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# Taxonomic Studies of Parasitic Nyctotherans from Chinese Anura Amphibians IV. *Spirocytopharynxa* gen. nov. and *Macrocytopharynxa* gen. nov.

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**Lian-Xiang Li, Jian-Guo Wang and Wu-Han Xiao (2002)** Taxonomic studies of parasitic nyctotherans from Chinese Anura amphibians IV. *Spirocytopharynxa* gen. nov. and *Macrocytopharynxa* gen. nov. *Zoological Studies* **41**(1): 77-84. This paper describes 2 new genera and 5 new species of nyctotherans from Anura amphibians distributed in southern China. Based on the composition of the upper and bottom flaps, the number and position of sutural lines, the length of the oral groove, and the morphology and position of the end of the cytopharynx, the adoral zone of the membranelle (AZM), and the macronucleus, two new genera were established. The 3 new species, *Spirocytopharynxa sinensis*, *S. guangxiensis*, and *S. quadranus*, belong to the new genus *Spirocytopharynxa*. Another 2 species, *Macrocytopharynxa* (Nyctotheroidae Nie, 1932) *pyriformis* n. comb. and *M. lingchuanensis* n. sp., belong to the new genus *Macrocytopharynxa*. The characteristics for diagnosis of the 2 new genera and 5 new species are described in this paper. http://www.sinica.edu.tw/zool/zoolstud/41.1/77.pdf

**Key words:** Anura amphibian, *Spirocytopharynxa*, *Macrocytopharynxa*, New genus, New species.

On the basis of reports of references, most nyctotherans are parasitic or endosymbiotic in the intestines of various invertebrates such as roaches, termites, earthworm, and snails, while a few of them live in fishes, reptiles, and amphibians. Some families or genera such as *Nyctotheroides*, *Wichtermania*, *Parasicuophora*, and *Sporocytopharynxa* gen. nov. of this paper are species which specifically live in the rectum of Anura amphibians. There is at least 1 species of nyctotherans usually living in *Rana* species and more than 4-5 species of nyctotherans can be found. There are sometimes more than 2-3 species of nyctotherans in a single frog, even different species of various genera live together in the same frog. Because of abundant or various forms of populations parasitized among anuran amphibians, there are more than 150 species belonging to different families or genera had been reported since Leidy (1849) discovered *Nyctotherus velox* and established the genus *Nyctotherus*. According to the reports of Earl (1970 1972), there are 2 families and 15 genera of nyctotherans known to now, but only 5 genera of nyctotherans are known from various frogs: *Nyctotherus* Leidy, 1849, *Sicuophora* (Wichterman, 1934) de Puytorae and Grain, 1968, *Nyctotheroides* Grassé, 1928, *Parasicuophora* Albaret, 1968, and *Wichtermania* Earl, 1972. Four species of nyctotherans are described in this paper and having no satisfactory position among existing classification, we decided to erect 2 new genera, namely *Spirocytopharynxa* gen. nov. and *Macrocytopharynxa* gen. nov. and the characteristics of the 2 new genera and their new species are described.

## MATERIALS AND METHODS

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The materials and methods were described in our previous works (Li et al. 1998, Wang et al. 1998, Xiao et al. 2002).

All specimens are deposited at the Institute of Hydrobiology, Chinese Academy of Sciences, Wuhan, China.

## DIAGNOSIS

### *Spirocytopharynxa* gen. nov.

Body consisting of upper and bottom flaps, upper flap small, convex, bottom flap large, flattened and extending to form a flange. A short sutural line at left anterior end, and associated with a sutural line on right side. A sutural line on right surface. Oral groove short and adoral zone of membranelle (AZM) distinct; cytopharynx wider than posterior part and coiled about 300˚-700˚ clockwise. Macronucleus sausage or "V" shaped, micronucleus unknown, with contractile vacuole and anal canal.

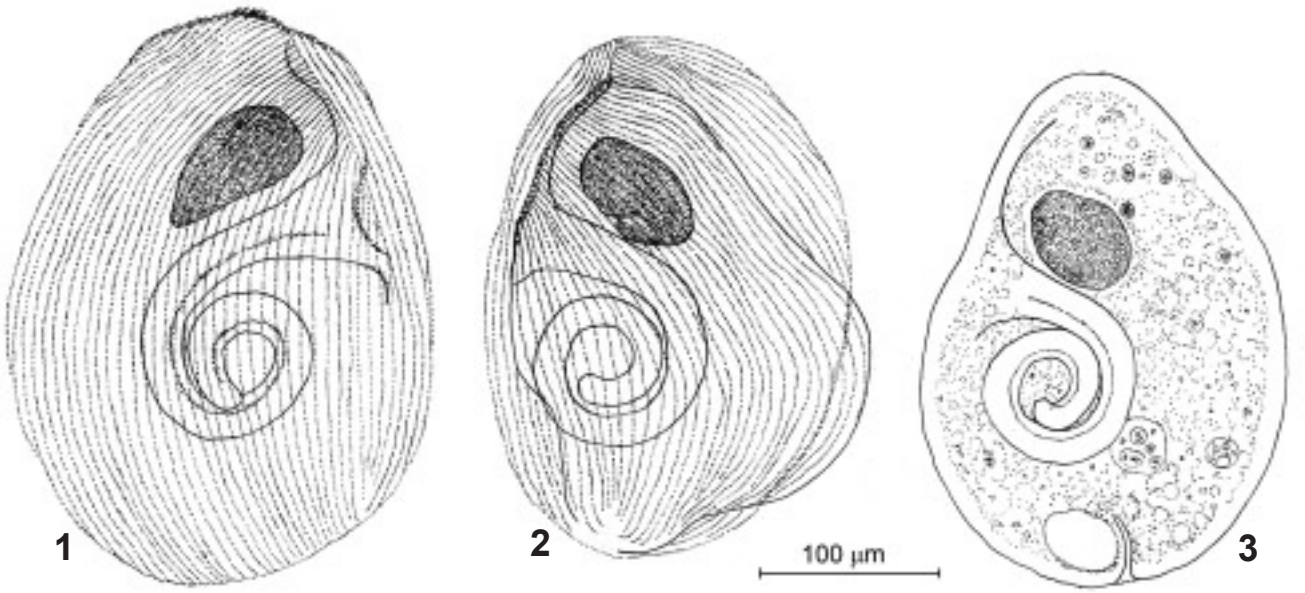
This new genus is similar to *Wichtermania* Earl, 1970, *Parasicuophora* Albaret, 1968, and *Pseudonyctotherus* Earl, 1970, being especially similar to *Wichtermania* and *Parasicuophora*, but the cytopharynx of *Wichtermania* bends less than 180˚, although it has right and left sutural lines, and the cytopharynx of *Parasicuophora* is longer, but its posterior portion coils less than 360˚, while the posterior part of the coil of the new genus exceeds 360˚.

### *Spirocytopharynxa sinensis* sp. nov.

(Figs. 1, 2, 3)

Host and infection site: Rectum of *Rana spinosa*.
Locality and distribution: China: Lichuan Co., Hubei Prov.; Lingchuan Co., Guangxi Prov.

Body large, oval or pyriform in shape; upper and bottom flaps indistinct, but left surface rather convex. Different ciliary rows on right and left surfaces. A short sutural line in front of oral groove and forming " λ " shape on top side of oral groove, sutural line of left side running toward posterior part forming left sutural line, and all ciliary rows coming from this sutural line to posterior of body arciform and converging at posterior end, while ciliary rows of sutural line of right side running to posterior part and arciform. A sutural line on right surface from anterior margin with several parallel ciliary rows running along longitudinal axis to posterior part, among them with 2-3 straight short ciliary rows near sutural line. Oral groove relatively short on tip of anterior side. AZM conspicuous, running along exterior wall of cytopharynx to posterior portion. Front of cytopharynx wider in oblique and clockwise directions, gradually narrowing in posterior part and coiling about 1-2




**Figs. 1-3.** *Spirocytopharynxa sinensis* sp. nov. 1. Right surface view, showing shape of the body, ciliary rows, macronucleus, and cytopharynx; 2. Left surface view, showing sutural line, ciliary rows, macronucleus, and cytopharynx; 3. Left surface view, showing macronucleus, cytopharynx, and cytoplasmic inclusions. Specimens fixed by 5% formalin and immersed in 10% glycerine-alcohol (glycerine 10 ml + 70% alcohol 90 ml).

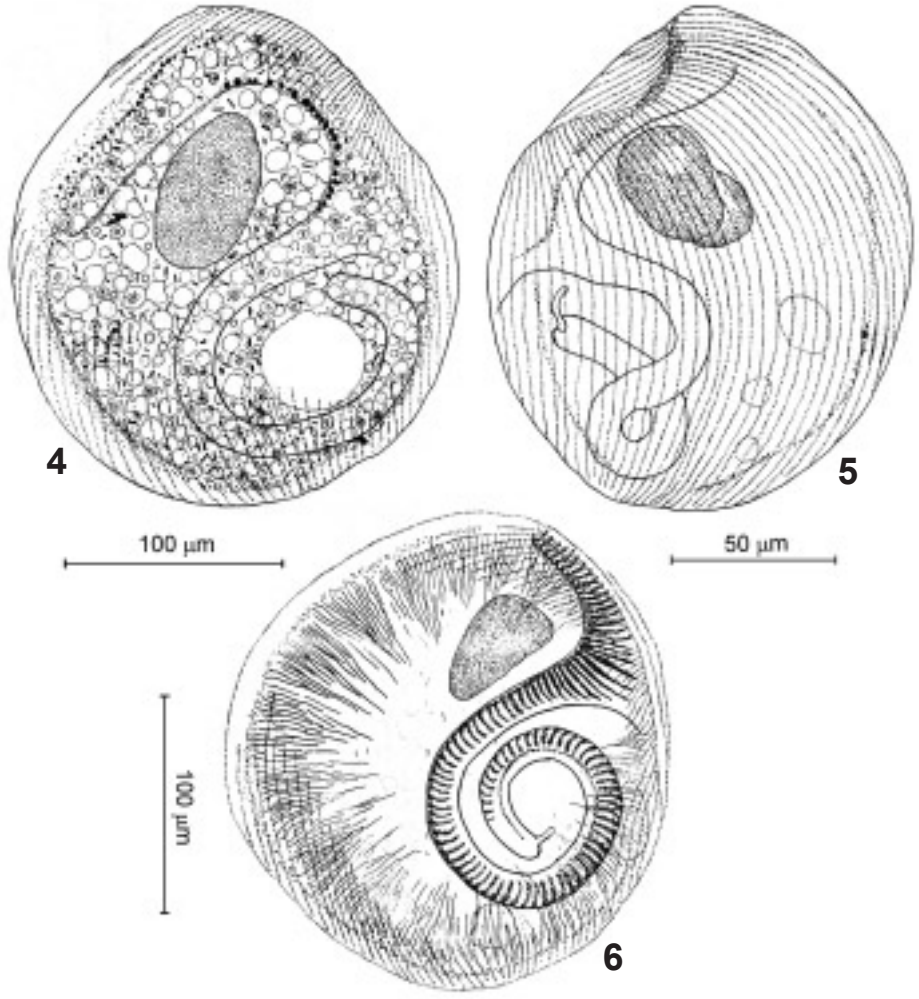
cycles or 360˚-700˚. Macronucleus oval or triangular with its large side on top, obliquely sitting on cytopharynx at a little distance; micronucleus unknown in trophic stage. Cytoplasm uniform within several large granules. Contractile vacuole and anal canal rift resembling, opening at left side of posterior portion. Body 357.7 (310.0-472.5) μm long; oral groove 65.1 (48.6-81.0) μm long; cytopharynx 246.0 (189.0-324.0) μm long, 59.1 (35.1-97.2) μm wide and 27.0-62.0 μm wide inside and a maximum of 81.3 (64.8-98.1) μm wide outside.

The arrangement of the ciliary rows, and the form of the sutural line and cytopharynx of this new species are similar to those of *Spirocytopharynxa quadranus*, but differ from the latter in having an additional coil of the cytopharynx, and lacking an endoplasmic platelet with striations under the pellicle.

***Spirocytopharynxa guangxiensis* sp. nov.**
(Figs. 4, 5, 6)

Host and infection site: Rectum of *Rana spinosa*.
Locality and distribution: China: Guilin City and Lingchuan Co., Guangxi Prov.

Body mediam sized, rounded or oval, left surface smaller and slightly convex, right surface large, with flap or slightly concave and crescenic in cross-sectional view, both right and left surfaces with distinct sutural lines. Left-surface sutural line originating from tip of body running along outer part of side to posterior part, arciform. Right side from sutural line of right surface near oral groove with several parallel ciliary rows, remaining ciliary rows running to posterior part, arciform. Oral groove shorter, occupying about 1/3 of body length. AZM relatively thick from outer wall of




**Figs. 4-6.** *Spirocytopharynxa guangxiensis* sp. nov. 4. Right surface view, showing ciliary row, macronucleus, and shape of the cytopharynx; 5. Left surface view, showing ciliary row, macronucleus, and cytopharynx; 6. Right surface view, showing macronucleus, cytopharynx, cytopharyngeal canal, AZM, and the striated cytoplasmic platelet under the pellicle.

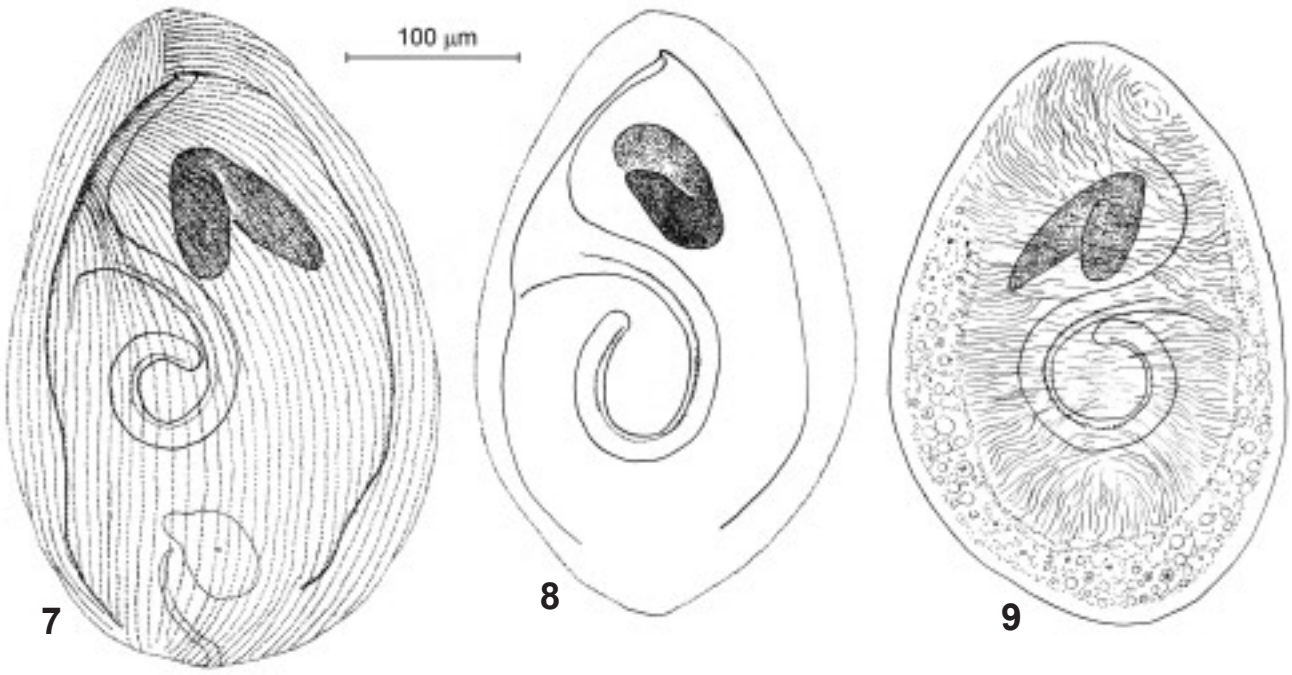
cytopharynx to posterior end, outer part of cytopharynx wider, loudspeaker shaped, gradually narrowing, its end varied or straight with slight bending or coiling in 1-1.5 clockwise coils, cytopharynx canal shorter, bean-prout shaped, macronucleus ellipsoid or triangular, on the tip of cytopharynx, parallel or forming an angle with cytopharynx, within a round clear area in a few specimens, in the position of the micronucleus. A single contractile vacuole, with 1-2 small vesicles. Cytoplasm very abundant and with many small vesicular granules. Under pellicle of right surface with a bunch of many centripetal striations. Body 166.0 (113.4-224.7) μm long, 108.9 (105.3-205.2) μm wide, oral groove 86.4 (76.5-102.6) μm long; cytopharynx 125.2 (91.8-210.0) μm long, 18.9-29.7 μm wide, and also 91.8 μm in exterior diameter and 12.1 μm in inner diameter; macronucleus 49.3 (43.2-64.8) μm long, 33.0 (27.0-40.5) μm wide, also with a clear area of micronucleus about 9.4 μm in diameter.

The bend of the cytopharynx and the arrangement of the ciliary rows of this ciliate are similar to those of *S. sinensis* sp. nov. and *S. quadranus* sp. nov., but differ from them in the small size, being nearly round, and in the different form of the endoplasmic platelet.

### ***Spirocytopharynxa quadranus* sp. nov.**
(Figs. 7, 8, 9)

Host and infection site: Rectum of *Rana quadranus*.
Locality and distribution: China: Lichuan Co., Hubei Prov.

Body oval, consisting of upper and bottom flaps. Left surface slightly convex and right surface flat or slightly concave and shaped like a bent sausage in cross-sectional view. A short "λ" like sutural line on top of oral groove, running uninterrupted to form left sutural line. All ciliary rows of left surface originating from this sutural line and running along posterior part, arciform. Ciliary rows on outer part of left side originating from anterior end, parallel to longitudinal axis of body. A sutural line on right surface, with several parallel ciliary rows on its outer right side. AZM distinct, from tip of oral groove and running out to wall of cytopharynx then to posterior part. Cytopharynx slightly wider on exterior forming a loudspeaker shape, and gradually narrowing, with a clockwise bend of about 360°, rounded at the end. Macronucleus sausage or "J" shaped and on tip of cytopharynx in oblique line. Micronucleus unknown. A single contractile vacuole near posterior part, cytopyge distinct and rift-like. Cytoplasm abundant with many small granules. Under pellicle of right sur-




**Figs. 7-9.** *Spirocytopharynxa quadranus* sp. nov. 7-8. Left surface view, showing shape of the body, ciliary row, sutural line, macronucleus, and cytopharynx; 9. Right surface view, showing shape of the body, macronucleus, cytopharynx and striated cytoplasmic platelet under pellicle.

face with a fine striated, endoplasmic platelet. Upper flap 327.8 (306.8-426.4) µm long, 247.0 (215.8-296.4) µm wide; bottom flap 339.8 (278.2-400.0) µm long and 248.5 (215.8-296.4) µm wide. Oral groove 117.5 (114.4-130.0) µm long; cytopharynx 405.6 µm long and 20.2-22.9 µm wide. Macronucleus 123.5 (62.4-187.20) µm long and 40.5 (33.8-52.0) µm wide.

The arrangement of the ciliary rows and sutural lines and the shape of the cytopharynx of this new species are similar to those of *S. sinensis* sp. nov. and *S. quadranus* sp. nov., but it differs from them in the large size of the body and by having a fine, striated endoplasmic platelet. The length and bend of the cytopharynx are also similar to those of *Paranyctotherus kirbyi* Earl, 1970, but the macronucleus of the latter is at the posterior part.

### ***Macrocytopharynxa* gen. nov.**

Body oval or pyriform, flat at anterior end and rounded at posterior end, sutural line distinct. Oral groove short, AZM short and narrow in front and conspicuously broad in middle part. Cytopharynx funnel shaped in outline and gradually narrowing, then expaning or dropping down at tip. Macronucleus sausage shaped or ellipsoid on tip of cytopharynx. Contractile vacuole and anal canal present.

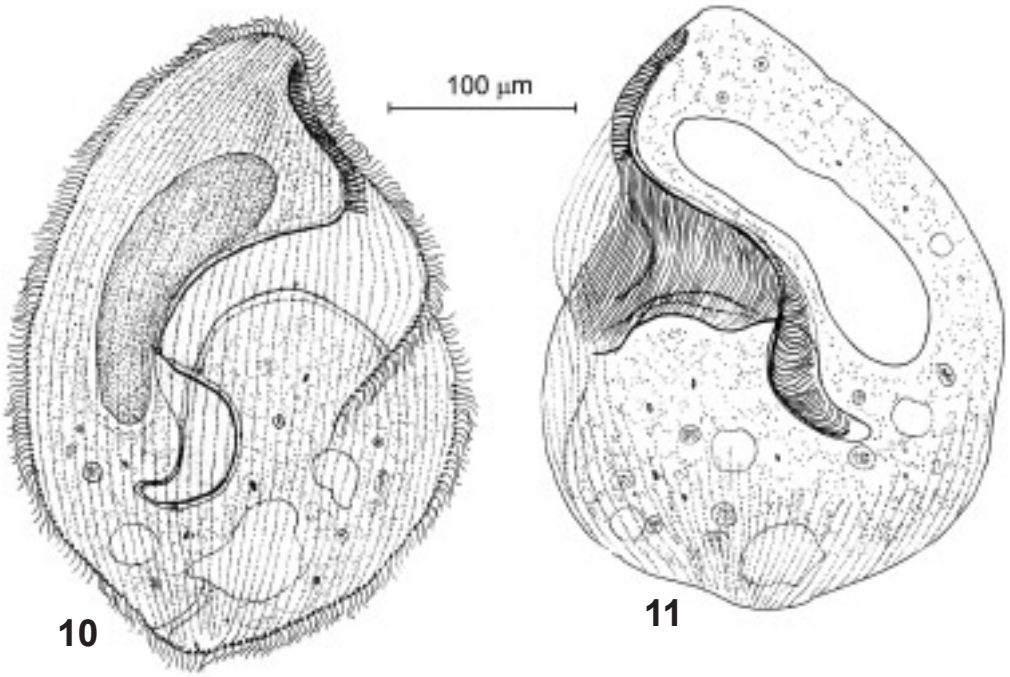
The characteristics of the new genus are similar to those of *Nyctotheroides*, but the new genus has a distinct sutural line; and its oral groove is short occupying about 1/3 to 1/4 of the body length. The AZM is relatively developed, and its cytopharynx is longer and thicker than its oral groove. The terminal portion of the cytopharynx is straight or slightly expanded. Two species belong to the genus.

### ***Macrocytopharynxa* (*Nyctotheroides*) *pyriformis* (Nie, 1932) comb. nov.**

(Figs. 10, 11)

Syn. *Nyctotherus pyriformis* Nie, 1932.
*Nyctotheroides pyriformis* (Nie, 1932) Earl, 1970.
Host and infection site: Rectum of *Rana limnocharis*.
Locality and distribution: China: Wuchang Co., Hubei Prov.; Shanghai City; Nanjing City, Jiangsu Prov.; Guilin City, Guangxi Prov.; Yueyang City, Hunan Prov.

Body oval or pyriform, pointed and flat at anterior end, expanded and rounded at posterior end, round in cross-sectional view, ciliary rows uniform. Oral groove relatively short, situated at anterior end and occupying about 1/4 of body length. AZM narrower, expanding to middle part, being equal to 3-5 times oral groove length.




**Figs. 10-11.** *Macrocytopharynxa* (*Nyctotheroides*) *pyriformis* comb. nov. 10. Right surface view, showing shape of the body, oral groove, AZM in oral groove, macronucleus, cytopharynx, and ciliary row; 11. Left surface view, showing AZM in oral groove, cytopharynx, expanding AZM, and cytoplasmic inclusions.

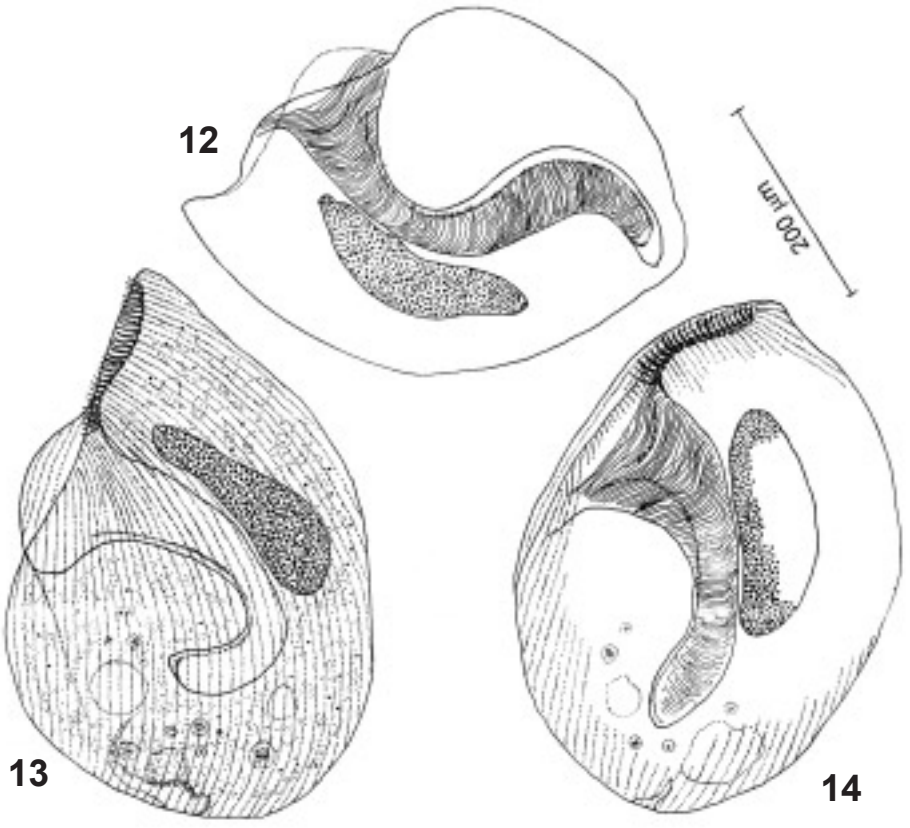
Macronucleus comma "," shaped. Micronucleus indistinct. Cytoplasm abundant with a few variable granules. Body 400.0 (306.8-521.0) μm long, 304.2 (294.6-374.4) μm wide; oral groove 144.4 μm long; cytopharynx shaped like a funnel with an upside down fold in its middle portion; cytopharynx 230.1 (218.4-239.2) μm long, 68.9 (62.4-78.0) μm wide; macronucleus 174.7 (156.0-192.7) μm long and 49.2 μm wide.

### ***Macrocytopharynxa lingchuanensis* sp. nov.**
(Figs. 12, 13, 14)

Host and infection site: Rectum of *Rana limnocharis*.
Locality and distribution: China: Lingchuan Co., Guangxi Prov.; Yueyang City, Hunan Prov.

Body oval or ellipsoid, anterior flat and pointed, rounded at posterior end and round in cross-sectional view. Ciliary rows uniform and without sutural line. Oral groove relatively short at anterior end, occupying 1/4 of body length. AZM narrow in oral groove, greatly expanding to outer part of cytopharynx, being equal to 3-5 times oral groove width. Cytopharynx loudspeaker shaped. End of cytopharynx "J" or "S" shaped, terminal end extending and without a fold. Cytopharyngeal canal indistinct. Macronucleus sausage-like, slightly pointed at both ends, situated on right side of cytopharynx, with uniform stained chromatin granules. Micronucleus obvious, ellipsoid, situated in bottom of middle part of macronucleus. One or 2 contractile vacuoles. Anal canal rift-like and opening at posterior end. Cytoplasm abundant with a few large granules. Body 485.1 (416.0-525.2) μm long, 326.3 (286.2-665.2) μm wide. Oral groove 120.6 (83.2-140.4) μm long, cytopharynx 316.0 (275.6-279.6) μm long, 80.0 (27.0-93.6) μm in exterior width and 44.0 (35.4-62.4) μm wide; macronucleus 196.5 (166.4-265.2) μm long, 54.6 (39.0-83.0) μm wide, micronucleus 13.5 μm long and 5.0 μm wide.

The shape, size, and arrangement of the ciliary rows of the new species are similar to those of *M*. (*N*.) *pyriformis* (Nie), but the latter is "J" or "S" shaped lacks a fold at the posterior portion of the cytopharynx, and the macronucleus has a different shape and size.




**Figs. 12-14.** *Macrocytopharynxa lingchuanensis* sp. nov. 12. Left surface view, showing ciliary row, AZM in oral groove, bend of the cytopharynx, and macronucleus; 13. Left surface view, showing AZM in the oral groove, macronucleus, cytopharynx, and expanding AZM; 14. Right surface view, showing shape of the body, macronucleus, cytopharynx, and expanding AZM.

## DISCUSSION

Earl (1972) based on *Pseudonyctotherus* Earl, 1970 which he established himself, and *Paranyctotherus* Sandon, 1941, changed them to the superfamily Plagiotomidea, dividing it into 2 families: the Plagiotomidae and Clevelandelldae with brief explinations of the chief characteristics of 15 genera of nyctotherans. Corliss (1977) also added some data to the works of Albaret (1968), Kidder (1937 1938), and Kudo (1977) and changed them from 2 families into 5 families including 18 genera. We support Corliss's ideas of classification and add some complementary data to his scheme:

Polyhymenophora Jankowski, 1967
Spirotrichida Butschli, 1889
Hetertridea Stein, 1859
Clevelandellina de Puytorae and Grain, 1976
Family Nyctotheriidae Amero, 1968
*Plagiotoma* Dujardin, 1938
*Nyctotherus* Leidy, 1849
*Nyctotheroides* (Grassé 1928) Corliss, 1961
*Pronyctotherus* Albaret and Njiné, 1976
*Metanyctotherus* Albaret, 1970
*Paranyctotherus* Sandon, 1941
*Pseudonyctotherus* Earl, 1970
*Macrocytophargnxa* Li et al., 2002 gen. nov.
Family Sicyaphoridae Amaro, 1967
*Geimania* Albaret, 1975
*Ichthyonyctus* Jankowaski, 1964
*Metasicuphora* Albaret, 1968
*Parasicuophora* Albaret, 1968
*Prosicuophora* de Puytorae and Oktem, 1967
*Sicuophora* de Puytorae and Graiin, 1969
*Wichtermania* Earl, 1972
*Spirocytophargnxa* Li et al., 2002 gen. nov.
Family Clevelandellidae Kidder, 1938
*Clevellandia* Ottangi and Desai, 1963
*Paracleveladia* Kidder, 1973
Family Inferostomdidae Ky, 1971
*Inferostoma* Ky, 1971
Family Nathellidae Singh, 1953
*Nathella* Singh, 1953

There are 4 species of nyctotherans described in this paper, and having no satisfactory position in the above classification then we establish 2 new genera of *Spirocytophargnxa* and *Macrocytophargnxa* to accommodate them. This is based on the specificity of unequal symmetry, not dividing into 2 flaps of the body, a single and short sutural line, short anal groove, coarse AZM, cytopharynx very thick and orally prolongated, in a funnel form, and having 3-4 clockwise bends making coils. The characteristics of the genus *Spirocytophargnxa* are similar to those of *Wichtermania* Earl and *Parasicuophora* Albaret, especially to *Wichtermania* Earl, but differs from them in having a very thick cytopharynx and degree of the bend exceeding 360˚, while the bend of *Wichtermania* is less than 180˚. The outline and oral groove of *Macrocytophargnxa* are similar to those of *Nyctotheroides*, but the greatest differences are in the wide AZM, the funnel form of the cytopharynx, and it having an upside down fold in its middle portion.

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# 中國無尾兩棲類寄生腸腎蟲的分類研究 IV. 旋咽腸腎蟲 (*Spirocytopharynxa* n. gen.) 和巨咽腸腎蟲 (*Macrocytopharynxa* n. gen.) 兩新屬及其種類的描述

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根據Earl 在 1970, 1972 的報導，在系統分類方面至今已建立兩科，即斜口科 (Plagiolonidae) 和克氏科 (Clevelandellidae) 共有15個屬。Corliss 1977 在 Earl 1972, Albaret 1968, Amero and Sena 1967, Sheret 1982 等的基礎上將原來兩科提升到5科，共18個屬，其中在無尾兩棲類寄生的只有5個屬的代表，即腸腎蟲屬 (*Nyctotherus* Leidy 1849), 擬腸腎蟲屬 [*Nyctotheroides* (Grassé 1928) Corliss 1961]， 側管腸腎蟲屬 (*Parasicuophra* Albaret 1968), 短管腸腎蟲屬 [*Sicuophora* (Wichterman 1934) de Puytorae and Grain 1968] 和韋氏腸腎蟲屬 (*Wichtermania* Earl 1972)。本文記述的4個物種，根據蟲體不對稱，無左右或上下兩片之分，具短而單一的縫線，口溝短，AZM粗大，胞咽粗而長，呈漏斗狀，或發生扭曲，或作順時針方向盤旋2-3圈等主要特徵，與上述5屬相對照，均沒有恰當的位置，特分別建立旋咽腸腎蟲屬 (*Spirocytopharynxa* n. gen)，包括3個新種；另一個是巨咽腸腎蟲屬 (*Macrocytopharynxa* n. gen) 內含1個新種和1個新組合種。旋咽腸腎蟲屬 (*Spirocytopharynxa* n. gen.) 的形態特徵與擬腸腎蟲屬 (*Nyctotheroides*)，韋氏腸腎蟲屬 (*Wichtermania*)，側管腸腎蟲屬 (*Parasicuophra*) 很相近，更近似韋氏腸腎蟲屬 (*Wichtermania*)，側管腸腎蟲屬(*Parasicuophra*)，但本新屬的種類胞咽粗，末端彎曲度超過360˚，而韋氏腸腎蟲屬的種類少於180˚。巨咽腸腎蟲屬種類的外形，口溝情況與擬腸腎蟲屬 (*Nyctotheroides*) 相似，但前者AZM寬大，胞咽管延長呈漏斗狀，或發生疊折狀的扭曲。

**關鍵詞**：無尾兩棲類，旋咽腸腎蟲屬，巨咽腸腎蟲屬，新屬，新種。

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