GYRODACTYLUS FROM EURASIAN FRESHWATER SALMONIDAE AND THYMALLIDAE

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Gyrodactylosis is one of rather widely distributed diseases of freshwater Salmonidae and Thymallidae in Eurasia. Unfortunately, in many cases the parasites causing this disease are identified only as Gyrodactylus sp. or they are even mistaken for species specific for quite different hosts. In order to enable the exact determination of these parasites, their comparable descriptions, illustrations and key for their determination are presented.

All data on the hard parts of opisthaptor and cirrus of individual species were obtained by morphological and mertrical studies of fixed specimens (in formalin or ammoniumcitrurate and glycerin mixture) mounted in glycerin jelly or Canadian balsam and deposited in the collections of the Institute of Parasitology, Czechoslovak Academy of Sciences in České Budějovice, Institute of Zoology, USSR Academy of Sciences in Leningrad and Department of Zoology, University of Stockholm. The methods of measuring and illustrating of the parasites were described by Gussev (1955) and Ergens and Lom (1970). All measurements are in millimeters.

Description of species

G. asiaticus Ergens, 1978

Host, location, localities: Brachygymnarcus lenok (Pallas); gills, fins; the River Tul near Songino (type locality) and the Lake Tükhin tegein, Mongolia.

Description (after Ergens 1978): Total length of anchors 0.009—0.101, their shaft measuring 0.071 to 0.073, point 0.043—0.044 and root 0.035—0.036. Ventral bar (0.011—0.012 x 0.025—0.030) with small lateral processes and 0.023—0.027 long shield. Dorsal bar 0.002 x 0.02. Total length of marginal hooks 0.042—0.044, hook proper 0.010—0.011. Cirrus 0.016—0.020 in diameter, with small spines in one arch. Pharyngal processes long.

G. asiaticus is most closely related to G. lencki Gussev, 1953 and G. brachygymnarcus Ergens, 1978 in the shape and to a considerable extent also in the measurements of individual parts of the complex of anchors, but it differs from these species in the shape of marginal hooks.
**G. birmani** Konовалов, 1967

*Host, location, locality:* *Salvelinus alpinus* (L.); fins; the Lake Arazhach, Kamehatka, USSR.

*Description* (adapted from Konovalov 1967): Total length of massive anchors 0.088—0.078, their shaft measuring 0.002—0.009, point 0.033—0.046 and root 0.020—0.023. Ventral bar (0.007—0.010 x 0.028—0.034) with well-developed lateral processes and 0.015—0.020 long shield. Dorsal bar 0.002—0.003 x 0.016—0.024. Total length of marginal hooks 0.041—0.045, their hook proper measuring 0.007—0.008. Cirrus about 0.015 in diameter, with small spines in one arched row. Pharyngeal processes long.

*G. birmani* resembles closely *G. salaris* Malmberg, 1957 in the shape and measurements of anchors, but differs from this species in the shape of hook proper of marginal hooks.

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**G. brachymystax** Ergeva, 1978

*Host, location, locality:* *Brachymystax lenok* (Pallas); fins; the River Tul near Songino, Mongolia.

*Description* (after Ergeva 1978): Total length of massive anchors 0.090—0.096, their shaft measuring 0.006—0.009, point 0.042—0.045 and root 0.031—0.036. Ventral bar (0.010—0.012 x 0.031—0.034) with relatively small but conspicuous lateral processes and 0.022—0.024 long shield. Dorsal bar 0.002—0.003 x 0.017—0.021. Total length of marginal hooks 0.045—0.048, the hook proper measuring 0.008—0.009. Cirrus 0.027—0.030 in diameter, with small spines in one arched row. Pharyngeal processes long.

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**G. derjavini** Mikailov, 1975

*Host, location, localities:* *Salmo trutta cupia* (Kessler) (type host), *S. trutta cupia* morpha fario L., *S. trutta azantius* Kessler and as occasional hosts *Chondrostoma curtum* Kessler and *Cypinus cupio* L.; skin, fins, gills; the Kur River basin, Aserb, SSR, the River Kafirniyan, Tadjik SSR.

*Description:* Total length of anchors 0.090—0.096, their shaft measuring 0.044—0.047, point 0.030 to 0.032 and root 0.018—0.021. Ventral bar (0.007—0.008 x 0.025—0.030) with well-developed lateral processes and 0.012—0.015 long shield. Dorsal bar 0.002—0.003 x 0.019—0.021. Total length of marginal hooks 0.031—0.034, the hook proper measuring 0.008. Cirrus 0.020—0.025 in diameter, with small spines in one arched row. Pharyngeal processes long.

*G. derjavini* is almost identical with *G. truttae* Glazer, 1974 in the shape and size of anchors, but it differs in the shape of marginal hooks. On the contrary, it is very similar to *G. thymali* Zíthán, 1960, *G. birmani* Konovalov, 1967 and *G. munki* Konovalov, 1967 in the shape and size of marginal hooks, but differs from these species in the shape of both the ventral bar and anchors.

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**G. derjavini** Mikailov, 1975

*Host, location, localities:* *Salmo trutta cupia* (Kessler) (type host), *S. trutta cupia* morpha fario L., *S. trutta azantius* Kessler and as occasional hosts *Chondrostoma curtum* Kessler and *Cypinus cupio* L.; skin, fins, gills; the Kur River basin, Aserb, SSR, the River Kafirniyan, Tadjik SSR.

*Description:* Total length of anchors 0.090—0.096, their shaft measuring 0.044—0.047, point 0.030 to 0.032 and root 0.018—0.021. Ventral bar (0.007—0.008 x 0.025—0.030) with well-developed lateral processes and 0.012—0.015 long shield. Dorsal bar 0.002—0.003 x 0.019—0.021. Total length of marginal hooks 0.031—0.034, the hook proper measuring 0.008. Cirrus 0.020—0.025 in diameter, with small spines in one arched row. Pharyngeal processes long.

*G. derjavini* is almost identical with *G. truttae* Glazer, 1974 in the shape and size of anchors, but it differs in the shape of marginal hooks.

With regard to the fact that the exact data on the morphology of marginal hooks are lacking in the original description of *G. derjavini* and that the author did not fulfill the article No. 13 of the International Code of Zoological Nomenclature, the
above description of this species is in fact its redescription. All data on the hard parts of opisthaptor were obtained by morphological and metrical studies of specimens originating from the type locality (leg. Bogdanova) and from the River Kafirnigan (legit. Danijarov).

*Salmo trutta caspius*, *S. trutta caspius morphs fario* and *S. trutta azovius* have been reported to be very strongly infected with *G. derjavini* causing manifest disorders and even death of the fishes. On the other hand, only single specimens of this parasite have been found on *Chondrostoma cyri* and *Cyprinus carpio*, which should be therefore considered their occasional hosts.

![Fig. 4. Hard parts of the opisthaptor and cirrus of *Oxysalmodiochelys derjavini* Mikaylov, 1975. A — from the fin of *Salmo trutta caspius* Kessler captured from the River Kura near Chaskendi (Azerb. SSR) in May, 1963; B — from the fin of *Salmo trutta azovius* Kessler captured from the River Kafirnigan (Kazakh SSR) on July 27, 1972. Scales (1 part = 0.01 mm): a — for anchors, b — for marginal hook and cirrus, c — for hook proper of marginal hooks.](image)

**G. lavaretus** Malmberg, 1978

**Hosts, location, localities:** *Brachymystax lenok* (Pallas); gills, fins, the River Ilyinovka, USSR (type locality) and the Lake Tirkhi taigan, Mongolia.

**Description** (adapted from Malmberg 1967): Total length of anchors 0.082 – 0.084, their shaft measuring 0.064, point 0.037 – 0.038 and root 0.021 – 0.024. Ventral bar (0.007 – 0.013 x 0.033) with well-developed lateral processes and 0.016 long shield. Dorsal bar 0.003 x 0.020 – 0.030. Total length of marginal hooks 0.040 – 0.041, the hook proper measuring 0.008 – 0.009.

**Exact measurements of the cirrus, the spines of which are arranged in one row, and the type of pharynx could not be determined.**

Malmberg (1957) states in the general diagnosis of *G. lavaretus*: "Cirrus and marginal hooks of same type as those of *G. salarlis*. Anchor large, somewhat resembling those of *G. salarlis*, but slender and with somewhat longer slenderer anchor roots."

The above description is based on the data obtained by morphological and metrical studies of two specimens: holotype and a conspecific specimen from gills of *C. lavaretus* caught in the Lake Pyazoero (legit. Rumyantsev).

Konovalov (1967) recorded a relatively high infection with gyrodactylids in *C. narnus* from the River Penza in Kamechatka (USSR) and determined the parasites as *G. lavaretus* Malmberg, 1957. However, during the reexamination of some specimens I found that they resemble *G. lavaretus* in their morphology but not in measurements. Consequently, in order to confirm the determination by Konovalov, it will be necessary to obtain some information on the variability of *G. lavaretus* from the type host, i.e., from *C. lavaretus.*

![Fig. 5. Hard parts of the opisthaptor of *Oxysalmodiochelys lavaretus* Malmberg, 1957. A — from the gills of *Carassius auratus* L. captured from the Lake Pyazoero, Karalia (FSFPPS) on July 16, 1967; B — from the fins of *Coregonus nasus* (Pallas) captured from the River Okhun, Kamechatka (USSR) in May, 1966. Scales (1 part = 0.01 mm): a — for anchors, b — for marginal hook and cirrus, c — for hook proper of marginal hooks.](image)

**G. lenoki** Gussev, 1953

**Host, location, localities:** *Brachymystax lenok* (Pallas); gills, fins; the River Ilyinovka, USSR (type locality) and the Lake Tirkhi taigan, Mongolia.

**Description** (adapted from Gussev 1953): Total length of anchors 0.082 – 0.084, their shaft measuring 0.064 – 0.072, point 0.041 – 0.043 and root 0.026 – 0.030. Ventral bar (0.009 – 0.014 x 0.026) with relatively small lateral processes and 0.023 – 0.026 long shield. Dorsal bar 0.002 – 0.003 x 0.017 – 0.023. Total length of marginal hooks 0.043 – 0.054, the hook proper measuring 0.010 – 0.011.

Cirrus about 0.029 in diameter, with small spines in one arched row. Pharyngeal processes long.

*G. lenoki* is identical with *G. brachymystaceus* Jerne, 1978 in the shape and size of anchors, but it differs markedly in the shape of marginal hooks.

![Fig. 6. Hard parts of the opisthaptor and cirrus of *Oxysalmodiochelys lenoki* Gussev, 1953 from the fin of *Brachymystax lenok* (Pallas) captured from the River Kherulen (Mongolia) on April 24, 1966. Scales (1 part = 0.01 mm): a — for anchors, b — for marginal hook and cirrus, c — for hook proper of marginal hooks.](image)
G. magnus Kononolov, 1967

Host, location, localities: Thymallus arcticus gruobii natio merensii Valenciennes (type host), T. arcticus (Pallas); fine, the River Pentzhina (type locality) and the River Oklun, U.S.S.R. and the River Tul near Ulan Bator, Mongolia.

Description (adapted from Kononolov 1967): Total length of anchors 0.996—1.070, their shaft measuring 0.069—0.076, point 0.027—0.033. Ventral bar (0.012—0.014 x 0.003—0.004) with relatively small but conspicuous lateral processes and 0.020—0.021 long shield. Dorsal bar 0.003—0.004 x 0.025—0.036. Total length of marginal hooks 0.044—0.066, the hook proper measuring 0.059—0.060.

Cirrus 0.020—0.023 in diameter, with small spines in one arched row. Pharyngeal processes long.

G. magnus most closely resembles the species G. brachynystacis Egeria, 1978 in the shape and size of anchors, but it differs from this species in the shape of both bars and in the shape of the hook proper of marginal hooks.

G. salaris Malmberg, 1957

This species was described by Malmberg (1957) from the fins and skin of young, 5—10 cm long Salmo salar L. coming from Höllaboratoriet, Bispors, Jämtland, Sweden (fresh water). In addition to illustrations of the complex of anchors and cirrus and not very exact illustration of one of the marginal hooks, the author used for the species characterization the measurements of body, opisthaptor, pharynx, cirrus and individual hard parts of opisthaptor of a single specimen (holotype), though more specimens were available (Malmberg 1957, Table II, p. 68). From the formal point of view, this characterization fulfilled the general rules of the ICZN., but it could hardly be used for practical purpose, since one of the deciding characters, the exact shape of the hook proper of marginal hooks, was lacking. I succeeded in determining this character only during the reexamination of the type specimen which was kindly loaned to me by Dr. G. Malmberg from Stockholm.

Making use of the supplemented data on the morphology of hard parts of opisthaptor of the holotype of G. salaris and on the basis of the known data on the morpho-

logical and metrical variability of Gyrinotriches species I came to the conclusion that the specimens from the skin of about 9-month-old S. salar caught in the Ladoga Lake in June 1972 (legit. E. A. Rumyantsev, unpublished results) can also be considered conspecific with G. salaris. The results of their detailed studies, as well as the available data on the type specimen, are summarized in the following characterization:

G. salaris Malmberg, 1957

This species was described by Malmberg (1957) from the fins and skin of young, 5—10 cm long Salmo salar L. coming from Höllaboratoriet, Bispors, Jämtland, Sweden (fresh water). In addition to illustrations of the complex of anchors and cirrus and not very exact illustration of one of the marginal hooks, the author used for the species characterization the measurements of body, opisthaptor, pharynx, cirrus and individual hard parts of opisthaptor of a single specimen (holotype), though more specimens were available (Malmberg 1957, Table II, p. 68). From the formal point of view, this characterization fulfilled the general rules of the ICZN., but it could hardly be used for practical purpose, since one of the deciding characters, the exact shape of the hook proper of marginal hooks, was lacking. I succeeded in determining this character only during the reexamination of the type specimen which was kindly loaned to me by Dr. G. Malmberg from Stockholm.

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Making use of the supplemented data on the morphology of hard parts of opisthaptor of the holotype of G. salaris and on the basis of the known data on the morpho-

ological and metrical variability of Gyrinotriches species I came to the conclusion that the specimens from the skin of about 9-month-old S. salar caught in the Ladoga Lake in June 1972 (legit. E. A. Rumyantsev, unpublished results) can also be considered conspecific with G. salaris. The results of their detailed studies, as well as the available data on the type specimen, are summarized in the following characterization:

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Making use of the supplemented data on the morphology of hard parts of opisthaptor of the holotype of G. salaris and on the basis of the known data on the morpho-

ological and metrical variability of Gyrinotriches species I came to the conclusion that the specimens from the skin of about 9-month-old S. salar caught in the Ladoga Lake in June 1972 (legit. E. A. Rumyantsev, unpublished results) can also be considered conspecific with G. salaris. The results of their detailed studies, as well as the available data on the type specimen, are summarized in the following characterization:
parison with other species and subspecies of *G. wageneri-complex." At the present time it may be stated that *G. salaris* is almost identical with *G. birmani* Konovalov, 1967 in the shape and measurements of anchors, but it differs from this species in the shape of the two bars and in the shape of the hook proper of marginal hooks.

**G. taimeni** Ergens, 1971

Host, location, locality: *Huso taimen* (Pal.) gills; the Lake Dod tagan, Mongolia.

Description (after Ergens 1971): Total length of anchors 0.061–0.072, their shaft measuring 0.051 to 0.065, point about 0.033 and root 0.025–0.027. Ventral bar (0.005–0.009 × 0.020–0.029) without lateral processes and with 0.018–0.017 long shield. Dorso bar 0.002, measuring 0.002 × 0.002. Total length of marginal hooks 0.023–0.024, greatly developed hook proper measuring 0.008–0.009. Cirrus 0.018–0.020 in diameter, with small spines in one arched row. Pharyngeal processes long.

*G. taimeni* closely resembles the species *G. slovaccicus* Ergens, 1963 in the shape and partly in the size of marginal hooks, but it differs from this species in the shape of anchors.

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**G. thymalli** Žižan, 1960

Hosts, location, localities: *Thymallus thymallus* L. (type host) and *T. arcticus grubei* natio meridemi Volmeri; flss. the River Hron near Brzemo (type locality) and the River Hliniec, Czechoslovakia, the rivers Nikola and Pehnacz, RSSFR.

Description (adapted from Žižan 1960): Total length of anchors 0.075–0.084, their shaft measuring 0.057–0.065, point 0.033–0.039 and root 0.025–0.030. Ventral bar (0.006–0.012 × 0.020–0.024) with relatively small but conspicuous lateral processes and 0.018–0.021 long shield. Dorso bar 0.002–0.004 × 0.020–0.022. Total length of marginal hooks 0.037–0.044, the hook proper measuring 0.007–0.008. Cirrus about 0.022 in diameter, with small spines in one arched row. Pharyngeal processes long. **G. thymalli** closely resembles the species *G. brachymetacis* Ergens, 1978 in the shape of marginal hooks, but differs from this species in the shape of anchors.

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**G. truttae** Gläser, 1974


Description (adapted from Gläser 1974): Total length of anchors 0.034–0.066, their shaft measuring 0.040–0.046, point 0.029–0.034 and root 0.016–0.021, ventral bar (0.007–0.009 × 0.004–0.005) with well developed lateral processes and 0.010–0.016 long shield. Dorso bar 0.001–0.002 × 0.017 to 0.030. Total length of marginal hooks 0.029–0.034, their hook proper measuring 0.006–0.008. Cirrus 0.014–0.018 in diameter, with small spines in one arched row. Pharyngeal processes long.

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**G. truttae** is most closely related to *G. derjavnii* Mikailov, 1975 in the shape and to a considerable extent also in the measurements of individual parts of the complex of anchors, but it differs from this species in the shape of marginal hooks. **G. truttae** was reported in Czechoslovakia already in 1956, but it was erroneously determined as *G. salaris* Malmberg, 1967 (Ergens 1961).
**Gyrodactylus** sp.

Host, location, localities: *Salmo trutta* morpha *fario* L.; fins; Chernorecheskoye (Georgian SSR), the rivers Salgir and Angara (Crimes).

Description: Total length of massive anchors 0.069—0.074, their shaft measuring 0.062—0.065, point 0.028—0.040 and root 0.022—0.026, Ventral bar (0.007—0.009 x 0.024—0.030) with lateral processes and 0.014—0.018 long shield. Dorsal bar 0.002—0.003 in length and 0.018—0.020 in width. Total length of marginal hooks 0.029—0.041, the hook proper measuring 0.008—0.009. Cirrus about 0.026 in diameter, with small spines in one arched row. Pharyngeal processes long.

The five specimens of *Gyrodactylus* sp. included in the material under study most closely resemble the species *G. salaris* Malmberg, 1957 and *G. thymallii* Zitánsčik, 1960, but they differ from the former particularly in the shape and measurements of anchors and from the latter in the shape of the hook proper of marginal hooks. It is possible that this is a new, hitherto undescribed species of the genus *Gyrodactylus*. This can be ascertained only after studies of a larger number of specimens and after the data on the general morphological and metrical variability of both *G. salaris* and *G. thymallii* are supplemented.

**KEY TO THE SPECIES**

1. (22) Ventral bar with developed lateral processes.
2. (16) Length of root of anchors smaller than width of ventral bar.
3. (4) Total length of anchors greater than 0.09 mm. 
4. (3) Total length of anchors smaller than 0.09 mm. 
5. (Point of the hook proper of marginal hooks of the same length as its shaft.)
6. (7) Total length of anchors smaller than 0.07 mm. 
7. (8) Total length of anchors greater than 0.07 mm. 
8. (6) Point of the hook proper of marginal hooks shorter than its shaft.
9. (10) Total length of anchors greater than 0.08 mm. 
10. (9) Total length of anchors smaller than 0.08 mm. 
11. (12) Total length of marginal hooks greater than 0.04 mm. 
12. (11) Total length of marginal hooks smaller than 0.04 mm. 
13. (14) Lateral processes of ventral bar poorly developed; ratio of their length and middle portion of bar 1 : 4.
14. (13) Lateral processes of ventral bar well developed; ratio of their length and middle portion of bar 1 : 2.
15. (2) Length of root of anchors same or greater than width of ventral bar.
16. (18) Minimum length of hook proper of marginal hooks 0.010 mm. 
17. (11) Point of the hook proper of marginal hooks shorter than its shaft.
18. (17) Point of the hook proper of marginal hooks longer than its shaft.
19. (16) Maximum length of the hook proper of marginal hooks 0.009 mm.
20. (21) Total length of anchors greater than 0.085 mm.
21. (20) Total length of anchors smaller than 0.08 mm. 
22. (1) Ventral bar without lateral processes.

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**ГИРОДАКТИЛИИ ОТ ЕВРАЗИАТСКИХ ПРЕСНОВОДНЫХ SALMONIDAE И THYMALIDAE**

**Р. Эргене**


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