

# Leech parasitism of waterfowl in the British Isles

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## Introduction

Information on North American leeches that parasitize waterfowl has been reviewed by Trauger & Bartonek (1977). There are 16 species of freshwater leeches in the British Isles, but only two species, *Haementeria* (= *Placobdella*) *costata* (Fr. Müller) and *Theromyzon tessulatum* (O.F. Müller), attack waterfowl. These species can be identified by using the key in Elliott & Mann (1979). The present paper summarizes information on the hosts, habitats and distribution of the two species.

## The leech parasites and their hosts

Both species belong to the Family Glossiphoniidae, which feed by inserting their eversible proboscis into the soft tissues of their hosts, are restricted to fresh water and are the only leeches that brood their fertilized eggs and carry their young.

*Haementeria costata* has been recorded only once in the British Isles (Elliott *et al.* 1979). It is widespread in Europe and in countries around the Mediterranean, Black and Caspian Seas. The chief host is the European terrapin *Emys orbicularis*, but other frequent hosts are frogs, mammals including man, and waterfowl including domestic geese and ducks (Wilkialis 1973).

*Theromyzon tessulatum* is widespread throughout Europe, including the British Isles, and has also been recorded in North America but the species may not be the same as that in Europe (Davies 1973; Sawyer 1972; Klemm 1977). It has now been recorded on 20 species of water-birds in the British Isles (Table 1). American leeches, chiefly *Theromyzon rude*, have been recorded on 20 species of waterfowl in the United States and Canada (Trauger & Bartonek 1977). Mallard *Anas platyrhynchos* and Pintail *A. acuta* are the only hosts common to the American species and *T. tessulatum* in the British Isles.

Several reports cite *T. tessulatum* as the probable cause of mortality in waterfowl, especially in young birds (Table 1). Death was usually due to the leeches blocking the respiratory tract and thus causing asphyxiation. Other possible causes of death were

excessive bleeding or damage to the brain when the leeches wandered into the air spaces in the skull. Leeches can cause severe conjunctivitis when they suck blood from the eye beneath the nictitating membrane. The damage to the eye may be permanent and thus impair the vision of the bird (Roberts 1955; Kuzetsova 1955; Gräfner & Baumann 1974).

The usual feeding site is the nasal cavity of the host. *T. tessulatum* is the most plastic of the British leeches and once attached to the beak of a bird, it soon enters the nasal cavity by squeezing through the external nares. As the proboscis of the leech can penetrate only the soft tissues of the host, most leeches are attached to the mucosa of the nasal cavity. The host often reacts by shaking its head, scratching or sneezing (Trauger & Bartonek 1977; McKinney & Derrickson 1979). It is doubtful if such reactions dislodge a feeding leech but they may facilitate the removal of satiated ones. Satiated leeches soon leave their hosts so that at any one time, only a small proportion of the population is actually attached to hosts. Davies & Wilkialis (1981) found that the mean time ( $\pm 95\%$  CL) spent by *T. rude* in the nasal cavities of domestic ducklings was  $2.50 \pm 0.24$  h. These authors also demonstrated that parasitized ducklings had significantly lower values for the weight of the liver and the ratio of the keel to sternum than unparasitized ducklings.

## Habitat and distribution in the British Isles

*Haementeria costata* has been found in almost all types of fresh water in Europe, but it usually occurs where macrophytes are present (Wilkialis 1970). The single locality for the British Isles (see Figure 1) is on the Hurst Haven which is a collection of lowland streams draining the Pevensey Levels in Sussex. Aquatic macrophytes are abundant at the margins of the river and there are plenty of suitable hosts, including frogs, newts, Mallard, Wigeon *A. penelope*, Teal *A. crecca*, Pintail, Garganey *Anas querquedula*, Mute Swan *Cygnus olor* and Heron *Ardea cinerea*. Some of these birds are known to migrate from Holland, Germany, Poland and western USSR, and the Garganey is a summer

**Table 1. Authenticated records of hosts of *Theromyzon tessulatum* in the British Isles.**

Species	Comments	References
Great Crested Grebe <i>Podiceps cristatus</i>	Eye	Mann 1951
Bittern <i>Botaurus stellaris</i>		Mann 1951
Mute Swan <i>Cygnus olor</i>		Mann 1951
Chinese Goose <i>Anser cygnoides</i>	Kerato-conjunctivitis	Mann 1951; Roberts 1955
Cape Shelduck <i>Tadorna cana</i>		Keymer 1969
Falkland Flightless Steamer Duck <i>Tachyeres brachypterus</i>	Death	Wildfowl Trust 1950
Pintail <i>Anas acuta</i>		Keymer 1969
Teal <i>A. crecca</i>		Sage 1958
Mallard (incl. domestic ducks) <i>A. platyrhynchos</i>	Haemorrhage from nares Conjunctivitis Death of juveniles	Rollinson <i>et al.</i> 1950; Mann 1951; Keymer 1969; McCarthy 1975; own data; Sage 1958
Wigeon <i>A. penelope</i>		
European Eider <i>Somateria mollissima</i>	32 leeches on dead juvenile	Hillgarth & Kear 1979
Carolina <i>Aix sponsa</i>		Keymer 1969
Muscovy Duck <i>Cairina moschata</i>	Death of ducklings Conjunctivitis	Rollinson <i>et al.</i> 1950 Lang 1969
Harlequin Duck <i>Histrionicus histrionicus</i>	Death	Own data
Long-tailed Duck <i>Clangula hyemalis</i>	Death	Own data
White-headed Duck <i>Oxyura leucocephala</i>	Death	Own data
Coot <i>Fulica atra</i>		Own data
Curlew <i>Numenius arquata</i>		Brown 1935
Common Gull <i>Larus canus</i>		Sage 1958
Herring Gull <i>L. argentatus</i>		Sage 1958

visitor from Africa. It is therefore possible that *H. costata* was transported to Britain on migrating birds.

*Theromyzon tessulatum* has been found in almost all types of fresh water in the British Isles, the only major exception being fast streams. There are now about 400 authenticated records of its occurrence and 338 10-km squares are covered by the records (Elliott & Tullett 1982). These records, together with a few recent additions, are summarized in Figure 1. When the records for 10-km squares are expressed as a percentage of the total number of squares in which freshwater leeches have been recorded, the coverage is 32% for the British Isles. Similar comparisons for all 16

species of freshwater leeches show that *T. tessulatum* is the fourth most frequently recorded species in the British Isles, and is by far the commonest of those species that are ectoparasites of vertebrates.

#### Life cycles

Wilkielis (1970, 1973) has studied some aspects of the life cycle of *Haementeria costata* in Poland. The leeches survived in the laboratory for about two years; copulation occurred in late May and June; leeches with eggs were found in June and early July, and leeches carrying young were found in June, July and August. The usual

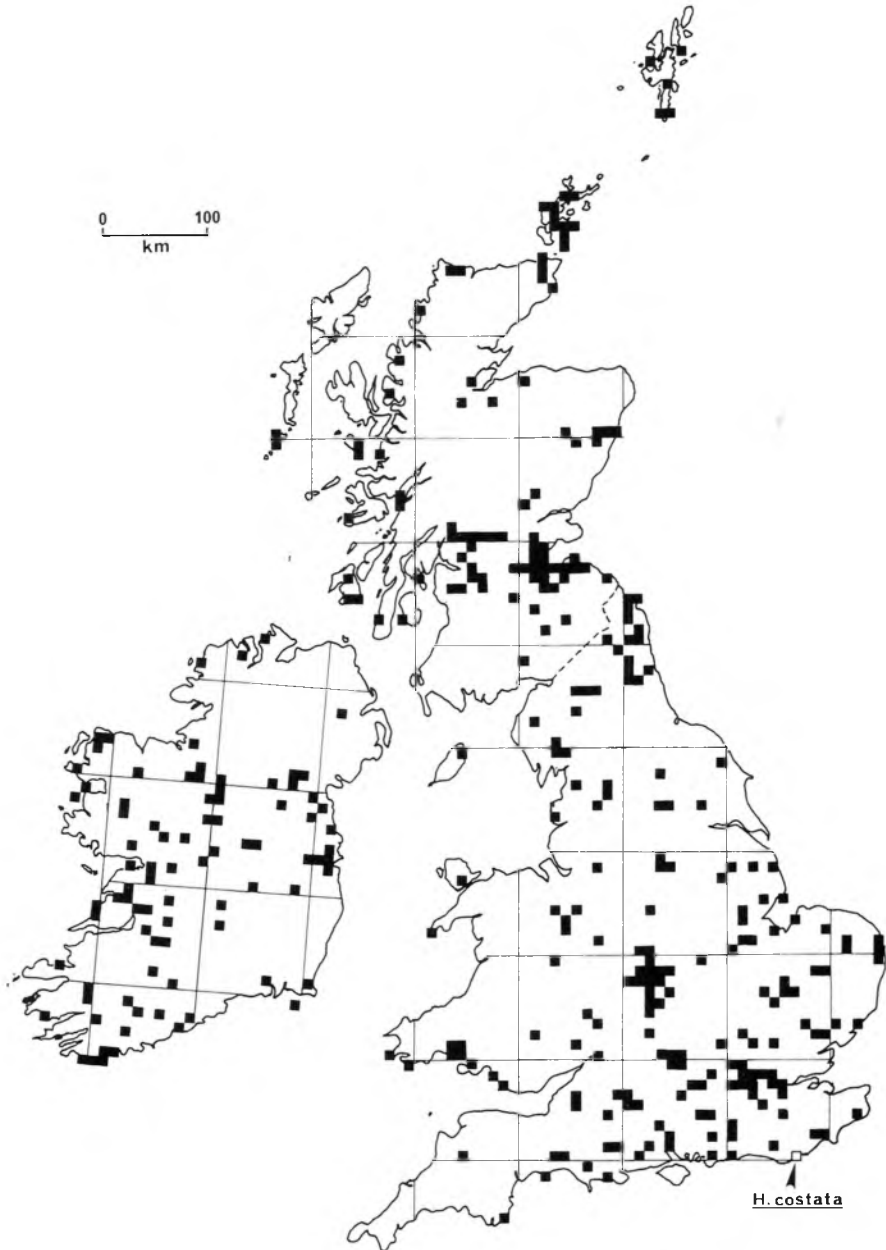


Figure 1. 10-km squares in which *Theromyzon tessulatum* (black squares) and *Haementeria costata* (single open square) have been recorded in the British Isles.

range for young per parent was 62–75, and an adult found at Hurst Haven in Sussex was carrying 78 young attached to its ventral surface. Satiated leeches and those carrying eggs usually hide amongst stones or burrow into a sandy bottom, whilst hungry leeches or those carrying young

usually cling to the upper surfaces of stones or the leaves of aquatic macrophytes and are thus in a position to attack any suitable host.

The only previous observations on the life cycle of *Theromyzon tessulatum* in the British Isles are those of Mann (1951) who

found that cocoons were laid in June and July, eggs hatched in about eight days and leeches carried their young for three to four months. Records of this species from Windermere provide the first complete account of the life cycle in the British Isles (Figure 2). Most specimens were obtained from the lake shore but a few came from Mallard, which are the commonest ducks on the lake (Atkinson & Shepherd 1974). The leeches were separated into the following six categories: small immature, large immature, mature without eggs or young, copulating, mature with eggs, and mature with young.

Small immature leeches were found from September to May and were most abundant in October and November, soon after all the parents had died. Larger immature leeches were first found in March and throughout the summer until the end of September. Mature leeches without eggs or young were present from mid-August to the end of June, and therefore both small immature and mature leeches were found throughout the winter. It is possible that some small immature leeches grew rapidly in spring to mature and breed at an age of about one year, but the majority probably grew slowly throughout the spring and summer to overwinter as mature leeches and breed when about two years old (Figure 2).

Leeches were found in copulation in May and June, brooding eggs from July to August and carrying young from mid-June to mid-October. Therefore the young remained on their parents for up to four months. The mature leeches did not feed after copulation, and became very sluggish and gelatinous towards the end of the breeding season. It was assumed that these

leeches all died in autumn and this assumption was confirmed by laboratory observations.

The number of young per parent was clearly related to the live weight of the parent (Figure 3), and had a mean value ( $\pm 95\%$  CL) of  $373.8 \pm 74.5$  with an overall range of 147–742. There was no corresponding relationship between parent weight and the weight of 100 young removed from each parent. The mean weight ( $\pm 95\%$  CL) of a single young leech was  $0.082 \pm 0.001$  mg, a value very similar to that given by Calow & Riley (1982).

The only comparable study of the life cycle of this species is that of Wilkialis & Davies (1980a, b) in northeast Poland. Life cycles in two lakes and a river were essentially similar to that in Windermere. The mean number ( $\pm 95\%$  CL) of young carried per parent was  $382.8 \pm 151.2$ . Laboratory experiments in the Polish study confirmed the earlier work of Herter (1929) that a minimum of three blood meals was required for the leech to reach maturity and breed. When a parent encountered a suitable host, the young leeches detached for their first meal but the parent never fed. If the parent died, the young leeches had to feed on a suitable host within 50 days or they also died. Young leeches may change their parent for a foster-parent, and young *Haementeria costata* have even been found on adult *T. tessulatum* (Wilkialis 1970).

Satiated leeches, copulating leeches and those brooding their eggs or carrying newly-hatched young are found in sheltered locations, often amongst stones in deeper water. Hungry leeches and those carrying young are usually attached to the leaves of aquatic macrophytes or the upper surfaces

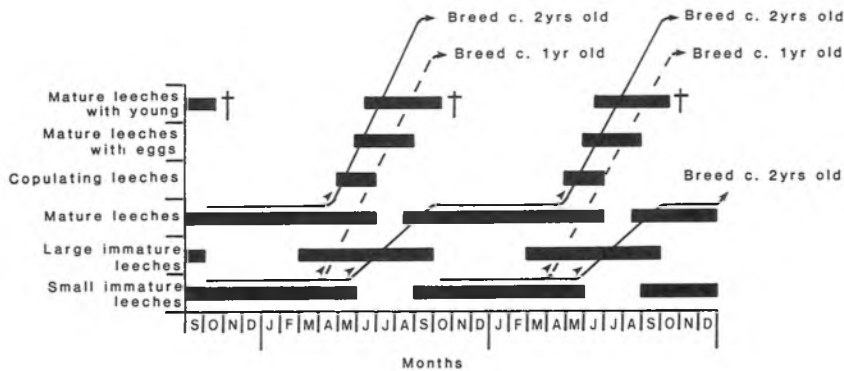


Figure 2. Life cycle of *Theromyzon tessulatum* in Windermere: each horizontal bar indicates the months in which the various stages occur; † indicates the death of the leeches.

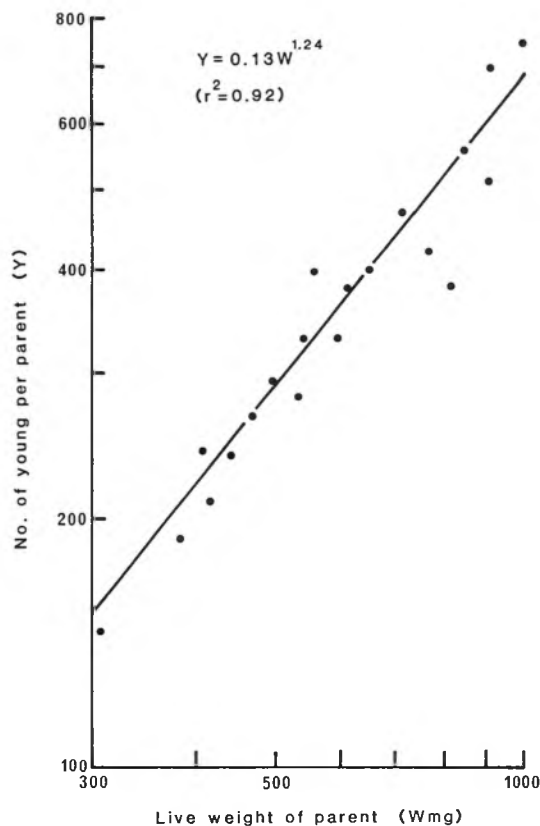


Figure 3. Relationship between the number of young per parent ( $Y$ ) and the live weight of the parent ( $Wmg$ ) for *Theromyzon tessulatum* from Windermere. Note that the data are plotted on log/log scales and that the equation for the curvilinear regression line is given on the figure.

of stones in shallow water. The leeches are attracted to a source of disturbance in the water, objects with a temperature in the range 33–35°C, and objects that have been in contact with the preen gland of waterfowl (Mann 1962).

#### Discussion

Little is known about the ecology of *H. costata*, but there is no apparent reason why it should not appear in more localities, especially in eastern England where migrating birds could carry the leeches from other European countries. Although *T. tessulatum* has been recorded on 20 species of water-birds in the British Isles (Table 1), its presence throughout the British Isles suggests that it probably attacks a larger number of species. It is therefore important that more records are obtained so that it can be established if *T. tessulatum* has a

preference for certain species of waterfowl. There are also still large gaps on the distribution map (Figure 1), no doubt due to a lack of collecting in a particular area. Therefore further records are required so that a more complete map can be produced.

*T. tessulatum* probably colonizes water-bodies by being transported on its hosts. As breeding leeches do not feed, all those so dispersed must be immatures or mature leeches that have not copulated. Although leeches are hermaphrodites, cross-fertilization is necessary and therefore at least two individuals must arrive in a water-body. Higher numbers are probably required for successful colonization.

*T. tessulatum* are to be found in bird stomachs, and in their experiments with *T. rude* feeding on domestic ducklings, Davies & Wilkialis (1981) found that 25% of the leeches were eaten by the birds. Waterfowl certainly eat other species of

leeches that feed exclusively on invertebrates, e.g. *Glossiphonia* spp., *Erpobdella* spp. and *Helobdella stagnalis*. These leeches often serve as intermediate hosts for parasites whose final hosts are waterfowl. For example, *Erpobdella octoculata* is the intermediate host for the cysticeroid stage of *Hymenolepis parvula*, a small tapeworm found in the guts of ducks (Kufel 1970). It is notable that similar parasites are rarely found in leeches, such as *T. tessulatum*, that attack vertebrates (Dobrowolski 1958).

There are very few records of the leeches causing death in water-birds (Table 1). They may, however, impair the general condition of their hosts and hence increase the probability of mortality. Once *T. tessulatum* is established in a water-body, it cannot be eradicated, unless all potential hosts can be excluded for at least a year or the water-body can be drained. If wild birds such as Mallard are frequent visitors, then there is a high probability that the leeches will be re-introduced. Therefore the control of the leeches in the field is almost impossible, but individual birds can be treated. Forceps can be used to remove leeches from their eyes and exterior. Leeches in the nasal cavity or other inter-

nal passages may be induced to leave their host by dunking the head of the infected bird in warm water or a 10% solution of sodium chloride. Kusnetsova (1955) suggested that weak solutions of gastric juice, acetic acid (vinegar) or ammonia could also be used.

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#### Summary

Two species of leeches, *Haementeria* (= *Placobdella*) *costata* and *Theromyzon tessulatum*, attack waterfowl in the British Isles. *H. costata* has been found at only one locality in Britain. *T. tessulatum* is common and has been recorded on 20 species of water-birds. Information on the effects of the leeches on their hosts is reviewed, and occurrence records for the British Isles are summarized. The life cycle of *T. tessulatum* is described, and some comparisons are made with other studies on this species.

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