SOME ECTOPARASITES OF THE COYPU (MYOCASTOR COYPUS) IN EASTERN ENGLAND

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INTRODUCTION

The coypu or nutria, Myocastor coypus (Molina), is large rodent of the sub-order Hystricomorpha and commonly reaches a weight of 7 kg. It is native to South America. It was introduced to Britain for fur farming and a wild population has existed since about 1932 when escaped animals became established in eastern Norfolk. By 1962 coypus were abundant throughout Norfolk and Suffolk, with many also present in several adjoining counties, and they were spreading steadily. The spread was checked, and coypu numbers were greatly reduced, by a systematic control trapping campaign run by the Ministry of Agriculture, Fisheries and Food during 1962–65 which has been described by Norris (1967). Many sites that were occupied by coypus are now free again.

The coypu prefers marshy areas and the banks of watercourses of all types and sizes including farm ponds and ditches. It nearly always remains within reach of at least a little water, but will readily travel up to 1 km to feed. It swims and dives freely and has adaptations for a semi-aquatic existence, including webbed hind feet, valvular nares and fur which consists of long coarse guard hair which becomes wet in water and of fine, dense underfur which does not become wet and thus, with its trapped air, provides buoyancy and thermal insulation. The coypu digs short burrows but often the water table is almost at the surface in its preferred habitats and temporary nests are made in good cover by gathering together a heap of vegetation which becomes flattened under the coypu’s weight. The native British mammals whose habitats impinge most often on that of the coypu are the water vole Arvicola amphibius L., the bank vole Cletonromys glareolus Schr., the short-tailed vole Microtus agrestis (L.), the wood mouse Apodemus sylvaticus (L.), the brown rat Rattus norvegicus Berk., the common shrew Sorex araneus L., the water shrew Neomys fodiens Pennant and the otter Lutra lutra (L.) From time to time coypus undoubtedly pass through habitats frequented by all the domestic and wild terrestrial mammals found in the region, except possibly squirrels (Sciuridae) and deer (Cervidae).

The only ectoparasite recorded from the coypu in South America appears to be Pitruquenia coypus Marelli (Mallophaga: Gyropidae) (Marelli 1932). This is also the only species of which there are published records in those countries, apart from Britain, to which the coypu has been introduced. The coypu is now a well-established member of the British fauna and the present work is an attempt to assess its role as a host for ectoparasites. Previous records from the coypu in Britain consist of the following, which

* At Bureau of Animal Population, Oxford, 1957–60. This paper was offered as a tribute to Mr Charles Elton, F.R.S., on his retirement as Director of the B.A.P., but arrived too late to be included in the special issue of February 1968.
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are all of isolated occurrences: *P. coyopus* (Freeman 1946); *Ixodes ricinus* (L.) (Laurie 1946), *I. hexagonus* Leach (Arthur 1953), *I. arvicolae* Warburton and *I. trianguliceps* Birula (Arthur 1963) (Acarina: Ixodidae); *Ceratophyllum gallinace* (Schrank) (Siphonaptera: Ceratophyllidae) (George 1964). The records of Arthur (1963) and George (1964) refer to material obtained during the present study.

![Sketch map of East Anglia](image)

**FIG. 1.** Sketch map of East Anglia to show the distribution of coyopus sampled for *Pitrafquenia coyopus*, using 10 km squares of the National Grid. Information about coyopus distribution from Norris (1967).

**MATERIAL AND METHODS**

Coypus were received almost every month during the period December 1960–April 1967 from throughout the area enclosed by a line joining King's Lynn, Newmarket and Aldeburgh (see Fig. 1). Most of the specimens were live-trapped by Ministry of Agriculture or Rabbit Clearance Society operators. They were killed on removal from the traps, and were received at the laboratory in plastic bags within 1 day of death. In other cases the coyopus were received alive in the traps and killed at the laboratory.
A total of 2578 coypus was searched for ticks in the course of a more general examination for studies of the reproduction, age structure and diseases of the wild coypus population. Most attention was paid to the head; exhaustive searches were not made, but the counts obtained clearly show seasonal and local variation in tick infestation. During August 1962–December 1965, 1861 of the coypus were also examined for lice and their eggs which were simply recorded as present or absent and were not counted.

1. THE COYPU LOUSE (*PITRUSQUENIA COYPUS*)

A description in English of this species is given by Freeman (1946). Despite the fact that it feeds on blood there is no apparent irritation to the skin of the host.

(a) Geographical distribution

The study area contained eighty-seven 10 km squares of the National Grid reference system in which coypus were considered to be present during 1961–65 (Norris 1967). Coypus were received from fifty-eight squares and *Pitrusquenia coypus* was found on

Table 1. Percentages of coypus infested with *Pitrusquenia* coypus, data pooled for August 1962–December 1965 (sample size in parentheses)

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<tr>
<td>Adult</td>
<td>48:0</td>
<td>60:0</td>
<td>72:9</td>
<td>59:5</td>
<td>26:2</td>
<td>33:3</td>
<td>33:3</td>
<td>44:5</td>
<td>38:3</td>
<td>45:5</td>
<td>39:2</td>
<td>51:8</td>
<td>47:4</td>
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<tr>
<td>males</td>
<td>(50)</td>
<td>(60)</td>
<td>(85)</td>
<td>(42)</td>
<td>(65)</td>
<td>(66)</td>
<td>(39)</td>
<td>(18)</td>
<td>(44)</td>
<td>(11)</td>
<td>(33)</td>
<td>(27)</td>
<td>(540)</td>
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<tr>
<td>Adult</td>
<td>58:9</td>
<td>72:8</td>
<td>75:5</td>
<td>49:1</td>
<td>45:7</td>
<td>54:5</td>
<td>42:2</td>
<td>57:4</td>
<td>70:0</td>
<td>64:0</td>
<td>62:3</td>
<td>54:6</td>
<td>59:2</td>
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<tr>
<td>females</td>
<td>(73)</td>
<td>(70)</td>
<td>(102)</td>
<td>(55)</td>
<td>(83)</td>
<td>(57)</td>
<td>(76)</td>
<td>(35)</td>
<td>(73)</td>
<td>(25)</td>
<td>(29)</td>
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<tr>
<td>Immature males</td>
<td>77:4</td>
<td>88:2</td>
<td>86:1</td>
<td>93:3</td>
<td>73:7</td>
<td>53:5</td>
<td>75:8</td>
<td>90:0</td>
<td>82:9</td>
<td>50:0</td>
<td>100</td>
<td>89:6</td>
<td>81:7</td>
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coypus from all but ten of these (Fig. 1). The squares in which lice were not found were represented by samples of only one to seven coypus. The original British specimens referred to by Freeman were obtained in 1946 from Cingleford on the River Yare approximately 4 km south-west of the centre of Norwich.

(b) Distribution on the host

On freshly-killed coypus the lice are most numerous on the thorax but they occur all over the body close to the surface of the skin in the shelter of the underfur. Thus only those parts of the skin which lack underfur (i.e. ears, feet, tail and ano-genital region), and become wet when the animal enters water, are not colonized by lice.

Samples of hair were examined from various parts of the body and louse eggs were found to be most abundant at the bases of guard hairs from the rump where the hair is long and difficult to groom. The routine check for eggs was therefore done on this part of the body.

(c) Life cycle and transmission

Lice were found on coypus of all ages and both sexes throughout the year (Table 1). If lice were present their eggs were almost invariably found too. Lice and their eggs were already present on young coypus that were known to be only 2–3 days old.

N J.A.E.
It appears that the lice transfer to the young coypus during the suckling period which lasts for up to 8 weeks (Newson 1966). The coypus has four pairs of teats, which are placed high on the sides of the body, and the young suckle comfortably for long periods with their muzzles pressed deep into the mother’s fur. Many rodents have naked young, but the coypus has full pelage at birth and the young therefore provide a satisfactory habitat for the lice immediately. Captive coypus of all ages will crouch closely together, which could provide further opportunities for cross-infestation among weaned animals, but this behaviour is rare in the wild after weaning (Ryszkowski 1966). Contact at copulation is not prolonged enough or close enough to permit migration of the slow-moving lice. We have never seen lice outside the underfur except on dead coypus and they do not seem to have any adaptations for survival off the host.

![Graph showing infestation of the coypus with *Pityostomum joycius* during the course of the year.](image)

Since, even in the wild, the coypus breeds all the year round (Laurie 1946; Newson 1966) an opportunity may occur at any time for lice from adult females to colonize new-born young. The observed ability of the lice to breed immediately after reaching a fresh host is obviously an advantage, and it seems that a closed population of lice is built up on each coypus from an infestation acquired soon after birth.

No complete counts of lice were made, but populations of 100 or more were common.

**Seasonal changes in infestation**

The percentage of infested adult males, adult females and immature young tended to increase during the period of the study, probably due to our own increasing efficiency at finding the lice. There was, however, also a consistent annual pattern (shown in the summarized results, Table 1 and Fig. 2) with peak infestations in late winter, a decline
in spring and a recovery during summer. The monthly totals for infestation are significantly different statistically \( (\chi^2 = 29.9, P < 0.01) \). Since the coypu depends on its pelage for both insulation and buoyancy in the water, molting is restricted to a gradual, general replacement of hair which occurs most markedly in March–April and also in early autumn (Kinsel 1958), and this could result in the loss of lice and eggs attached to moulted hairs.

2. TICKS (IXODES SPP.)

Of 2578 coypus examined throughout the study only seventy-four (2.9%) were found to carry ticks. There were thirty-four infestations with *Ixodes ricinus* (all but three from the same general locality), thirty-nine with *I. arvicolae* (from three localities), one with *I. hexagonus* and two with *I. trianguliceps* (Table 2). These figures include one coypu that was carrying specimens of both *I. ricinus* and *I. trianguliceps* and another with specimens of *I. ricinus* and *I. arvicolae*. All sites yielding ticks were in Norfolk and are shown in Fig. 3. Almost all the attached (i.e. feeding) ticks were found on the lips, muzzle, eyelids and, in particular, the ears. Although these ticks were all relatively exposed to grooming by the host they would be immersed only when the host dived.

<table>
<thead>
<tr>
<th>Table 2. Monthly distribution of coypus infested with Ixodes ricinus, I. hexagonus, I. arvicolae and I. trianguliceps, for all coypus examined 1960–67</th>
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<tr>
<td>------</td>
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<tr>
<td><em>Ixodes ricinus</em></td>
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<tr>
<td><em>I. hexagonus</em></td>
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<td><em>I. arvicolae</em></td>
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<td><em>I. trianguliceps</em></td>
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| No. of coypus examined | 235 | 364 | 366 | 226 | 230 | 208 | 209 | 91 | 230 | 141 | 142 | 136 | 2578 |

Life stages of tick present: \( a \), adult female; \( b \), nymph; \( c \), larvae.

(a) *Ixodes ricinus*

The only previous record of this tick on the coypu was one nymph from Cringleford (see p. 473) in February 1946 (Laurie 1946; Freeman 1946). Between December 1960 and May 1965, 1841 coypus were examined and three females were found (one at Cantley, September 1964; one at Croxwick, December 1964; and one at Ranworth Broad, March 1965). The remaining thirty-one records of *I. ricinus* were concentrated in the periods June–July 1965 and July–August 1966 and they all came from 198 coypus obtained in an area of about 10 km\(^2\) between Hickling Broad and Horsey Mere (Fig. 3). During June 1965–April 1967 a further 542 coypus were examined from many other parts of East Anglia and none was found to be carrying *I. ricinus*.

Examination of the Hickling Broad data showed that all but one of the tick-infested coypus came from within 1 km of the north and east sides of the broad whereas there was only one infested coypu in a catch of twenty from the extensive beds of reed (*Phragmites communis* Trin.) on the south and west sides of the broad. The infested coypus came from the vicinity of poorly-maintained grazing marshes which had a mat of damp vegetation that is ideal for sheltering the ticks during the large proportion of the life cycle that is spent off the host. The cattle on this land were heavily infested with ticks.

The life-stages of the ticks encountered on thirty-two coypus from the Hickling area in 1965 and 1966 were represented by two larvae, 344 nymphs and seven adults (1 male:
6 females). The number of nymphs per infested coypu ranged from one to fifty-six (average 10.8). The adults and nymphs showed no preference for sex or size in the coypus they infested. These results agree with the statement by Arthur (1963) that adults of

*Ixodes ricinus* feed chiefly on larger mammals, including domestic stock; the nymphs feed on species of intermediate size (such as the coypu); and the larvae are mainly confined to small rodents and passerine birds. The smallness of the larvae (about 1 mm long) would, however, make them hard to find on an animal the size of a coypu.
(b) *Ixodes hexagonus*

We found this species infesting a coypu once only with one adult female and eight nymphs on a coypu from the outskirts of Horning in March 1963. However, a single specimen was taken on a coypu in the parish of Strumpshaw, Norfolk, in March 1959 (J. D. Norris, personal communication), and Arthur (1953) recorded the nymph of this species on 'escaped coypu' but no collection data were available. Although *I. hexagonus* is widely distributed in Britain, it has only been recorded five times previously in Norfolk and only on the coypu on the occasions given here. The usual hosts are small or medium-sized mammals, commonly the hedgehog (*Erinaceus europaeus* L.); man and domestic animals are occasional hosts (Arthur 1963).

(c) *Ixodes arvicolae*

The water vole is thought to be the chief host of this little-known species. Only the adult female has been described (Warburton 1926) with records from Kent and Cambridgeshire. A female that we collected from Strumpshaw in May 1962 was the first record of the species from Norfolk or from the coypu (Arthur 1963). Rood & Burtt (1965) recorded (but did not describe) adults, nymphs and larvae of ticks thought to belong to this species from wood mice, short-tailed voles and shrews (*Sorex minutus* L. and *Crocidura suaveolens* (Pallas)) from Cornwall and the Scilly Isles.

The seasonal distribution of our records for *Ixodes arvicolae* on the coypu is given in Table 2 and their locations are shown in Fig. 3. Between December 1960 and January 1966 we examined 2182 coypus and found six adult females of *I. arvicolae*: one each from Strumpshaw, Brundall, Crome's Broad, Martham Broad, Hickling Broad and 1 km south of Hickling Broad. From February 1966 until April 1967 a further thirty-three coypus were found to be carrying *I. arvicolae*. These were part of a sample of 239 coypus which came from three distinct areas (a) the basin of the River Thurne, including Hickling and Martham Broads, (b) a restricted locality around Burlingham Broad and Brundall in the valley of the River Yare, and (c) Woodbastwick Marshes (near Horning) and Wroxham Broad in the valley of the River Bure. During the same period no ticks of this species were found on 157 coypus collected from nine other sites, some of which were represented by samples of less than ten coypus.

The local and seasonal nature of the infestations makes it difficult to generalize about the life cycle of this tick from the samples obtained, but the annual peak of activity of adults and nymphs probably is reached in April or May (see Table 2). Thirteen larvae were obtained, but only during the months of February, April and October. Thirty-two nymphs were found on twenty coypus in numbers of one to five; no preference was shown for sex or size in the host. Twelve adult females, but no males, were found. The records for adults and nymphs were distributed among the months February–July except for one female in November.

Despite the limitations set by the data, it appears that the geographical distribution of *I. arvicolae* in eastern England, as revealed by records on coypus, is very restricted and patchy. For example, samples of more than twenty coypus from Cantley (only 7 km downstream from Burlingham Broad) in September 1964 and March 1966 yielded no ticks, neither did samples from the upper Yare valley in Spring 1964 and the Waveney Valley in April 1966 and February 1967. All these sites had abundant water vole populations, but these voles were not sampled for ticks.
(d) *Ixodes trianguliceps*

We have only two records for this species. One adult female and one nymph found on a coypu from Surlingham Broad in November 1962 are mentioned by Arthur (1963). One nymph was found on a coypu from Hickling Broad in July 1966. These appear to be the only records for the species on the coypu and the first records of the species from Norfolk. The range of hosts is wide, consisting mainly of insectivores and rodents no bigger than the mole (*Talpa europaea* L.) and the brown rat respectively (Arthur 1963). Thus all but the youngest coypus were outside the size range of its normal hosts, although in fact one of the infested coypus was large.

3. OTHER ECTOPARASITES

(a) *Siphonaptera*

No special search was made for fleas; two only were found on all the coypus examined. One was identified as a specimen of *Ceratophyllum gallinae* (George 1964) and the other was lost again on the host. If coypus were regular hosts to fleas many more would certainly have been found.

(b) *Trombicula autumnalis* Shaw (Acarina: Trombiculidae)

Harvest mite larvae were not found on the coypu during the period of the main study, although they were present in small clusters on water voles, bank voles, short-tailed voles, wood mice and common shrews which we trapped near Hickling Broad in July 1966. We examined eight coypus in October 1967 from a site 4 km north of Hickling Broad. Six of these had up to five *T. autumnalis* attached singly on the ears and the ano-genital region, and there were others moving in the ventral underfur.

Although, therefore, we may have previously overlooked some light infestations on other coypus it is unlikely that we would have missed heavier infestations if they were present.

(c) *Lyctocoris* sp.

A single specimen of a larval anthocorid bug, probably *L. campestris* (Fabricius) (Hemiptera: Anthocoridae) was found on the perineum of a female coypu which was caught in the parish of Swainsthorpe, Norfolk, in June 1964. It was not feeding. This species, common and widely distributed throughout the British Isles, is considered to be a facultative mammalian blood-sucker and is usually found among plant debris, including that used as nest material (Butler 1923).

DISCUSSION

Ectoparasites of the coypu must be adapted to a host with aquatic habits, that is active throughout the year, is capable of breeding at any time, has precocious young and usually makes only temporary surface nests. On emerging from the water after each of its frequent swims the coypu shakes itself vigorously and grooms thoroughly.

Only *Pitrfugienia coypus*, which is host-specific to the coypu, fulfills all these requirements. It is the most frequent and numerous ectoparasite of the coypu, has not been found on any other mammal and presumably was introduced into Britain with its host. It has also been recorded from coypus introduced into the U.S.A. (Miller 1956), Germany (Klapperstück 1964) and the U.S.S.R. (F. F. Aliev, personal communication).
It is interesting that, although the percentage of infested coypus is now high, a search of sixteen coypus from Cringleford in 1943 produced no lice (Laurie 1946), but they were found at the same locality 3 years later (Freeman 1946).

Lice are easier to find on a small coypu than a large one, which might explain why the mean percentage of infested coypus was statistically significantly higher \((d = 8.48, P < 0.001)\) among the young of both sexes than among the adult females. An alternative explanation is that in some cases the infestations may fall to very low levels or die out altogether as the young animals grow older. No explanation is offered for the significantly higher percentage \((d = 4.13, P < 0.001)\) of infestation found among adult females than adult males, although the percentage infestation of the young did not differ significantly between the sexes \((d = 0.33, P = 0.74)\).

An unknown proportion of the ticks that are picked up from the vegetation must be washed off before they become attached to feed. On account of the flattening of their bodies and the horizontal spread of their legs ticks moving to attachment sites on the host's head must remain exposed in the guard hair. For this reason, perhaps, only one adult male *Ixodes ricinus* was found. In this species the males go on to the host for mating and, though they may attach temporarily, they do not feed. They therefore continue to move about precariously in the host's fur searching for females. The only male that was found on a coypu was already in *copula* with one of a group of three females feeding, exceptionally, at a small wound on the host's heel. Dragging a blanket over the vegetation at the Hickling Broad site in May 1966 showed that unfed males and females were both abundant. In the other three tick species the males are thought to remain in the host's nest where fertilization of the females occurs. The poorly-developed nesting habits of the coypu make it an even less suitable final host for such species than for *I. ricinus*.

The numbers of ticks were on the whole so low as to suggest that their presence was accidental and that the coypu is normally unimportant as a host. However, in recent years cases of red water fever in cattle in north-east Norfolk have been diagnosed from examination of blood smears. Since *I. ricinus* is the vector for the causative organism, *Babesia divergens* (M'Fadyean & Stockman), and coypus have been found in dykes draining the grazing land on which cattle became infected, it is apparent that coypus could lead to the spread of this disease by carrying to new areas ticks that were infected earlier in their life cycle. Coyups could also act as alternative hosts to infected ticks in areas from which cattle were temporarily absent.

The records of ticks obtained in the present study provide new information on the geographical distribution of these four species as well as confirming that the coypu is a potential host for them. Some tick-infested areas may have been overlooked because coypus were not obtained from them at times when the ticks were on their hosts. The fact that all the records were confined to the Broads area of north-east Norfolk, although coypus were obtained from a much larger area (Fig. 1), suggests that suitable conditions for coypus to acquire ticks exist only in this particular area. The higher rate of infestation of coypus with *Ixodes ricinus* found near Hickling Broad emphasizes that suitable conditions exist at this site for the more usual relationship of this tick with cattle or sheep, and reveals that a proportion of the tick population, especially the nymphs, happened to be feeding on coypus instead. The records of *I. arvicolae* on the coypus are localized into three distinct areas in the valleys of the Rivers Yare, Thurne and Bure but the significance of this is doubtful since there is almost no other information on the distribution of the tick.

A description of the hitherto unknown larva, nymph and adult male of *I. arvicolae*
will be possible when studies on the tick’s life-history have been completed in the laboratory with specimens obtained during the present study and with additional material collected by us from voles, mice and shrews. The taxonomic status of the species is at present being re-examined and, in all probability, it is synonymous with I. apronophorus Schulze (S. F. Barnett, personal communication), as originally suggested by Arthur (1963).

The data for Siphonaptera likewise emphasize the unsuitability of the coypu as a host—a feature which it shares with the otter (Chapman 1962). The only specimen that was identified was of a species well known for its wide range of bird hosts (George 1964). The fact that so few stragglers were found suggests that any fleas reaching coypus must soon be lost again. Yet seventeen out of twenty-eight water voles caught in the supplementary live-trapping mentioned earlier were infested with fleas. The species were Ctenophthalmus nobilis (Rothschild), Megabothris walkeri (Rothschild) and Doratopsylla dasycnema (Rothschild). In addition Nosopsylla fasciatus (Bosc) and Peromyscopsylla spectabilis (Rothschild) have also been collected on water voles caught in coypu traps during this study. None of these is host specific to the water vole but they obviously manage to survive frequent immersion on this host. Presumably the coypu fails as a host because its poorly-developed nesting habits and precocious young do not enable any species of flea to complete its life cycle. Finally, it is of interest that, so far, the coypu does not appear to have acquired any of the ectoparasites adapted for life on the water vole. The water voles that we examined were, for instance, invariably heavily infested with the mites Laelaps muris (Ljungh), Listrophorus leuckharti Pgst. and Parasitus sp., but none was ever seen on the coypu.

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The following kindly identified the parasites for us: Professor D. R. Arthur, Dr S. F. Barnett, Mrs G. M. Black, Dr T. Clay, Mr R. S. George and Mrs A. M. Hughes. Most of the coypus were obtained through the close co-operation of Mr J. D. Norris and other staff of the Ministry of Agriculture, Fisheries and Food and Mr G. M. Oakes, Secretary of Acle Rabbit Clearance Society. Mr P. E. Ketteringham and Mr W. F. Rayner helped with all aspects of the work.

SUMMARY

During December 1960–April 1967, 2578 coypus from Norfolk and Suffolk were examined for ectoparasites. The host-specific louse Pitrufquenia coypus was found on 62.7%. Ixodid ticks were found on 2.9%. Ixodes ricinus occurred in appreciable numbers on coypus from only one locality. Stragglers of I. hexagonus and I. trianguliceps were found. I. arvicola was found in appreciable numbers on coypus from three restricted localities. Only two specimens of fleas were seen. Light infestations with Trombicula autumnalis may also occur and one specimen was found of a facultative blood-sucking anthocorid bug. It is concluded that only Pitrufquenia coypus is fully adapted to life on the coypu, which is perhaps unsuitable as the main host for any of the native species of ticks and fleas due to its poorly-developed nesting habits, precocious young and aquatic behaviour.

REFERENCES


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