ACTA UNIVERSITATIS AGRICULTURAE ET SILVICULTURAE MENDELIANAE BRUNENSIS
SBORNÍK MENDELOVY ZEMĚDĚLSKÉ A LESNICKÉ UNIVERZITY V BRNĚ

Ročník LII 3 Číslo 2, 2004

NOTES TO THE NEMATODA OF THE GENUS *HELIGMOSOMUM* RAILLIET ET HENRY, 1909 (NEMATODA, HELIGMOSOMIDAE) PARASITIZING RODENTIA IN JAPAN

M. Asakawa, F. Tenora, M. Borkovcová

Received: December 27, 2003

Abstract

ASAKAWA, M., TENORA, F., BORKOVCOVÁ, M.: *Notes to the Nematoda of the genus Heligmosomum Railliet et Henry, 1909 (Nematoda, Heligmosomidae) parasitizing Rodentia in Japan*. Acta univ. agric. et silvic. Mendel. Brun., 2004, LII, No. 2, pp. 23-26

Performed is the analysis of the hitherto findings of Nematoda from the genus *Heligmosomum* Railliet et Henry, 1909 in Japan. It is stated that in Japan the members of two subgenera, namely *Heligmosomum* and *Paraheligmosomum* parasitize rodents. They are the following species: *H. (H.) costellatum* (Dujardin, 1845), *H. (P.) hasegawai* Asakawa, 1987, *H. (P.) yamagutii* Chabaud, Rausch, Durette-Desset, 1963, *H. (P.) asakawai* N´Zobadila, Boyer, Durette-Desset, 1996, *Heligmosomum (P.) mixtum* Schulz, 1954, *Heligmosomum (P.)* sp. Asakawa, 1995. The key for determination of all above species is established

Heligmosomidae, *Heligmosomum,* Rodentia, Japan, parasitic Nematoda

The history of findings of parasitic nematodes from the genus *Heligmosomum*, parasitizing the rodents of Japan, is relatively short but though very complicated. The first finding was reported by Yamaguti (1954) who determined the Nematoda found as the species *Heligmosomum costellatum*. He was evidently influenced by the studies of Travassos and Darriba (1929) and Travassos (1937). Later on, Chabaud *et al.* (1963), on the new material, revised the conclusions by Yamaguti (1954) and described the new species *Heligmosomum yamagutii*. Another finding belongs to the species *Heligmosomum halli* (Schulz, 1926). The latter species is reported by Hasegawa and Otsuru (1981) from Japan from the host *Microtus montebelli.* This finding is questionable, because already earlier Desportes (1943) and later others (review in Tenora *et al.* 2002a, b) declared *H. halli* as the synonym of *H. costellatum.* Other case concerns the finding of *Heligmosomum mixtum* (cf. Asakawa and Satoh, 1987, Asakawa, 1995). N´Zobadila *et al.* (1996) judge about this finding that an incorrect determination of the new species *Heligmosomum asakawai* is concerned. Other questionable case is the finding of Nematoda determined by Asakawa (1995) as *H. (P.) yamagutii.*

As well, the characteristics of a set of the known species from the subgenus *Paraheligmosomum* (review in Asakawa, 1995) (which is criticized in the study by N´Zobadila *et al*., 1996), indicates the necessity to make more precise the diagnosis of the latter subgenus. All this, already presented is the reason for critical evaluation of the hitherto findings from the genus *Heligmosomum* in Japan and for realisation of critical analysis.

MATERIAL AND METHODS

The basis of the present study is the material of species that are presented in the study by Asakawa (1990,1995,1998). Concerned are the following species: *Heligmosomum halli* (Schulz, 1926), *H. mixtum* Schulz, 1954, *H. hasegawai* Asakawa 1995. The material (except for *H. halli*) is deposited in the Department of Parasitology, School of Veterinary Medicine, Rakuno Gakuen, Ebetsu, Hokkaido, Japan. The material of *H. halli* is deposited in the collection of the Department of Parasitology, School of Medicine, University of the Ryukyus, Japan. The findings of *H. (P.) yamagutii i*n the present work were undertook from the original publications of Chabaud *et al.* .(1963), Asakawa (1990, 1995).

RESULTS AND DISCUSSION

A) A review of species of the genus *Heligmosomum* parasitizing Rodentia in Japan

1. *Heligmosomum (H.) costellatum* (Dujardin, 1845)
   Syn.: *Heligmosomum halli* Schulz, 1926
   Host in Japan: *Microtus montebelli* (cf. Hasegawa and Otsuru, 1981, Asakawa and Satoh, 1987, Asakawa, 1995).

Note: The species is characteristic of symmetrical bursa copulatrix. On the body surface, there are only diagonal oblique ridges (cf. Tenora *et al.,* 2002b). Characteristic hosts are rodents of the genus *Microtus.* It belongs systematically to the subgenus *Heligmosomum* (cf. Asakawa and Satoh, 1987; Tenora *et al.,* 2002a, 2002b).

2. *Heligmosomum (P.) yamagutii* Chabaud, Rausch, Durette-Desset, 1963
   Syn.: *Heligmosomum costellatum* (Duj., 1845) sensu Yamaguti, 1954
   Host in Japan: *Clethrionomys rufocanus bedfordiae* (cf. Chabaud *et al.,* 1963, Asakawa, 1990).

Note: The species is characteristic of asymmetrical bursa copulatrix (Chabaud *et al.,* 1963, Asakawa, 1990). The dorsal part of the body surface of the species *H. yamagutii* is characterized by diagonal ridges, the right ventral body half has diagonal ridges, the left ventral body half has longitudinal ridges (cf. Chabaud *et al.,* 1963, Asakawa, 1990). It belongs systematically to the subgenus *Paraheligmosomum* (cf. Asakawa, 1987).

3. *Heligmosomum (P.) hasegawai* Asakawa, 1987
   Syn.: *Heligmosomum* sp. Hasegawa et Otsuru, 1981
   Host in Japan: *Eothenomys andersoni, E. smiti.*

Note: The species is characteristic of dorso-ventral ribs with a small branch (Hasegawa and Otsuru, 1987: „*H. yamagutii, H. mixtum* and *H. asiaticum* differ from the present one in lacking branch in the externo-dorsal ray"). On the body surface, there is the same structure of ridges as in the species *H. yamagutii.* It belongs systematically to the subgenus *Paraheligmosomum* (cf. Asakawa and Satoh, 1987).

4. *Heligmosomum (P.) asakawai* N´Zobadila, Boyer, Durette-Desset, 1996
   Syn.: *Heligmosomum (P.) mixtum* Schulz, 1954 sensu Asakawa and Satoh, 1987, Asakawa, 1995,
   Host in Japan: *Clethrionomys rutilus Mikado.*

Note: N´Zobadila *et al.* (1996) adjudged incorrectly determined material (*H. (P.) mixtum*) by the authors Asakawa and Satoh (1987) and Asakawa (1995) (host *Cl. rutilus*), and created the taxon of the new species value: *Heligmosomum asakawai.* The species is characteristic of symmetrical bursa copulatrix; on its body surface there is the same structure of cuticular ridges as that in the species *H. yamagutii.* With the structure on the body surface it differs essentially from the species *H. mixtum* (see *H. mixtum* below).

5. *Heligmosomum (P.) mixtum* Schulz, 1954
   Syn.: *Heligmosomum (P.) yamagutii* sensu Asakawa and Satoh 1987, Asakawa, 1995 nec Schulz, 1954
   Host in Japan: *Clethrionomys rutilus.*

Note: In Japan, the species was registered for the first time by Asakawa and Satoh (1987) under the name *H. (P.) yamagutii.* The same name is presented by Asakawa (1995, 1998). The species is characteristic of the symmetrical bursa copulatrix, and its significant feature is its body surface structure. On the dorsal part, there are only diagonal ridges, on the ventral part only longitudinal ridges. With this feature, it differs essentially from the species *H. (P.) yamagutii.* The species *H. (P.) mixtum* was described from the host *Cl. rutilus* from the former USSR (Skrjabin *et al.,* 1983) and it is a frequent parasite of *Cl. glareolus* in Europe (Tenora and Mészaros, 1971, Prokopič and Hulínská, 1983, Genov, 1984, N´Zobadila, 1996, Haukisalmi and Henttonen, 2000, and others).

B) Notes to the subgenus *Paraheligmosomum* Asakawa et Satoh, 1987, genus *Heligmosomum*

Regards to the present knowledge on the body surface structure of Nematoda of *Heligmosomum* (cf. Asakawa, 1995, Tenora *et al.,* 2002b), it is evident that the hitherto characteristics for Nematoda from the subgenus *Paraheligmosomum* is not sufficient (N. Zobadila et al., 1996). We suggest the following precision and complements:

Genus: *Heligmosomum* Railliet et Henry, 1909

Subgenus: *Paraheligmosomum* Asakawa et Satoh, 1987

Typus subgeneris: *Heligmosomum (Para-helig-*

mosomum) asakawai N'Zobadila, Boyer, Durette-Desset, 1996

Syn.: *Heligmosomum mixtum* Schulz, 1954 sensu Asakawa et Satoh, 1987, Asakawa 1995

Characteristics (emend.): Nematoda of the genus *Heligmosomum*. On the body dorsal part diagonal oblique ridges. On the body ventral part either only a) longitudinal ridges, or b) ridges divided in 2 groups. On the right half of the body ventral part are diagonal ridges; on the left half are longitudinal ridges.

C) Key to the determination of the species from the genus *Heligmosomum* parasitizing Rodentia in Japan

1. On the body only diagonal oblique ridges …… ..……..... *Heligmosomum (H.) costellatum* (Dujardin, 1845)
   - on the body diagonal and longitudinal ridges …… 2
2. On the body dorsal part diagonal ridges, on the body ventral part longitudinal ridges …… ……..... *Heligmosomum (P.)mixtum* Schulz, 1954
   - on the body dorsal part diagonal ridges. On the body ventral part, ridges divided in 2 groups. In the left half longitudinal ridges, in the right half diagonal ridges ……... 3
3. Dorso-ventral ribs with small branch …… ……..……. *Heligmosomum (P.) hasegawai* Asakawa, 1987
   - dorso-ventral ribs without small branch …. 4
4. Bursa copulatrix asymmetrical …… ……..... *Heligmosomum (P.) yamagutii* Chabaud, Rausch, Durette-Desset, 1993
   - bursa copulatrix symmetrical .....…… .....… *Heligmosomum (P.) asakawai* N´Zobadila, Boyer, Durette-Desset, 1996

Note: The species *Heligmosomum (P.)* sp. Asakawa, 1995 is not included in the key. Its taxonomic status has to be precised on the further material.

SOUHRN

Poznámky k hlísticím rodu *Heligmosomum* Railliet et Henry, 1909 (Nematoda, Heligmosomidae) parazitujícím v hlodavcích Japonska

V současné době je známo 6 druhů hlístic rodu *Heligmosomum*, které cizopasí v hlodavcích Japonska. Jsou začleněny do dvou podrodů, a to *Heligmosomum* sensu stricto a *Paraheligmosomum*. Přitom posledně jmenovaný podrod není vždy uznáván (N'Zobadila et al., 1996). Je proto v práci doplněna charakteristika jmenovaného podrodu. Komplikovaná systematicko-taxonomická pozice prezentovaných šesti druhů je dokumentována jejich synonymy: 1) *H.* (*H.*) *costellatum* (Dujardin, 1845), *syn.*: *H. halli* (Schulz, 1926); 2) *H. (P.) yamagutii* Chabaud, Rausch, Durette-Desset, 1963, syn.: *H. costellatum* (Duj., 1845) sensu Yamaguti, 1954; 3) *H. (P.) hasegawaii* Asakawa, 1987, syn.: *Heligmosomum* sp. Hasegawa et Otsuru, 1981; 4) *H. (P.) asakawaii* N'Zobadila, Boyer, Durette-Desset, 1966, syn.: *H. (P.) mixtum* sensu Asakawa et Satoh, 1987, Asakawa, 1995; 5) *H. (P.) mixtum* Schulz, 1954, syn.: *H. (P.) yamagutii* sensu Asakawa and Satoh, 1987, Asakawa, 1995; 6) *Heligmosomum (P.) sp.* Asakawa, 1995. Pozice posledně jmenovaného druhu může být vyřešena jen na základě nového materiálu. Práce je základem k objasnění speciace Nematoda v hlodavcích ostrovního rozšíření. Je také příspěvkem k poznání hlístic parazitujících u hlodavců palearktické oblasti.

paraziti, Nematoda, *Heligmosomum*, *Paraheligmosomum*, hlodavci, Japonsko

Acknowledgements

This study was partly supported by a 2001 Gakujutsu-Frontier Fund grant of Rakuno Gakuen University, the 2002 Kyodo-Kenkyu-Josei of Rakuno Gakuen University, and a Grant-in Aid (no. 14560271) from the Ministry of Education, Science and Culture of Japan.

This study is a part of research work of Agronomical Faculty of Mendel University of Agriculture and Forestry Brno, Czech Republic, No. 432100001, as well.

Authors thank Miss Martina Hönigová for technical support.

REFERENCES

ASAKAWA, M.: A new heligmosomid nematode, *Heligmosomum hasegawai* (Heligmosomatidae: Nematoda), from the Japanese voles, *Eothenomys smithi* Thomas and *E. andersoni* (Thomas). *J. Coll. Dairying, Nat. Sci*., 1987, 12: 103-109

ASAKAWA, M.: *Heligmosomum (Paraheligmosomum) yamagutii* Chabaud *et al*., 1963 (Heligmosomidae: Nematoda), from red-backed vole, *Clethrionomys rex* (Microtidae: Rodentia) on Mt. Petegari, Japan. *J. Rakuno Gakuen Univ., Nat. Sci*., 1990, 15: 159-165

ASAKAWA, M.: A biogeographical study on the parasitic nematodes of Japanese Microtidae and Murinae with systematic and phylogenetic studies of the genera *Heligmosomoides* and *Heligmosomum* (Nematoda: Heligmosomidae). *J. Gakuen Univ*., 1995, 19: 285-379

ASAKAWA, M.: Host-parasite relationship between the red-backed voles and its parasitic nematodes in Japan. *Honyurui Kagaku (Mammalian Science*), 1998, 38: 171-180

ASAKAWA, M., SATOH, R.: Discovery of the genus *Heligmosomum* Railliet et Henry, 1909 (Heligmosomidae: Nematoda) from the Japanese *Cletrionomys* and establishment of *Paraheligmosomum* n. subgen. *J. Coll. Dairying, Nat. Sci*., 1987, 12: 111-129

CHABAUD, A. G., RAUSCH, R. L., DURETTE-DESSET. M. C.: Nématodes parasites de rongeurs et insectivores japonais. *Bull. Soc. Zool. France*. 1963, 88: 489-512

DESPORTES, C.: Un curieux nématode, *Heligmosomum costellatum* (Dujardin, 1984). *Ann. parasit. hum. comp.,* 1943,19: 160-167

GENOV. T.: *Helminths of insectivorous mammals and rodents in Bulgarian*. Izd. Bulgarian AN. Sofia, 1984

HASEGAWA, H., OTSURU, M.: Two nematode species belonging to the genus *Heligmosomum* recovered from rodents in Niigata Prefecture, Japan (Trichostrongyloidea: Heligmosomidae). *Ryukyu Univ. J. Health Sci. Med*., 1981, 4: 214-218

HAUKISALMI, V., HENTTONEN, H.: Variability of helminth assemblages and populations in the bank vole *Clethrionomys glareolus. Polish journal ecology*, 2000, 48: 219-231

N´ZOBADILA, G., BOYER, J., DURETTE-DESSET, M. C.: Morphogenése d´*Heligmosomoides polygyrus polygyrus* (Dujardin, 1845) (Trichostrongylina, Heligmosomoidea) chez *Apodemus flavicollis* en France. Comparaison avec les espéces proches: *Heligmosomoides laevis* (Dujardin, 1845) et *Heligmosomum mixtum* Schulz, 1954, parasites d´Arvicolidae. *Bull. Mus. Nat. D´Histoire natur.* Paris, 1996, 18: 367-385

PROKOPIČ, J., HULÍNSKÁ, D.: Scanning electron microscopic study on the superficial cuticle of the nematodes *Heligmosomum costellatum* (Dujardin, 1845) and *H. mixtum* Schulz, 1954. *Folia Parasit*., 1983, 30: 27-29

SKRJABIN, K. I., SCHIKHOBALOVA, N. P., SCHULZ, R. S.: *Essential of nematodology. Vol. IV. Dictyocaulidae, Heligmosomatidae and Ollulanidae of animals.* Izd. AN SSSR, Moscow, 1954

TENORA, F., MÉSZAROS, F.: Nematodes of the genus *Heligmosomum* Railliet et Henry, 1909, sensu Durette-Desset, 1968, parasitizing rodents in Europe. *Acta Zool. Acad. Sci. Hung.*, 1971*,* 3-4: 397-407

TENORA, F., BARUŠ, V., HILDEBRAND, J.: The species of the genus *Heligmosomum* Railliet et Henry, 1909 (Nematoda, Heligmosominae) parasitizing rodents in Europe. *Helminthologia*, 2002a*,* 39: 181-182

TENORA, F., BARUŠ, V., HILDEBRAND, J., PROKEŠ, M.: Species of the genus *Heligmosomum* Railliet et Henry, 1909 (Nematoda, Heligmosominae) parasitizing Rodentia in Europe. *Acta Univ. Agric. Silvic. Mendelianae Brunensis*, 2002b*,* 50: 7-13

TRAVASSOS, L.: *Revisao da familia Trichostrongylidae Leiper, 1912*. Monogr. Inst. Oswaldo Cruz, 1937

TRAVASSOS, L., DARRIBA, A. R.: Notas sobre Heligmosominae. *Sciencia Med*., 1929, 9: 432-438

YAMAGUTI, S.: Studies on the Helminth Fauna of Japan. Part 51. Mammaliam Nematodes, V. *Acta Med. Okayama*, 1954, 9: 105-121

Address

Assoc. Prof. Mitsuhiko Asakawa, PhD., Department of Parasitology, Rakuno Gakuen University, School of Veterinary Medicine, Hokkaido 068, Japan. Prof. RNDr. František Tenora, DrSc., Ing. Marie Borkovcová, PhD., Ústav zoologie a včelařství, Mendelova zemědělská a lesnická univerzita v Brně, 613 00 Brno, Česká republika