Notes on parasites of horses in Hawaii. A. O. Foster, Gorgas Memorial Laboratory, Panama, and J. E. Alicata, University of Hawaii, Honolulu.

The present report is chiefly a series of notes on the species of endoparasites (29 in all) which are known to infect equines in Hawaii, and is presented as a contribution to our knowledge of the economically important parasites of the Islands.

Nothing detailed report was heretofore available relative to the kinds of parasites of horses in Hawaii. Four species were recorded by Hall (1936) and the following quotation is from his "Problems of Parasitism in Hawaii" (p. 382):

Horses in the Islands are infested with ascarids, strongyles, and bots. Specimens in the collection of the U. S. Bureau of Animal Industry include specimens of Acesis equorum, Strongylus vulgaris, and Gastrophilus equi. . . . In the writer's experience, horses in the tropics are usually heavily parasitized. . . . Specimens of Fasciola hepatica from the horse in Honolulu were sent to the U. S. Bureau of Animal Industry by Rowat in 1894.

In addition, one of us (Alicata, 1936) reported briefly that the most common parasites of horses in Hawaii were Habronema sp., Trichostrongylus sp., Parascevis equorum, Strongylus spp., Oxyuris equi, small clycicostomes, bots and tape-worms.

The material covered in this report was collected by one of us (J. E. A.) during 1936 and 1937 from a few horses born and raised on the islands of Oahu and Mani. The exact number of animals from which these specimens were taken is unknown, since, at first, the examinations were conducted primarily to ascertain the presence of liver flukes, and in most of these cases the intestinal species were collected casually or not at all.

The fact that the species listed herein are established on the Islands is apparent from the sources of the material, although it is equally true that not only the parasitic species, but the hosts also, were originally imported, as is the
case with practically all the livestock in Hawaii. According to a report by Henke (1929) the first horses, from California (a horse and a mare with foal), were imported in 1803 as a gift to King Kamehameha I. Following this, it is recorded that by 1854 horses were so numerous on the streets of Honolulu as to be regarded as a nuisance. Subsequent importations have been from England, Australia, Arabia, India, and the continental United States. It is not unlikely therefore that some of the species encountered have existed on the Islands for over a century, nor is it remarkable that a rather varied parasitic fauna has become established there.

In the following paragraphs the several species of endoparasites identified by us are recorded and those noted by Hall (loc. cit.) are reviewed. A zoological arrangement is adopted to insure clarity.

**TREMATODA; FASCOLIDAE**

1. *Fasciola gigantica* Cobbold, 1885.

No flukes have been encountered by us in horses at any time, and we are indebted to Dr. E. W. Price and Mr. A. McIntosh of the U. S. Bureau of Animal Industry for this identification. In a personal communication in response to a request by one of us (J. E. A.) they state that the specimens submitted by Rownt in 1894 (referred to by Hall, loc. cit.) have been re-examined by them and found to be *F. gigantica*. This appears to be the first published record of the occurrence of this species in the horse, although a few cases of *F. hepatica* infection have been reported from scattered sources.

**cestoda; anoplocephalidae**

2. *Anoplocephala perfoliata* (Goëze, 1782).

This is probably the commonest and most injurious tapeworm of equines although it is rare in some regions, notably the continental United States. Its normal habitat is the cecum where the presence of 20 or more may produce proliferation, stenosis, and ulceration at the ileo-cecal junction. Only 10 specimens were identified from the Hawaiian material but these were collected purely for determination and are not an index of the occurrence of the species. Two other tapeworms, *A. magna* and *A. manillava*, which are of cosmopolitan but less frequent occurrence, were not encountered in our study.

Monnig (1928) has described a fourth anoplocephalid species from domestic equines, *Moniezia pallida* Monnig, 1926, but this appears to have been found but once in South Africa.

**Nematoda; strongylidae**

4. *S. edentatus* (Looss, 1900).
5. *S. vulgaris* (Looss, 1900).

These 3 species were abundant in the Hawaiian material, as might be expected from the fact that all of them have been encountered wherever equines have been examined for parasites. Specimens of *S. vulgaris* were the most numerous, which probably means that verminous arteritis and aneurysms are not infrequent among equines on the Islands although the extent of arterial invasion by the larvae of this species was not noted. In their adult life all strongyles are blood-suckers and live firmly attached by their powerful buccal walls to the lining of the cecum and colon.

---

A fourth species of this genus, *S. asiini*, was described by Boulenger (1920) from the intestine and liver of donkeys in Africa, but this appears to be the only record of its occurrence. This species, like *Cylicococcus adersi* and *Cyathostomum tetracanthum*, but unlike the majority of strongylid species, may be of limited distribution and best adapted to the donkey host.


Species of the genus *Triodontophorus* attach themselves to the lining of the large bowel, usually the ventral colon, and suck blood. The two most injurious species, *T. minor* and *T. tenuicollis*, associated with the production of ulcers, are conspicuous absences from this record, since both are generally distributed and fairly common.


This species, the only member of the genus, is relatively rare, but is quite generally distributed. Three specimens, from the ventral colon, were among some 1500 strongylid specimens from Hawaii.


This is a generally distributed species but rarely occurs in large numbers. Two specimens were among the Hawaiian material. The other member of the genus, *P. ratzii*, was not encountered.

10. *Cyathostomum coronatum* (Looss, 1900).

This is probably the most characteristic "cylicostome" species of the ecem infecting equines everywhere, but was represented by only 16 specimens in the Hawaiian material.

The genus *Cyathostomum* Molin, 1861, the *tetracanthum* group of Looss, contains 4 definitely valid species (viz. *tetracanthum*, *coronatum*, *labratum*, and *labiatum*), all described by Looss, and 1 questionable species, *C. ornatum* (Kotlán, 1919). Outside of its original record from Hungary, this latter species appears to have been reported only from Puerto Rico (McIntosh, 1933). This species appears, on the one hand, to be very close to *C. labratum* from which it differs, according to Kotlán's description, only by a slightly more elongated dorsal gutter, while, on the other hand, according to Kotlán's figure, the structure of the mouth capsule is not like that of the *Cyathostomum* spp., but more like that of the genus *Cylicococcus*.

Although but one species of this genus was among the Hawaiian material, it is probable that *C. labratum* and *C. labiatum* will be found on the Islands since both are common and distributed all over the world. *C. tetracanthum* on the other hand, may not be presumed to occur here since it is almost exclusively an Egyptian species and highly specific to the donkey.

11. *Cylicococcus cuniculatus* (Looss, 1900).
13. *C. pateratus* (Yorke and MacFie, 1919).

These 3 species are harbored by equines everywhere and are relatively common in Hawaii. The genus contains one other equine species, *C. alveatus*, the type of the genus, which has not yet been reported outside of Africa.

15. *C. longibursatus* (Yorke and MacFie, 1918).
16. *C. minor* (Yorke and MacFie, 1918).
17. *C. asygnieticus* (G. Theiler, 1923).

The first 3 of the above were among the most abundantly represented species from Hawaii. All are of cosmopolitan distribution. *C. asygnieticus* is the most recently discovered, valid "cylicostome" species. It was described from South African material by G. Theiler (1923) who found a "few specimens" (p. 656).
One specimen occurred among about 1500 strongylid worms from Hawaii. In Panama (Foster and Ortiz, 1937), 7 specimens were identified from a total of about 85,000 strongylid worms. This species has also been reported from Puerto Rico (McIntosh, 1933) and Poland (Skladnič, 1935). It is interesting to consider the possible significance of the fact that probably less than 20 specimens, in all, of a definitely fixed species of "cylicostome" have been taken from equines in such scattered localities as South Africa, Puerto Rico, Poland, Panama, and Hawaii.

The genus *Cylicostephanus* contains 2 other valid species which did not occur in the material from Hawaii, namely; *C. poculatus* and *C. hystrix*. A seventh species, *C. porcibaratus* Vaz, 1934, was described from a single male specimen and its validity is questionable. Lacking knowledge of the structure of the posterior end of the female one cannot with certainty preclude this species, as described, from the genus *Cylicocercus*, and indeed it appears both from Vaz' figure and his description that one can hardly differentiate Vaz' species from *C. goldii*.

18. *Cylicocercus nasutus* (Looss, 1900).

The former was abundantly represented in the Hawaiian material, while the latter occurred once. Both are widely distributed throughout the world and, with the possible exception of *Cylicostephanus longibaratus*, *Cylicocercus nasutus* is the most common of the "cylicostomes" of equines.

The genus contains 5 other species (*radiatus*, *auriculatus*, *insigne*, *adseri*, and *elengatus*) which were not encountered during the present survey. Of these latter, *C. insigne* is common in most parts of the world as a characteristic species of the dorsal colon and for this reason its absence from the Hawaiian equines already examined is unusual.

20. *Cylicodottaphorus bicoronatus* (Looss, 1900).

Two specimens of the former species and one of the latter were encountered in this survey. Both species occur in most parts of the world but appear never to occur in large numbers. The genus contains 2 other equine species, viz., *C. mettmani* and *C. ultrajectus*.

**Nematoda Other than Strongylidae**

The following extra-Strongylidae were identified from native Hawaiian equines:

24. *Oxyurus equi* (Schrank, 1788).
27. *H. microstoma* (Schneider, 1866).

In addition to the above, the following botflies were identified from larvae which parasitized the intestinal tract of these equines:


**Discussion and Summary**

In the above paragraphs we have listed 29 species of endoparasites from equines in Hawaii. There were 19 strongylid species representing 9 genera. The genera from domestic equines not represented in this survey are *Oesophagodontus* (only species, *O. robustus*), *Craterocotylus* (*C. miceronatum* and *C. aetolicaudatum*).
and Cyclicobrachylus (C. prionodes and C. brevicapsulatus). In commenting on the Strongyliidae, mention was made of all the valid species contained within the several genera and such notations were made upon their distribution and relationships as seemed desirable for a foundation to further study both in Hawaii and elsewhere.

LITERATURE CITED


