. 2010a), Peru: *Potamites ecpleopus* (McAllister *et al*. 2010b).

b. Costa Rica: *Lithobates warszewitschii* (Bursey and Goldberg 2007), *Li. vibicaria* (Bursey and Goldberg 2006), *Craugastor ranoides*, *C. taurus* (Goldberg and Bursey 2008a), *Dendropsophus ebraccatus*, *D. phlebodes*, *Hypsiboas rosenbergi*, *Smilisca sordida*, *Tlalocohyla loquax* (Goldberg and Bursey 2008b).

c. Brazil: *Chaunus ictericus* (= *Bufo ictericus*) (Rodrigues *et al*. 1982), *Crossodactylus gaudichaudii* (Gomes and Vicente 1966), *Hypiboas faber* (= *Hyla faber*) (Freitas and Lent 1941), *Leptodactylus latrans* (Steffen, 1815) (= *Leptodactylus caliginosus*) (Freitas and Lent 1941; Vicente and Santos 1976; Fabio 1982; Rodrigues *et al*. 1982), *Leptodactylus pentadactylus* (Fahel 1952, Freitas 1955, Guimaraes *et al*. 1976, Rodrigues *et al.* 1982), *Hylodes nasus* (= *Elosia nasus*) (Freitas and Lent 1941), *Liophis poecilogyrus* (= *Leimadophis poecilogyrus*) (Freitas 1955), *Hypsiboas albopunctatus* (Magalhães Holmes *et al*. 2008), *Leptodactylus rhodomystax* (Goldberg *et al*. 2007).
Argentina: *Rhinella schneideri* (González and Hamann 2008); Paraguay: *R. granulosa* (McAllister *et al*. 2010c), *Chaunus schneideri* (= *Bufo paracnemis*) (Lent *et al*. 1946); Uruguay: *Leptodactylus latrans* (= *Leptodactylus ocellatus*) (Freitas and Lent 1941).

d. Brazil: *Geomyda punctularia* (Baker and Bain 1981); Costa Rica: *Rhinoclemmys annulata* (Bursey and Brooks 2011); Ecuador: *Rhinoclemmys annulata*, *R. melanosterna*, *R. nasuta* (Dyer and Carr 1990).

Miller (2004), *F. guatamalana* (Caballero, 1953) Chabaud et Golvan, 1957 and *F. mascula*) have been previously found in amphibian hosts of the families Bufonidae, Ceratophrydae, Craugastoridae, Hylidae, Hylodidae, Leptodactylidae and Ranidae. Up to the moment, there are no reports of the genus *Falcaustra* in amphibians of the family Cycloramphidae.

Only one of the six species of *Odontophrynus* found in Argentina (Lavilla *et al*. 2000), i.e. *O. achalensis* (di Tada, Barla, Martori et Cei, 1984), *O. americanus* (Duméril et Bibron, 1841), *O. barrioi* (Cei, Ruiz et Beçak, 1982), *O. cordobae* (Martino et Sinsch, 2002), *O. lavillai* (Cei, 1985) and *O. occidentalis* (Berg, 1896), has been reported to harbour nematode parasites. González and Hamann (2009) reported the species *Rhabdias elegans* Gutierrez, 1945, *Cosmocerca podicipinus* Baker et Vaucher, 1984 and *Cosmocerca parva* Travassos, 1925 from the common lesser escuerzo, *O. americanus* in Corrientes province. The only report of *Falcaustra* in amphibian hosts corresponds to *F. mascula* found in *Rhinella schneideri* from Corrientes Province (González and Hamann 2008).

Below we add a key for the species of *Falcaustra* from the Neotropical Realm.

Key to Neotropical species of *Falcaustra*

1. a. Pseudosucker present 2
   b. Pseudosucker absent 3
2. a. With one unpaired papilla anterior to the anus 4
   b. Without unpaired papillae anterior to the anus 5
3. a. With one unpaired papilla anterior to the anus 6
   b. Without unpaired papilla anterior to the anus 7
4. a. With one pair of adcloacal papillae 8
   b. With more than one pair of adcloacal papillae 9
5. a. One pair of adcloacal papillae, six pairs of postcloacal papillae. Dipsadidae, Bufonidae, Leptodactylidae, Hylidae and Hylodidae from Brazil; Bufonidae from Argentina and Paraguay; Leptodactylidae from Uruguay..... ..... *F. mascula* (Rudolphi, 1819) Freitas et Lent, 1941 = *Ascaris mascula* Rudolphi, 1819 = *Ascaris leptodactyla* Parodi in Savazzini, 1930 = *Florencioia mascula* (Rudolphi, 1819) Travassos, 1919 = *Florencioia nitida* Travassos, 1920
   b. Two pairs of adcloacal papillae, two pairs of postcloacal papillae. Pisces of Peru .... *F. tiahuanaquensis* Ibañez and Cordova, 1976
6. a. With three pairs of adcloacal papillae. Turtles from Costa Rica ..... *F. guanacastensis* Bursey and Brooks, 2011
   b. Without adcloacal papillae 10
7. a. Four pairs of precloacal papillae, three pairs of postcloacal papillae. Ranidae from Mexico ..... *F. caballeroi* Chabaud and Golvan, 1957 = *Dibulbiger longispiculis* Caballero, 1935
   b. Five pairs of precloacal papillae, four pairs of postcloacal papilla. Ranidae from Guatemala ..... *F. guatamalana* (Caballero, 1953) Chabaud and Golvan, 1957 = *Spironoura guatamalana* Caballero, 1953
8. a. Spicules longer than 0.7 mm. Pisces from Peru .... *F. condorcanquii* Ibañez and Cordova, 1976
   b. Spicules less than 0.5 mm. Pisces from Peru..... ..... *F. pumachauahi* Ibañez and Cordova, 1976
9. a. Three pairs of postcloacal papillae, spicules longer than 1 mm. Turtles from Mexico ..... *F. intermedia* (Caballero, 1939) Freitas and Lent, 1941 = *Spironoura intermedia* Caballero, 1939
   b. Six pairs of postcloacal papillae, spicules less than 1 mm. Cycloramphidae from Argentina ..... *F. sanjuanensis* sp. nov.
10. a. Three pairs of precloacal papillae, seven pairs of postcloacal papillae. Teiidae from Brazil, Gymnophthalmidae from Brazil, Ecuador and Peru .... *F. belemensis* Baker and Bain, 1981
    b. Five pairs of precloacal papillae, six pairs of postcloacal papillae 11
11. a. Males and females 10 mm or smaller, gubernaculum 0.11 mm or smaller. Polychrotidae, Ranidae, Brachycephalidae and Hylidae from Costa Rica .... *F. costaricae* Bursey, Goldberg and Miller, 2004
    b. Males and females 10 mm or longer, gubernaculum 0.31 mm or longer. Turtles from Trinidad .... *F. tikasinghi* (Schoenecker, Schmidt and Everard, 1977) Baker and Bain, 1981 = *Spironoura tikasinghi* Schoenecker, Schmidt and Everand, 1977

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