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The First Record of *Raillietina (Raillietina) celebensis* (Janicki, 1902), *(Cestoda)* in Man from Australia, with a Critical Survey of Previous Cases

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Amongst material sent by Dr. M. J. Mackerras of the Queensland Institute of Medical Research, Brisbane, to one of us for identification were (a) a number of gravid proglottides collected from the faeces of a twenty-month old child from Brisbane, Australia, and (b) tapeworms from the duodenum of rats identified as *Rattus assimilis* Gould, from Mt. Glorious, South Queensland. They were all collected in 1955.

Although only ripe proglottides were recovered from the child, these have been identified as *Raillietina* (*Raillietina*) *celebensis* (Janicki, 1902) on the basis of the position of the genital pore which is, in each proglottid, close to the anterior border. The cirrus pouch is 137 to 160μ long and 46 to 69μ in diameter. Each egg-capsule contains 1 to 4 eggs, 34 to 46μ in diameter. The proglottides have a markedly torulose appearance and are 1 to 2 mm. long and 0.75 to 1.2 mm. wide (Fig. B).

Among the cestodes from rats, were several complete worms identified as *Raillietina* (*R.*) *celebensis* (Janicki, 1902). These are 35 to 175 mm. in length, with a maximum width of 1.4 to 1.75 mm. The scolex, which is 274 to 411μ long and 480 to 803μ in diameter, bears four suckers each 114 to 183μ in diameter and with a number of very minute spines on the inside walls. The rostellum is 105 to 123μ in diameter and bears 160 hooks 18 to 23μ long arranged in two circlets. The mature proglottides have the typical anatomy

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for this genus. The cirrus pouch is 114 to 151μ long and 50 to 73μ in diameter and the genital pore is always within the anterior quarter of the proglottid length. There are 28 to 30 testes (7 to 9 poral; 21 aporal) which have a diameter of 37 to 46μ. In gravid proglottides there are 100 to 140 egg-capsules and in each capsule 1 to 4 eggs of 27μ diameter. The nearer to the posterior end of the worm the gravid proglottides are, the more torulose they are in shape (Fig. A).

These tapeworms fall within the incomplete description given by Janicki (1902), for *Davainea celebensis* and the redescription given by Meggitt & Subramanian (1927). There have been described no less than six further species of *Raillietina* (*Raillietina*) which have been, or may be, regarded as synonyms of *R.* (*R.*) *celebensis*.

Joyeux & Baer (1929) recognised *R.* (*R.*) *formosana* (Akashi, 1916) as a synonym. An examination of Table I will show that the variety *R.* (*R.*) *celebensis paucicapsulata* Meggitt & Subramanian, 1927, *R.* (*R.*) *funebris* Meggitt & Subramanian, 1927, *R.* (*R.*) *garrisoni* Tubangui, 1931, *R.* (*R.*) *sinensis* Hsu, 1935, all have the same range in numbers and size of rostellar hooks and testicular follicles and agree in the anterior position of the genital pore. They also agree in other features, such as in the presence of spines both on the rostellum and the suckers and in the range for number of eggs in each capsule. *R.* (*R.*) *murium* Joyeux & Baer, 1936, when considered from the description given, is strikingly different from the other forms in the number of rostellar hooks and in the number of testicular follicles. However, re-examination of the material described by these authors reveals that the number of hooks and testes do fit within the range for *R.* (*R.*) *celebensis*. All these species are from the same geographic region. They are all now, regarded as synonyms of *Raillietina* (*R.*) *celebensis* (Janicki, 1902).

Material from *Rattus norvegicus* from Hanoi has also been examined and its features shown in Table I. It is identified as *R.* (*R.*) *celebensis*.

The ripe proglottides from the child bear a striking resemblance to the gravid proglottides of *R.* (*R.*) *celebensis* from the Queensland rat. They may be regarded as being from the same locality, since Mt. Glorious is within 30 miles from the centre of Brisbane. There can be little doubt that they are infections with the same species of cestode and that the child has acquired, secondarily, this infection from normal rat hosts.

Table I

	R. (R.) celebensis present paper	*R. (R.) celebensis* present paper	*R. (R.) celebensis* var. *paucicapsulata* Meggitt & Subramanian, 1927	*R. (R.) funebris* Meggitt & Subramanian, 1927	*R. (R.) garrisoni* Tubangui, 1931	*R. (R.) sinensis* Hsu, 1935	*R. (R.) murium* Joyeux & Baer, 1936
Length in mm.	35–175	60–110	242	32	600	120	16–35 (40)
Width in mm.	1.4–1.75	1.5–2.5	1.04	0.76	1.4–1.65	0.87	1 (1.4)
Number of rostellar hooks	160	90–100	100–120	80–100	90–140	120	240–250 (100–120)
Size of rostellar hooks in μ	18–23	18–25	20–25	17–21	20–26	14–16	18–22
Spines on rostellum	+	+	+	+	+	+	+
Spines on suckers	+	+	?	—	—	+	(+)
Position of genital pore	anterior	anterior	anterior	anterior	anterior	anterior	anterior
Cirrus pouch μ	114–115/50–73	105–114/41–46	89–121/40–65	105–121/48–54	130–180/54–85	57 (long ?)/90	120–140/50 (91–114/46)
Testes	28–30 7–9 poral	21–37 7–13 poral	33–35 11–15 poral	35–40	36–50 9–15 poral	22 6–7 poral	14–16 (21–23) (6–8 poral)
Egg capsules per proglottid	100–110	110–150	100–120	?	180–400	230	230–250 (200–220)
Eggs per capsule	1–4	1–4	3–4	?	1–4	2–5	1–4
Host	*Rattus assimilis*	*Rattus norvegicus*	*Rattus norvegicus* *Bandicota bengalensis*	*Rattus norvegicus*	*Rattus norvegicus*	Rat	*Rattus rattus*
Locality	Sth. Queensland	Hanoi	Rangoon	Rangoon	Manila	Canton	Tamatave

* All measurements in brackets have been found on re-examination of the original types

This is the first time that *R.* (*R.*) *celebensis* (Janicki) has been reported from Australia both from a child, and an autochtonous rat.* But since this tapeworm was first reported from *Lenomys meyeri* (Jentinck) from the Celebes, it very likely occurs throughout Australasia. *R.* (*R.*) *celebensis* has been found in rodents in the Philippines, Southern China, Formosa, Burma and Madagascar. It has been reported from man, in Siam (Leuckart, 1891), Formosa (Akashi, 1916), Philippines (Garrison, 1911, Africa & Garcia, 1934) and Queensland (present paper). It will, doubtless, be found elsewhere within this region, if searched for systematically.

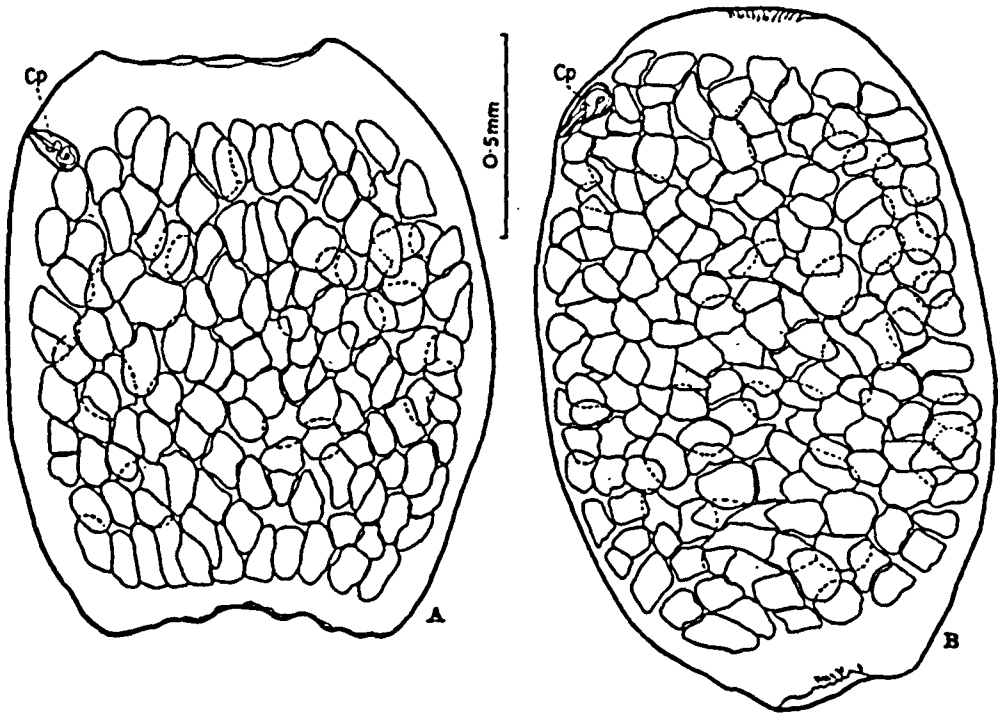
The species of *Raillietina* (*seu Davainea*) reported from man were first reviewed by Joyeux & Baer (1929) after an examination of the original material deposited in the Blanchard collection in Paris. They came to the following conclusions :

1. *Taenia demerariensis* Daniels, 1895, from British Guiana, is distinct from *T. madagascariensis* Davaine, 1869. An opinion that was later vindicated by the same authors (1940 ; 1949) (*vide infra*).
2. Under the name *T. madagascariensis* Davaine, 1869, there appear to have been described two distinct species : one from the Comores and Mauritius, and the other from Nossi Bé.
3. *T. madagascariensis* Garrison, 1911, from man in Manila, is a synonym of *R.* (*R.*) *celebensis* (Janicki) from rodents.
4. *T. madagascariensis* Leuckart, 1891, from a child in Bangkok, appears to be distinct from the above species. Its possible relationship to *T. madagascariensis* from the Comores, is discussed.
5. Several tapeworms belonging to the genus *Raillietina*, also occur in rodents, they may have been passed, secondarily, to man.

Subsequently, Tubangui (1931), reported a tapeworm from Philippine rats which is identical to the species described by Garrison (*loc. cit.*). Joyeux & Baer (1936) recorded a species of *Raillietina* found in *Rattus rattus* at Tamatave (Madagascar), which they were unable to identify with any of the species described from either the Comores or Mauritius.

* Ellermann (*Proc. Zool. Soc. Lond.* 1947, p. 262) is of the opinion that *Rattus assimilis* Gould is probably a race of *R. rattus*.

Re-examination of the fragments of the worms described by Joyeux & Baer (1929), from the collections of Blanchard and Davaine, has shown that in these the genital pore is always in the middle of the lateral border of the segment. This is in contradistinction to the position of the sexual aperture in *R.* (*R.*) *celebensis* which is invariably either in the anterior third of the lateral border in each



Gravid proglottides of *R.* (*R.*) *celebensis*: A.—from a Queensland Rat; B.—from a Queensland child. Cp.—cirrus pouch.

proglottid, or, as is more frequent, in the anterior quarter. Moreover, the fragments of the various strobilas reveal an internal anatomy not unique for the genus *Raillietina* but also identical with that of the genus *Inermicapsifer*. *Inermicapsifer* can be distinguished only in that all the species possess an unarmed scolex. They are found in rodents, hyraxes and man, in Africa*.

* *I. arvicanthidis* (Kofend), a frequent parasite of African rodents, has been reported at least three times from children in East Africa, and appears to occur quite commonly in man in Cuba (Baer, Kouri and Sotolongo, 1949; Baer, 1955). The first case observed by Davaine (1869) at Mayotte, was from a Creole child who had come from the West Indies!

Since Joyeux & Baer (1929) consider that the scolex, described by Blanchard as belonging to *T. madagascariensis*, is that of *T. saginata*, therefore no entire worm complete with scolex, has ever been described from the Comores or from Mauritius. In view of the above observations, we propose to consider the tapeworm from man, described in all textbooks under the name *Raillietina* (*R.*) *madagascariensis* as a *species sub judice* since it is at present, quite impossible to establish its true identity. In the hope of rediscovery of this tapeworm it would be necessary to obtain further material from either man or rodents, or both, from the Comores or Mauritius.

In the New World, Joyeux & Baer (1951) have established the existence of two species of *Raillietina* (*R.*) viz. *R.* (*R.*) *demerariensis* (Daniels, 1895) from man and a Howler monkey in the Guianas and Ecuador, and *R.* (*R.*) *alouattae* Baylis, 1947 from Howler monkeys in Surinam. At the time, the above authors overlooked a paper by Perez-Vigueras (1943) in which is described *R.* (*R.*) *halli* Perez-Vigueras, 1943 from a wild rodent in Cuba.*

Cameron & Reesal (1951) have described tapeworms from wild rodents from Trinidad, which they consider to be a variety of *R.* (*R.*) *demerariensis* which is named var. *trinitatae.* In a later paper, Stunkard (1953) reports this variety from a Venezuelean rodent and considers it to be identical with *R.* (*R.*) *demerariensis*, as redescribed by Joyeux & Baer (1951).

We have been able to examine numerous specimens of *R.* (*R.*) *halli* collected from the type host, *Capromys pilorides* Say in Cuba and have found this species to be identical with *R.* (*R.*) *demerariensis* (Daniels). On the other hand, the variety described by Cameron & Reesal is certainly not a synonym of *R.* (*R.*) *demerariensis*, as was suggested by Stunkard. Both the size of the rostellar hooks and the number of testes provide sufficient distinctive characters for separating them into two species. We therefore propose to raise the variety to specific rank and to name it *R.* (*R.*) *trinitatae* (Cameron & Reesal, 1951) *nov.comb.*

* It is interesting to find that in Cuba, wild rodents harbour tapeworms of the genus *Raillietina*, whereas man harbours a species of *Inermicapsifer* (*vide supra*) which has not yet been observed in any wild Cuban rodent.

The three species of *Raillietina* from mammals in the Neotropical region may be differentiated upon the following basis :

1. More than 80 testes per segment .....*R. alouattae* Baylis, 1947
   Less than 80 testes per segment 2

2. Rostellar hooks 10–18μ ; 26–46 testes
   R. trinitatae (Cameron & Reesal, 1951)
   Rostellar hooks 18–20μ ; 50–70 testes
   R. demerariensis (Daniels, 1895)

In the following the synonyms of these three species, and also those for *R.* (*R.*) *celebensis*, are listed, the host list and distribution given and the diagnosis of each species. The latter has been based, wherever possible, on examination of fresh material.

RAILLIETINA (*R.*) *CELEBENSIS* (Janicki, 1902), Fuhrmann, 1920

Syn. *Davainea madagascariensis* Leuckart, 1891 *nec* Davaine, 1869 ; *Davainea celebensis* Janicki, 1902 ; *Davainea madagascariensis* Garrison, 1911 *nec* Davaine, 1869 ; *Davainea formosana* Akashi, 1916 ; *Raillietina* (*R.*) *celebensis* (Janicki), Fuhrmann, 1920 ; *Raillietina* (*R.*) *celebensis* var. *paucicapsulata* Meggitt & Subramanian, 1927 ; *Raillietina* (*R.*) *formosana* (Akashi), Joyeux & Baer, 1929 ; *Raillietina* (*R.*) *garrisoni* Tubangui, 1931 ; *Raillietina* (*R.*) *sinensis* Hsu, 1935 ; *Raillietina* (*R.*) *murium* Joyeux & Baer, 1936 : *Meggittia celebensis* (Janicki), Lopez-Neyra, 1943.

Hosts : Man, *Rattus rattus* L., *R. norvegicus* Berkenhout, *R. assimilis* Gould, *Bandicota bengalensis* (Gray & Hardw.), *Lenomys meyeri* (Jentink).

Distribution : Canton, Formosa, Hanoi, Rangoon, Tamatave, Manila, South Queensland.

Diagnosis : The length is 16–600 mm. with a maximum width of 2.5 mm. The scolex is 0.30–0.80 mm. in diameter. The rostellum which has a covering of small spines, bears 80–160 hooks, 14–26μ long. The four suckers are armed with minute spines and are 91–183μ in diameter. The genital pore is within the anterior third of the lateral border in each proglottid. The cirrus pouch is 89–180μ long and 40–85μ in diameter. There are 21–50 testes, 37–50μ in diameter, with the greater number on the aporal side of each

proglottid. The egg capsules are numerous (100–230) ; each capsule contains 1–4 eggs.

Raillietina (*R.*) *demerariensis* (Daniels, 1895), Joyeux & Baer, 1929.

Syn. *Taenia demerariensis* Daniels, 1895 ; *Davainea madagascariensis auctorum nec* Davaine, 1869 ; *Raillietina* (*R.*) *demerariensis* (Daniels), Joyeux & Baer, 1929 ; *Raillietina* (*R.*) *quitensis* Leon, 1935 ; *Raillietina* (*R.*) *brumpti* Dollfus, 1939 ; *Raillietina* (*R.*) *equatoriensis* Dollfus, 1939 ; *Raillietina* (*R.*) *leoni* Dollfus, 1939 ; *Raillietina* (*R.*) *luisaleoni* Dollfus, 1939 ; *Raillietina* (*R.*) *halli* Perez-Vigueras, 1943.

Hosts : Man, *Alouatta seneculus* (L.), *Capromys pilorides* Say.

Distribution : Ecuador, British Guiana, Cuba.

Diagnosis : The length is 90–120 mm. with a maximum width of 1.3–1.8 mm. The scolex has a diameter of 450μ. The rostellum is armed with 200–300 rostellar hooks, each 18–20μ long. The four suckers are armed with small spines. There are 50–70 testes in each segment. The cirrus pouch is 180–220μ long and 80–90μ in diameter. The egg capsules in the gravid segments are numerous (180). Each capsule contains 8–10 eggs.

Raillietina (*R.*) *alouattae* Baylis, 1947

Syn. *Raillietina* (*R.*) *multitesticulata* Perkins, 1950.

Hosts : *Alouatta seneculus* (L.), *A. macconnelli* Elliot.

Distribution : British and Dutch Guianas.

Diagnosis : The length is 130–340 mm. with a maximum width of 3.2–7 mm. The diameter of the scolex is 450–700μ. The rostellum bears 175–245 hooks, each 15–18μ long. The four suckers bear small spines. There are 110–140 testes per segment. The cirrus pouch is 220–308μ long and 100μ in diameter. The egg capsules are relatively few in the gravid segments (70–85) and each capsule contains 6–11 eggs.

RAILLIETINA (*R.*) *TRINITATAE* (Cameron & Reesal, 1951) *nov.comb.*

Syn. *Raillietina* (*R.*) *demerariensis* var. *trinitatae* Cameron & Reesal, 1951 ; *Raillietina* (*R.*) *demerariensis* Stunkard, 1953 nec. Daniels, 1895.

Hosts : *Cuniculus paca* (L.), *Dasyprocta aguti* (L.), *Proechimys cayennensis* (Desm.).

Distribution : Trinidad, Venezuela.

Diagnosis : The length is 60–100 mm. and the maximum width, 1.3–2.7 mm. The diameter of the scolex is 270–370μ. The rostellum has 170–175 hooks, 10–11μ long. The four suckers are armed with minute spines. There are 26–46 testes in each segment. The cirrus pouch is 120–300μ long and 50–70μ in diameter. The egg capsules are numerous in the gravid proglottides (80–240). Each egg capsule contains 2–12 eggs.

SUMMARY

Gravid proglottides of *Raillietina* (*R.*) *celebensis* (Janicki) are reported from a child in Brisbane, Queensland. Complete tapeworms of the same species are reported from *Rattus assimilis* Gould, from Mt. Glorious, South Queensland. A critical survey is made of all the cases previously recorded from man. *Raillietina* (*R.*) *madagascariensis* is for the present, regarded as a *species sub judice*. *Raillietina* (*R.*) *demerariensis* var. *trinitatae* Cameron & Reesal, 1951 has been raised to specific rank and named *R.* (*R.*) *trinitatae* (Cameron & Reesal, 1951) *nov.comb.* The synonyms of *R.* (*R.*) *celebensis* ; *R.* (*R.*) *demarariensis* ; *R.* (*R.*) *alouattae* and *R.* (*R.*) *trinitatae*, are discussed.

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