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AN EARLY EIGHTEENTH-CENTURY TREATMENT FOR EQUINE BOT FLY

Abstract: This paper presents brief comments on an early modern treatment for infestation of horses by bot fly (probaby *Gasterophilus intestinalis*). The Scottish author and physician, Martin Martin (c. 1660-1718) records the rural Gaelic practise of treating diseased animals using water in which Jurassic belemnites, probably belonging to the genus *Megateuthis* and collected from Bajocian rocks on the eastern shores of the Isle of Skye, had been steeped. This means of treatment is something of an outlier in the range of medicinal uses of belemnites, and the philosophy behind it is not clear.

Keywords: materia medica, veterinary medicine, myiasis

Non MeSH: Scotland, Oestridae, bot fly, belemnite, Megateuthis

Introduction

Myiasis is the invasion of living vertebrates by dipteran (fly) larvae. The larvae may be introduced as accidental, facultative or obligate parasites. The most derived group of obligate myiasis-causing parasites of mammals are the members of the family Oestridae, commonly known as Bot Flies, Warble Flies, Heel Flies and Gadflies, and which embraces four subfamilies. Bot flies which parasitise horses belong to the genus *Gasterophilus* (subfamily Gasterophilinae), although some species in the genus may infest cows, sheep or goats.

This paper will briefly consider a rather unusual rural Scottish folk medicine treatment for equine bot fly dating from the late seventeenth and early eighteenth century. The approach was recorded by Martin Martin (Màrtainn MacGilleMhàrtainn; c. 1660-1718).

***Gasterophilus intestinalis* de Geer, 1776**

Fig. 1. Adult female of Gasterophilus intestinalis De Geer, 1776. Wikipedia: Photograph by Janet Graham, CC BY 2.0.

The adult botfly measures around 10 mm to 15 mm in length and the hairy body gives it an overall appearance that somewhat resembles a bee (Fig. 1). The female is generally larger than the male, mostly by virtue of its long pseudoovipositor. A constriction between the first and second abdominal segments results in a 'wasp waist'. The adult fly does not feed directly on the host animal. Following mating, the female lays up to 1000 yellowish eggs on the skin of the forelimbs and shoulders of the host animal; eggs are laid by bending the abdomen in a tight C-shape (Fig. 1) so that each egg can be precisely placed on an individual hair shaft where it is secured by means of a cement. During normal grooming activity, the horse licks the infected area, thereby transferring the eggs onto its tongue. After a very brief period of incubation, the presence of salivary enzymes, the moist environment and the high temperature in the mouth (compared to the skin) stimulates hatching of the eggs. The first instar or maggot emerging from the egg then burrows into the tissues of the tongue surface (and sometimes also the gums and lining of the oral cavity). This can result in loss of appetite, inflammation of the oral tissues, loose teeth and pockets of pus developing in the host animal, although many animals show no ill effects at all.

After the first moulting, the second instars develop in the glossal tunnels for around 28 days. They emerge, only to be swallowed, thus gaining access to the stomach. They attach themselves to the upper, oesophageal and cardiac regions of the stomach, well away from the glandular fundic region where proteolytic enzymes and strong

digestive acids are produced [1]. These somewhat pill-shaped larval instars are adapted for clinging on to the stomach lining by possessing hooked mouthparts and rings of backwardly-projecting spines down the length of its body, with the exception of the last few body segments [1]. The third instars are relatively large (up to 19 mm long) and feed on the blood and tissues of the stomach lining by the abrasive use of their mandibles, causing ulceration. The host animal can often tolerate the myiasis quite well, although particularly heavy infestations may result in gastrointestinal blockage, colic, chronic gastritis, ulcerated stomach, oesophageal paralysis, peritonitis, stomach rupture, squamous cell tumours, and anaemia [2]. It takes up to 12 months for the third instar to mature. When ready, some time during the spring, it detaches itself from the stomach lining and passes out of the host animal in the faeces. Here, they burrow deeper into soil or faeces in order to pupate for a period of three to five weeks, depending on the ambient temperature [3], before emergence of the adult bot flies and the commencement of a new cycle.

Modern approaches to management and treatment include the use of insect repellents, scraping unhatched eggs off horse hairs using a bot knife, and the use of broad spectrum anti-parasitic agents such as Ivermectin and the antihelmintic Moxidectin.

Martin Martin and his publications

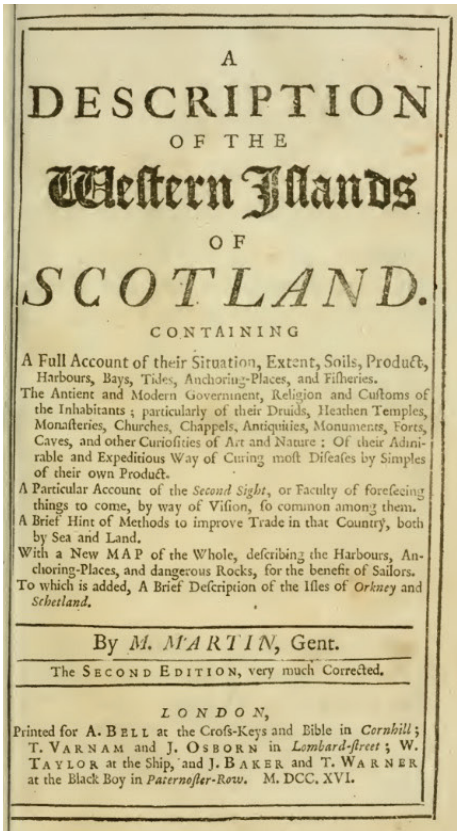
Martin Martin [4] was cousin to several Scottish clan (kinship group) chiefs. Born at Bealach on the Isle of Skye, he studied at Edinburgh University, graduating MA in 1681. Over the next fourteen years he acted as tutor to, successively, Dòmhnall a‘ Chogaidh (Donald MacDonald; 1650-1718), 4th Baronet of Sleat and Ruaraidh Òg MacLeod (dates unknown) of the Isle of Harris. During the first decade of the eighteenth century, Martin spent time both in the Highlands of Scotland and London; he made a permanent move to the latter in 1708, then becoming tutor to the third son of the Earl of Bradford. Furthermore, encouraged by his support group of fellow episcopalians, he established friendly working academic relations with a number of virtuosi whilst in the capital [5]. After studying for his MD in Leiden, Martin returned to London in 1710, where he continued to live and practise as a medical doctor, eventually dying from asthma in 1718.

In 1695, Martin travelled to Holland where he met Hans Sloane (1660-1753), then Secretary to the Royal Society. Under Sloane’s patronage, Martin undertook a tour of the Isle of Lewis in 1696, and St Kilda in May 1697. His voyages were made in the company of fellow geographer, John Afair (c. 1655 – c. 1722), a specialist in surveying and cartography, but with whom he did not enjoy good relations [6 p94].

A Gaelic speaker, with his university education and a seeming ease at moving in the circles of both the Gaelic èlite and the common man, Martin was well qualified to collect and record observations on the history, customs, geography, natural history, anthropology and folklore of Scotland. He was also a keen collector of ‘curiosities’ [5, 7]. It may have been Sir Robert Sibbald (1641-1722), first professor of medicine in Ed-

inburgh, who encouraged Martin to include an investigation into the medical conditions experienced by the inhabitants of Skye and the Western Isles of Scotland in his geographical studies [8 p84].

Martin's *Voyage to St Kilda* [9] was followed five years later (1703) by *A Description of the Western Islands of Scotland* [10]; a second edition was published in 1716 [11]. The latter volume is of particular interest here as it contains the treatment for equine bot fly which is the focus of this paper, together with many further observations on Scottish folk medicine, which have been the subject of recent scrutiny [8].



A
DESCRIPTION
OF THE
Western Islands
OF
SCOTLAND.

CONTAINING

A Full Account of their Situation, Extent, Soils, Product, Harbours, Bays, Tides, Anchoring-Places, and Fisheries.
The Antient and Modern Government, Religion and Customs of the Inhabitants; particularly of their Druids, Heathen Temples, Monasteries, Churches, Chappels, Antiquities, Monuments, Forts, Caves, and other Curiosities of Art and Nature: Of their Admirable and Expeditious Way of Curing most Diseases by Simples of their own Product.
A Particular Account of the *Second Sight*, or Faculty of foreseeing things to come, by way of Vision, so common among them.
A Brief Hint of Methods to improve Trade in that Country, both by Sea and Land.
With a New MAP of the Whole, describing the Harbours, Anchoring-Places, and dangerous Rocks, for the benefit of Sailors.
To which is added, A Brief Description of the Isles of *Orkney* and *Schetland*.

By *M. MARTIN*, Gent.

The SECOND EDITION, very much Corrected.

LONDON,
Printed for A. BELL at the Cross-Keys and Bible in *Cornhill*; T. VARNAM and J. OSBORN in *Lombard-street*; W. TAYLOR at the Ship, and J. BAKER and T. WARNER at the Black Boy in *Paternoster-Row*. M. DCC. XVI.

Fig. 2. Title page of A Description of the Western Islands of Scotland by Martin Martin (second edition, 1716). Archive.org.

Bot fly treatment

Amongst the geological observations made concerning the Isle of Skye, Martin [9; 10 p134] records:

> The Velumnites likewisegrow in these Banks of Clay; some of 'em are twelve Inches long, and tapering towards one end: the Natives call them Bot Stones, because they believe them

to cure the Horses of the Worms which occasion that Distemper, by giving them Water to drink, in which this stone has been steep'd for some hours,

'Velumnites', the item of materia medica identified here, is a spelling variant of 'belemnites'. Belemnites are fossil cephalopods characterised by the possession of an internal calcareous skeleton comprising a conical phragmocone (a chambered portion which housed the mantle) and a relatively long, dense calcite guard (Fig. 3) which acted as a counterbalance to the soft parts of the animal. Being heavily mineralised, the guard is most commonly found as a fossil. The belemnites ranged from Carnian (Late Triassic) to Maastrichtian (latest Cretaceous) times. High fidelity fossils preserving soft parts reveal that the living animal possessed 10 arms (plus an additional two, longer arms in males), all approximately the same length, bearing suckers and hooks. The long spear-, dart- or bullet-shaped morphology of the guard has led to the fossil having a diverse associated folklore [12, 13, 14, 15], including use as a medicinal material [16, 17, 18, 19; 20]; historical therapeutic applications include the treatment of wounds, a variety of urogenital, gynaecological, obstetrical and ocular problems, gout, jaundice, malaria and haemorrhage [18]. The only other recorded veterinary application of which I am aware is made by Robert Plot (1640-1696), first Keeper of the Ashmolean Museum in Oxford, who states that it was used to treat 'Ocular distempers in horses, in all parts of England' [21 p96]. Slightly earlier, the Flemish physician to Rudolph II, Anselm Boetius De Boodt (1550-1632), noted that 'There are those who, in order to extirpate the scars in the eyes of horses, infuse it into the eyes' [22 p237].

Fig. 3. Unidentified belemnite rostrum, Oxford Clay of Bedfordhire, UK. Length = 132 mm. Author's Collection.

Martin [11 p133] makes the comment that 'Banks of Clay on the East Coast' of the island yield *Lapis Ceraunius* or *Cerna Amomis* and the aforementioned belemnites. *Lapis ceraunius* or 'thunderstones', lightning bolts and associated objects hurled from the sky to the earth during thunderstorms, have variously been identified themselves as belemnites, fossil echinoids and prehistoric stone implements (e.g. 23), the latter commonly being the favoured view, actively questioned during the seventeenth and eighteenth centuries [24, 25, 26]. Thunderstones have a long literary history dating back at least to the first century AD and Pliny the Elder's *Naturalis Historia* [27] written around AD 73. According to the Aberdeen Bestiary [Folio 103r], they were believed to protect from lightning strikes, preserve the bearer during storms, provide assistance during battle and ensure restful sleep with sweet dreams. The latter resource

may have been produced in the scriptorium at the Augustinian priory of St Mary, Bridlington (East Riding of Yorkshire). Made around 1200, the Bestiary displays an illustrated style that is closely allied to that of late 12th century documents produced in the Yorkshire and Lincolnshire areas, and the Ashmole Bestiary in particular. Probably produced for a rich ecclesiastical patron, perhaps Abbot Robert de Longchamp (died 1239), the volume is believed to have been used as a teaching aid in a church or monastic setting during medieval times [28].

The *Cerna Amomis* cited by Martin almost certainly refers to fossil ammonites, usually cited at the time as *Cornua Ammonis*. This is borne out by his description of some such specimens – 'the breadth of a Crown-piece bearing an impression resembling the Sun' [11 p133] – which evokes the circular shape of the fossil and the radial ribs common to many species.

These observations are important in that they suggest a potential geological origin for the 'velumnites' cited by Martin; the presence of ammonites and belemnites in the same deposit suggests that an outcrop of Mesozoic (Triassic, Jurassic and Cretaceous) rocks acted as a source of specimens used by the inhabitants of Skye. Geologically, the bulk of the island is taken up by unfossiliferous Pre-Cambrian metamorphic rocks (Lewisian Gneiss, Torridonian Sandstone and Moine Schists), and a complex of Tertiary volcanics (granites, basalts and other igneous rocks). Mesozoic rocks crop out on the eastern side of the island, as recorded by Martin. The outcrop forms a band that stetches from just north of Uig, round the north-east peninsula and down the east coast to a point south of Portree. Further Mesozoic rocks are present between Broadford and Elgol, flanking the central igneous complex forming the Red Hills and Cuillin Hills on the island.

Martin records that the belemnites he had seen in use were at least 12 inches (30 cm) long. This is relatively enormous and suggests that the belemnites in question probably belonged to the genus *Megateuthis*, and possibly the species *Megateuthis gigantea* (formerly *Belemnites giganteus* von Schlotheim 1820) [29], now placed in *Megateuthis suevica* (Klein 1773) [30] by synonymy [31]. Relatively common and geographically widespread, members of the Megateuthidae range from Toarcian to Kimmeridgian rocks (Jurassic), and *M. suevica* is typically found in the Bajocian. A recent study of belemnite rostra belonging to this species suggests that the living animal may have attained lengths of up to 3.1 m [32], with larger rostra measuring up to 51 cm long.

Some of the earliest studies of the geology of the Isle of Skye record '*Belemnites giganteus*' in the Bajocian *humphresianum* zone outcropping near Portree [33 p325]. This suggests that Martin's record was accurate and that suitable belemnites could have been collected for veterinary purposes from the Jurassic rocks exposed along the eastern coast of the island.

Martin indicates that horses suffering from bot fly were given water to drink in which large belemnites had been steeped for several hours. The practise of soaking materials in water and other liquids in order to soften them and so to extract their therapeutic essences and virtues was common in early modern times, although it was usually applied to herbal materials as many instruction books for housewives show [e.g. 34,35]. The soaking of fossils is a rather unusual approach; contrary to soaking

resins, gums and other plant materials, steeping belemnites in water for a few hours would not have resulted in either their dissolution or softening.

Martin provides no indication as to the thinking behind this folk medicine practise. Some clues might be gained from considering the various accounts of the origins of belemnites in written sources and popular belief. Martin does express the idea that the belemnites grew *in situ* within the Jurassic clays, rather than being petrifactions of former life forms. This is an expression of the idea known as *lapides sui generis* ('stones unto themselves') which advocated that fossils were produced by a natural force whose qualities were unknown but which was instituted by God [21]. Perhaps it was this expression of God's provision that accounted for the presence of therapeutic virtues within fossils such as belemnites.

The Doctrine of Signatures was the concept that God had provided all the medicines needed for the health of mankind in the natural world. In addition, He had marked zoological, botanical and geological materials with clear signs as to the therapeutic potential which they contained – special shapes, colours, patterns, smells etc. - which acted as identifiers (to the appropriately educated Magus) for their intended medicinal application. This idea grew in popularity following the work of the German physician, Paracelsus (1493-1541). Oswald Croll (1560-1609), one of Paracelsus' followers stated the philosophy like this:

> 'But the foot-steps of the invisible God in the creatures, the shadow and image of the creator impressed in the creatures, or that internal force, and occult virtue of operation, (which as Natures gift is insited, and infused by the most high God, into the plant or anima, from the signature and mutual analogic sympathy and harmonious concordance of plants, with the members of the human body.' [36 p8].

He uses belemnites as an exemplar of this doctrine in action, referring to them as Lapis lincis or Lynx Stone (believed to have been voided in the urine of the European Lynx):

> 'All things which expel the Stone in the humane Body, are Magically signated from the similitude, and by their resemblances signifie the Disease. The Crystal, Flint, Citrine Stone, Judaick, and Stone of the Lynx: the Urine of the Lynx coagulates into a Stone, therefore its Urine is exceeding profitable to expel Gravel in the Bladder.' [36 p8]

It is difficult, however, to visualise how this might be translated into a treatment for bot fly. As mentioned above, belemnites were also seen as examples of thunderstones, other examples of which were credited with magical powers of protection and healing [24]. Perhaps the harnessing of the majestic power of lightning striking the earth was at play here.

The steeping of fossils to produce therapeutic waters is not a commonly recorded practise; fossils were normally pulverised to a fine powder which could then either be dissolved in vinegar or a similar solvent or blended with other comminuted materials and taken inwardly as a compound mixture in a suitable vehicle or applied topically. However, Martin himself indicates that the Jurassic ammonites collected from the same localities as the belemnites were treated in exactly the same manner as the bel-

emnites. These 'Cramp Stones', as he refers to them, provided a therapeutic water when steeped that could be used to wash any muscles in cows that were subject to cramp [11 p134].

Another, separate example of steeping ammonites, this time for protective rather than therapeutic benefit, occurs in German folklore. The *Milchdracken* or Milk Dragon was reputed to suckle cows, especially those in the barn, and so steal the milk, which it then took to its master. In order to prevent this theft of the farmer's milk, dragonstones or *Trackensteine* were placed in the milk pail. By the principle of sympathetic magic, the dragonstone would keep the dragon away. This particular dragonstone is undoubtedly an ammonite, as it is linked with the *Cornu Hammonis*. George Henning Behrens (1662-1712) described [37 p179] how farmers from Gandersheim in the Harz Mountains used [38 p7]:

> 'a fossile shaped like a Ram's Horn call'd Drake-stone [Dragonstone] …. For when the Cows lose their milk, or void Blood instead of it, they put these Stones into the Milk-pail, and by that means expect a due quantity of Milk from these Cows again.'

The Harz forms part of the enormous outcrop of the German Triassic, and the ammonites identified as Dragonstones likely belong to the Ceratitina, particularly *Ceratites* (*Paraceratites*) *nodosus*, a zonal fossil of the Upper Muschelkalk.

There are, however, some interesting parallels in terms of means of treatment, between the Bot Stones cited by Martin, flint arrowheads and snakestones. The latter, commonly beads of glass or vitreous paste, were said to develop curative powers when soaked in water or milk. Drinking the water in which such objects had been steeped was a means of treating snakebite and stings experienced by domestic animals in Cornwall [39 p186]. The water in which the stone had been soaked might also be used as a drench to wash a snakebite wound in cattle and other animals at various Scottish localities [39 p186]. Similarly, neolithic flint arrowheads, commonly identified as fairy darts or elf arrows and supposed to have been used to cause harm to cattle, are reported as having been added to water in cattle drinking troughs in order to effect a cure in County Kerry (Ireland) [40 p286]. Water in which neolithic flints had been dipped might also be used as a medicinal drench [40 p287].

Thus, it is not entirely clear as to the background philosophy behind using belemnites in this way. Furthermore, the record is something of an outlier in the list of medical uses to which belemnites were put.

List of Illustrations

1. Adult female of *Gasterophilus intestinalis* De Geer, 1776. Photograph by Janet Graham, CC BY 2.0.
2. Fig. 2. Title page of A Description of the Western Islands of Scotland by Martin Martin (second edition, 1716). Archive.org.

3. Fig. 3. Unidentified belemnite rostrum, Oxford Clay of Bedfordhire, UK. Length = 132 mm. Author's Collection.

Acknowledgements

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Rezime

Ovaj rad predstavlja kratak komentar o ranom modernom tretmanu zaraze konja obadom (verovatno *Gasterophilus intestinalis*). Škotski pisac i lekar Martin Martin (oko 1660-1718) beleži seosku gelsku praksu lečenja obolelih životinja upotrebom vode u kojoj su prethodno potopljeni belemniti iz perioda Jure, koji verovatno pripadaju rodu *Megateuthis* i koji su sakupljeni sa bajesijskih stena na istočnim obalama ostrva Skaj. Ovo sredstvo za lečenje je nešto izvanredno u rasponu medicinskih upotreba belemnita, a rezon iza toga nije jasan.

Ključne reči: materia medica, veterinarska medicina, mijazis, Škotska, Ostridae, obad, belemniti, Megateuthis

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