

## REVIEW ARTICLE

# Banishing barberry: The history of *Berberis vulgaris* prevalence and wheat stem rust incidence across Britain

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**Abstract**

Wheat stem rust, caused by the fungus *Puccinia graminis* f. sp. *tritici* (Pgt), is a notoriously damaging disease of wheat and barley. Pgt requires two hosts to complete its lifecycle; undergoing asexual reproduction on cereal crops and completing sexual reproduction on *Berberis* spp. The latter stage of its lifecycle is of particular importance in temperate regions such as western Europe, where asexual urediniospores are unable to survive cold winter weather. In the past, the crucial role of *Berberis* in the lifecycle of stem rust led to intensive eradication campaigns, initially carried out by farmers in the face of hostile scientific opinion. In the United Kingdom, common barberry (*Berberis vulgaris*) is today a relatively rare plant. Stem rust is, however, currently experiencing a resurgence; at the same time, there has been a general increase in the prevalence of barberry and an upsurge in its planting which, in the United Kingdom, is associated with attempts to encourage the endangered barberry carpet moth (*Pareulype berberata*). This article situates current developments within a broader chronological framework, examining changing attitudes towards barberry and rust in England in the past and the history of the plant's use and cultivation. It assesses how widespread *B. vulgaris* really was in the environment historically, and thus the scale of its eradication. We suggest that *Berberis* was never widely established as an archaeophyte in the United Kingdom. Current attempts to re-establish it are based on a misunderstanding of the plant's historical status and could potentially pose a serious threat to food security.

**KEYWORDS**"blight", barberry carpet moth, *Berberis vulgaris*, hedges, orchards, wheat stem rust

## 1 | INTRODUCTION

Wheat stem rust, caused by the fungal pathogen *Puccinia graminis* f. sp. *tritici* (Pgt), is a notoriously damaging disease of wheat and barley (Figure 1). Today, stem rust occurs in most major wheat-growing regions worldwide, and western Europe is currently experiencing a

resurgence in infections after many decades of absence (Lewis *et al.*, 2018; Saunders *et al.*, 2019). Stem rust has threatened crop production throughout history, with the earliest archaeological evidence of its spores having been identified close to the centre of the area where cereal cultivation first began, on Neolithic potsherds from Jarmo, Iraq (Stewart and Robertson, 1968). The historical importance

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**FIGURE 1** Wheat and barley infected with stem rust (*Puccinia graminis* f. sp. *tritici*). (a) Illustration of stem rust telia formation on wheat stems (Vavilov, 1913). (b) Black stem rust telia (left) and orange uredinia (right) were identified on the stem of a barley plant in early August 2019. (c) Erumpent black telia full of teliospores on the stem of a late sown barley plant in the UK (Orton *et al.*, 2019)

of controlling stem rust epidemics is encapsulated in the attempts by the ancient Greeks and Romans to placate the “Apollo of the Rust” Erythibius, and the “rust god” Robigus, respectively; the Romans established the “Robigalia” festival to appease the latter and ward off stem rust infection (Peterson, 2001). Despite the early recognition of stem rust as a significant threat to cereal crops, it was only in the eighteenth century that the *Puccinia* genus was first defined (Micheli, 1729) and more than a century after this that the general link between fungi and disease firmly established (Peterson, 2001). Furthermore, although an empirical connection between stem rust and barberry had been recognized as early as the seventeenth century, the complexities of the stem rust lifecycle continued to perplex farmers, botanists, and mycologists alike until De Bary’s seminal experiments in 1865 finally introduced the concept of heteroecism (De Bary, 1865–1866).

It is now well established that Pgt requires two hosts to complete its lifecycle, undergoing asexual reproduction on cereal crops and completing sexual reproduction on *Berberis* (including a number of species formerly placed in *Mahonia*), where recombination can lead to the emergence of novel genotypes, thereby spawning new Pgt races (Chaves *et al.*, 2008; Olivera *et al.*, 2019). However, in temperate zones such as western Europe, asexual urediniospores



**FIGURE 2** *Berberis vulgaris* is particularly susceptible to stem rust infection. (a, b) Illustrations of *B. vulgaris*, which produces yellow flowers in June and bears bright red drooping clusters of two-seeded berries in autumn. Typical spines that form on the stem and serrated inversely ovate leaves with minute hairs are illustrated (Sowerby, 1829; Pratt, 1855). (c) Yellow-orange aecia structures identified on the abaxial side of *B. vulgaris* leaves, typical of cluster cup rust caused by stem rust

are unable to survive the cold winter weather and are therefore created anew each year within the country or are transported on the wind from regions with milder climates (Zadoks and Bowman, 1985). Hence, the pathogen’s alternate host *Berberis* plays a crucial role as the only source of in-country stem rust inoculum at the beginning of the season (Figure 2). In such temperate regions, the survival of stem rust between crop seasons is reliant on the production of hardy overwintering teliospores that can form on rust-infected plant debris and in the spring germinate, producing basidiospores that can infect *Berberis*. Following sexual recombination, aeciospores are then generated from cluster cups that form on the underside of the *Berberis* leaves and disperse on the wind to continue the infection cycle on cereal crops (Chaves *et al.*, 2008). This crucial role in the stem rust lifecycle led in the past to extensive campaigns to eradicate *Berberis* spp. across many countries in

Europe and North America, some backed up by state legislation (Stakman, 1923).

Although legislation was never introduced in the United Kingdom to enforce the plant's removal, for at least three centuries strenuous attempts have been made to destroy it, particularly when present in hedges (Pollard *et al.*, 1974). These attempts appear, superficially, to have been highly successful. Even in the nineteenth century, some botanists and pathologists believed that barberry was disappearing from the British countryside as a consequence of farmers' actions (Arnold, 1887). In 1923, E. C. Stakman, reporting on a tour of Europe carried out on behalf of the US Agriculture Department, was in no doubt of the scale of eradication, noting "So thoroughly did the English farmer exterminate the destructive barberry that one can drive for miles through the countryside without finding a single bush" (Stakman, 1923, p. 3).

Unfortunately, because stem rust has been in abeyance for many decades, attempts at eradication have come to an end in western Europe, any legislation to restrict the planting of *Berberis* spp. has long since lapsed, and this popular hedgerow shrub is again increasing in prevalence—with clear implications for cereal infections. Since the repeal of the barberry exclusion laws in Sweden in 1994, for example, barberry has become much more common and as a consequence the oat stem rust fungus, which also uses barberry as an alternate host, has significantly increased in its genetic diversity (Berlin *et al.*, 2012), while in some areas a highly diverse sexual population of wheat stem rust has recently emerged (Berlin, 2017). In the United Kingdom, in addition to natural propagation, an upturn in active planting has been led by conservation bodies, keen to encourage habitat for the endangered barberry carpet moth (*Pareulype berberata*), for which *B. vulgaris* is the only currently known food source (Waring, 2004). The story of barberry and its eradication in England has therefore taken on a new relevance. Although the role of *Berberis* spp., and in Britain specifically common barberry (*Berberis vulgaris*), in the Pgt lifecycle is now accepted and understood, little has been written on attitudes towards the plant in England in the past. Nor has there been any investigation of the scale and chronology of its eradication. This article briefly discusses changing attitudes to barberry and rust in England, and the history of the plant's use and cultivation. It then attempts to assess how widespread it may have been in the environment in the past, and thus the scale of its eradication.

## 2 | BARBERRY AND BLACK RUST (STEM RUST)

The belief that barberry in hedges caused black rust or "blight" in the adjacent wheat crop was already widespread among farmers, but treated with caution or scepticism by agricultural writers, by the early eighteenth century. In his *Timber Trees Improved* of 1741, William Ellis reported that barberry:

Has an ill name in this country for attracting Blights to the corn that grows near it; insomuch, that an ignorant,

malicious, farmer of Gaddesden [Hertfordshire], about the year 1720, conceived such a hatred against a large one, that grew in his neighbours ground, very near his, that, for this very reason, he poured several pails of scalding water on its roots, in the night-season, at different times, 'till he killed it. Were there, indeed, many trees that stood close together, its possible that they might contribute to such a misfortune; but, in my humble opinion, one can be of no effect; however, most of our Countrymen affirm its damage. (Ellis, 1741, p. 157)

In 1766 anonymous authors reported the "foolish superstition" that had "for many ages prevailed among the farmers in many parts of England, namely, that a field of corn will always be blasted, if a barberry-shrub grows in any of the hedges that surround it" (*The Compleat Farmer or a General Dictionary of Husbandry in All its Branches*, 1766, "Barberry" definition). They believed that "these ridiculous notions are now pretty well banished from the generality of our husbandmen, and it is to be hoped that the rest will follow their example". The optimism was misplaced. In 1779 the "foolish superstition" was still reported (*The General Dictionary of Husbandry, Planting and Gardening*, 1779), and into the nineteenth century many writers continued to ridicule the idea. One contributor to the *Farmers Magazine* for 1803 reported how:

It has been said that wheat will not thrive within I don't know how many hundred yards of barberry, and nothing more ridiculous could possibly have been said, for I can aver, for one, that I have repeatedly seen as fine wheat as ever grew, in a field enclosed on all sides with a barberry hedge, in a wild, unclipt, shrubby state; and which produced flowers and fruits in abundance. (Answers to Queries on Vegetation, 1803, p. 46)

This was a common objection to the theory: while stem rust in wheat could be found beside barberry bushes, the association was by no means universal, a reflection of the fact that, as noted earlier, the spores of the fungus can also be spread over quite considerable distance by wind, and can thus infect the wheat crop even in the absence of the barberry host. Educated writers in the seventeenth and eighteenth centuries suggested various alternative explanations for the incidence of "blight". Samuel Hartlib thought that it was caused by environmental factors—by high hedges around fields or by hollows in the ground, which made for stagnant air; that it came from the atmosphere; or that it was a disease carried on the straw of poorly rotted manure (Hartlib, 1655). This follows the concept of spontaneous generation that prevailed in scientific literature until the mid-nineteenth century (Peterson, 2001). Similar ideas were repeated by other writers, including Hale (Hale, 1756).

By the start of the nineteenth century, however, attitudes were changing, to judge from the *General Views*—county summaries of the state of farming in Britain, sponsored by the Board of Agriculture,

and which often include comments from or correspondence by working farmers. Some of the authors of particular volumes continued to be hostile to the idea that *Berberis* was in any way implicated in attacks of "blight". Walter Davies, who authored the volume for North Wales in 1810, thought that "The venom of the fabulous Bohon-upas tree of Java could scarcely be equal to the effects attributed to this apparently harmless shrub" (Davies, 1810, p. 190). William Stevenson similarly struck a sceptical note in his *General View for Dorset* in 1812 (Stevenson, 1812). And while most farmers continued to blame barberry for rust eradication, exceptions were reported. In Bedfordshire the idea was "treated with ridicule" by some, who continued to attribute the disease to high hedges and poor circulation of the air (Batchelor, 1808, p. 377), while many in Devon considered "smutty straw, or smutty dung in a fresh state" to be the prime culprit (Vancouver, 1808, p. 434). However, William Pitt, in the volume for Staffordshire published in 1796, simply reported the belief without comment (Pitt, 1796), as did Arthur Young in his *General View of the Agriculture of the County of Lincoln* (1799); while William Gooch, in his volume for Cambridgeshire, listed a number of convincing cases where wheat sown near barberry bushes had been very seriously affected by blight (Gooch, 1811), and Thomas Batchelor, for similar reasons, accepted it as a major if not only cause in 1808 (Batchelor, 1808). Mavor, in the Berkshire volume of 1813, was likewise convinced and recommended that the plant "be removed from the hedges of corn fields" (Mavor, 1813, p. 366), and Holland in the Cheshire report recounted his recent conversion to the idea (Holland, 1808).

Some scepticism about the role of barberry in attacks of "blight" continued to be expressed well into the nineteenth century (Woodville, 1832). But for the most part, a causal relationship was gradually accepted by agricultural commentators, in large measure as a consequence of scientific research. At the start of the century, following lengthy investigations, the noted botanist Joseph Banks was able to declare "Is it not more than possible that the parasitic fungus of barberry and that of wheat are one and the same species, and that the seed is transferred from the barberry to the corn?" (Banks, 1806, p. 12). In France in 1869, cultivators complained about long hedges of barberry that had been planted along the Paris to Lyon Railway in Cote d'Or and some sections were removed by way of experiment; the railway company concluded that barberry was, indeed, associated with rust in the adjacent fields (Rivet, 1869). Research by de Bary in Germany, Oersted in Denmark, Tulasne in France and Plowright in England all elucidated the role of barberry in the lifecycle of *Puccinia*, while allowing that infection could occur in its absence (De Bary, 1865–1866; Plowright, 1882).

In the first half of the twentieth century, agricultural textbooks published in England, such as *Fream's Elements of Agriculture*, continued to note the role of barberry and to recommend its eradication (Robinson, 1949). However, they now generally referred to stem rust as something that afflicted foreign countries. Biffen and Engledow's *Wheat Breeding Investigations at the Plant Breeding Institute, Cambridge* of 1926 similarly described how "there is no pest the foreign wheat grower dreads more, but here we carry on without

paying much attention to it. It can be found somewhat sparsely every season, but infection never appears to take place sufficiently early to damage the plant much" (Biffen and Engledow, 1926, p. 74). It seems likely that the decline in infections in Britain was related, at least in part, to the progress of eradication, but this in turn had the result that, in some circles, barberry's involvement in rust began to be forgotten or even doubted. Biffen and Engledow actually make no reference at all to the plant, and, in 1956, the Ministry of Agriculture's Plant Pathology department thought that there was still some slight doubt about its role (The National Archives/Public Record Office Ministry of Agriculture and Fisheries (TNA/PRO MAF)/190/200). Nevertheless, for the most part the matter was settled and, following an upsurge in the incidence of rust in the 1950s, Ministry of Agriculture officials were keen to locate any remaining specimens of the plant, and discussed the possibility of enlisting the aid of local botanical and natural history societies, or of the Botanical Society of the British Isles in such a task (TNA/PRO MAF/190/200). Much research through the 1940s, 1950s, and 1960s was focused on the development of resistant wheat varieties, chemical treatments, and crop management as ways of dealing with the disease. Only recently has there been a new emphasis on barberry, precipitated by the renewed emphasis following emergence of the infamous Ug99 race in Africa (Singh *et al.*, 2011) and, more recently, its potential re-emergence across western Europe (Saunders *et al.*, 2019).

The story of barberry and black rust in England, briefly outlined above, is interesting for a number of reasons, not least as a classic example of the clash between beliefs based on practical working experience and close observation in the field, and those of "scientific" commentators focused on the use of experimental data to identify causal mechanism. It also demonstrates, perhaps, the shortness of scientific memory. Both have parallels elsewhere: the former in nineteenth century Denmark, for example, the latter in early twentieth century America (Stakman, 1923). However, it also raises questions about barberry itself, and, more specifically, about how common it ever was in the countryside before the attempts at eradication. Insofar as this issue is ever addressed, it is implied that the plant was once frequent and widespread, and that the scale of its eradication was thus significant; but close examination of the historical evidence suggests a more nuanced picture.

### 3 | BARBERRY IN ORCHARDS AND GARDENS

There is general agreement that *B. vulgaris* is native to the Middle East, and possibly to parts of eastern and central Europe, but not to the United Kingdom, where it has the status of archaeophyte (Botanical Society of Britain and Ireland [BSBI] Species Accounts Archive). This status has long been recognized: in the words of Nathaniel Winch in 1819, "The barberry and gooseberry, though now of frequent occurrence, I suspect were not originally natives of the soil" (Winch, 1819, p. 13). *Berberis* may, like a number of other species, have been introduced during the later Middle Ages, but hard

evidence is currently lacking. What does seem clear is that it was initially a plant of gardens and orchards. In gardens it was valued for the appearance of its flowers and berries, but also as a hedging plant, the two uses to an extent in conflict; as the forester Moses Cook described in 1676, a well-maintained barberry hedge produces fewer berries, “the better they are kept, I mean the handsomer, the worse they will bear” (Cook, 1676, p. 97). Nursery advertisements from the eighteenth century often imply that the plant was mainly used for garden hedges but either way, the plant was a common feature of gardens both great and small throughout the seventeenth and eighteenth century (Bradley, 1718). Barberry was not, however, only an ornamental plant. It was also valued for its range of practical uses.

First, although John Parkinson in 1629 thought that the berries had “a sharpe sowre taste, fit to set their teeth on edge that eate them” (Parkinson, 1629, unpaginated), barberries were widely used as an ingredient in both sweet and savoury dishes. As William Ellis observed in 1741, the “pretty red berries ... are not only ornamental on the tree, but ... after pickling, and being kept in glasses, are ready to be the same for gracing the sides of dishes of meat, and giving a pleasant tart taste to sauces, and to conserves” (Ellis, 1741, p. 57). John Murrell in his *A Daily Exercise for Ladies and Gentlewomen* of 1617, gave detailed instructions for making barberry preserve (Murrell, 1617), and the berries were widely recommended as an ingredient in sauce for chicken (The Good Hous-Wives Treasurie, 1588), goose and stewed lamb's head (Markham, 1615), duck, pigeons and plover (Kent, 1653); as well as in making malt vinegar (Markham, 1615). The leaves could also be used as a substitute for sorrel (Parkinson, 1629). All these uses are widely reported in seventeenth-century cookery books (Bright, 1580; May, 1610; Cooper, 1654) and in those published throughout the eighteenth century, although with an increasing emphasis on sweets and pastries rather than savoury dishes (Glasse, 1774; Price, 1780). Frederick Nutt's *Compleat Confectioner* of 1790 thus provided instructions on how to make barberry jam, barberry ice cream, barberry biscuits, and barberry wafers (Nutt, 1790). As late as 1848 an article in the *Kentish Independent* entitled “Garden operations for October”, included the instruction to “Gather ripe barberries, quinces and medlars, the former for preserving, the latter two for storing ...”.

In addition to this, barberry was considered to have a range of medicinal uses, and, even today, the berries, leaves, stem, and roots from various species are still used in traditional Chinese medicine to treat an array of ailments (Sarraf *et al.*, 2019). Thus, Parkinson described how “The berries are preserved and conserved to give to sicke bodies, to help to coole any heate in the stomach or mouth, and quicken the appetite” (Parkinson, 1629, unpaginated). The berries, or the juice extracted from them, were considered particularly efficacious in reducing fevers but they also had a range of other supposed benefits, including an ability to kill intestinal worms and treat liver complaints (Cote, 1640). Such uses were described throughout the seventeenth century in texts like Thomas Vicary's *The English-Man's Treasure* (1641), Elizabeth Cray Kent's *A Choice Manual of Rare and Select Secrets in Physick and Chirurgery* (1653), and Nicholas Culpepper's *School of Physick* (1659). Again, they continued to be

propagated right through the eighteenth century, although with a growing emphasis on barberry's role as a wholesome addition to the diet of an invalid, encouraging recovery (Smythson, 1785).

Barberry was thus a plant much valued for both culinary and medicinal properties, and newspaper advertisements show that it was sold by most commercial nurseries in the eighteenth century. In March 1774, for example, the *Newcastle Chronicle* listed “barberrys” amongst the plants for sale at a Hexham nursery; in 1768 it was amongst those which the *Manchester Mercury* announced were being sold by the nurseryman Robert Turner; and it was advertised in the catalogue of John Mackie of Norwich in 1790. Moreover, being a practical plant, albeit one also valued for its appearance, it was perhaps even more closely associated with orchards than with gardens. Joseph Worlidge in 1675 simply stated that “The barberry is a common plant in orchards, and bears a fruit very useful in housewifery” (Worlidge, 1675, p. 103); while William Lawson, in his *New Orchard and Garden* of 1618 described how an orchard should have “borders on every side hanging and droopy with Feberries [gooseberries], Raspberries, Barberries, Currans” (Lawson, 1618, p. 71). Many subsequent writers, such as Richard Weston in 1773, recommended planting barberry as part of an orchard (Weston, 1773). In 1734, when Mary Birkhead designed a new orchard for her daughter at Thwaite in Norfolk, she included a perimeter hedge of filberts, plums, quinces, and barberries (Norfolk Record Office BRA 926 122).

Parkinson (1629) described three types of barberry: the common small variety; a larger variant; and ones that were stoneless. Joseph Worlidge in his *Vinetum Britannicum* of 1676 similarly distinguishes three types (Worlidge, 1676); but Batty Langley in 1728 thought there were two kinds, “the one with stones, the other without stones; which last is esteem'd the best” (Langley, 1728, p. 91). The presence of a larger type, and of one that was stoneless, perhaps suggests that a measure of selective breeding had been taking place in the relatively few commercial nurseries that existed in the sixteenth and seventeenth centuries, mostly based in the London area. In this context, it is noteworthy that John Gerard writing in 1597, emphasized that both were found “in our London gardens” (Gerard, 1597, p. 1144).

The popularity of barberry as a garden plant seems to have declined in the second half of the nineteenth century, and Hogg in 1884 reported how it was “found wild in hedgerows, and is also *sometimes* [emphasis added] grown in shrubberies, both as an ornamental plant, and for its fruit” (Hogg, 1884, p. 44). However, it continued to feature in nursery catalogues well into the twentieth century, both as a hedging plant—as late as 1936, in that produced by Rivers of Sawbridgeworth—and for its culinary uses.

#### 4 | BARBERRY IN HEDGES AND GAME COVERTS

Barberry was, therefore, widely planted, probably from the later Middle Ages, as an ornamental, culinary, and medicinal plant, in gardens and especially orchards. Its presence in the wider

countryside was in part the result of natural spread from such locations, through suckering and the movement of seeds by birds, and seventeenth- and eighteenth-century botanists drew attention to its continued association with settlements. Robert Turner (1664, p. 25) suggested that barberry “groweth plentifully in Gardens, Orchards, and Closes near dwelling houses, where it hath been planted”, but he added “it hath been also found wilde in hedgerows, but I believe some Ditcher planted it there to mend his hedges instead of Thorns”; this introduces a second way in which it spread into the wider countryside.

In the sixteenth, seventeenth, and eighteenth centuries hawthorn and blackthorn were the preferred hedging plants in England, although most agricultural hedges also seem to have been planted with additional species, especially ash, maple, and hazel. This was because hedges, as well as serving as a barrier to livestock, were also regarded as a source of domestic fuel (Barnes and Williamson, 2006). However, from the mid-eighteenth century, as coal came into wider use in rural areas and the development of provincial nurseries made it easier to obtain hedging plants, single-species planting—usually of hawthorn, or planting with a mixture of hawthorn and blackthorn—became normal. Individual landowners—under pressure from the commercial nurseries—also sometimes planted hedges with other species, alone or in combination with these. In East Anglia, for example, much of the land enclosed in the arid, sandy Breckland in the early nineteenth century was bounded by hedges of Scots pine (*Pinus sylvestris*; Barnes and Williamson, 2006). The Duke of Argyll's tea plant (*Lycium barbarum*), a species introduced to Britain in the eighteenth century, was also sporadically employed, although more for gapping-up existing hedges than for planting new ones (Barnes and Williamson, 2006). With its sharp thorns, the plant is well suited for hedging, while its purple flowers have an obvious aesthetic appeal.

Barberry, with its sharp thorns and attractive berries, was probably used in a similar way to gap-up existing hedges, and only sporadically, perhaps usually in combination with other species of thorn, to plant new ones. As early as 1712, the *Dictionarum Rusticum, Urbanicum and Botanicum* suggested that barberry “might be now and then inserted among our hedges”, the wording implying that this was not common practice (*Dictionarum Rusticum, Urbanicum and Botanicum*, 1712, unpaginated). Harte (1764) recommended its use as a hedging plant, but again in terms which suggest that the notion was a novel one, while one correspondent to *The Farmer's Magazine* (Volume 3, p. 175) in 1802 described barberry as “so useful a plant in filling up gaps in thorn hedges, and even in making a tolerable fence where thorns will hardly thrive”. However, its use was presumably limited, in arable areas at least, by its observed association with rust. In 1781, the *Bath Chronicle and Weekly Gazette* (p. 1) reported that the local agricultural society had been urged by one member to “offer premiums for raising and planting the barberry shrub in quick hedges”, but that “as this shrub is supposed to have a bad effect on corn crops, especially wheat...”, the society was unable to oblige. It had other shortcomings: James Brown commented in 1847, that barberry was “very apt to die under severe pruning, as is indispensable in hedge culture” so that it “does not generally answer well” (Brown, 1847, p. 76).

There was another reason why *Berberis* was deliberately planted in the wider countryside: as game cover in woods and plantations. Maxwell (1913) recommended its use both as an evergreen under-cover and as a hedge around coverts. As late as 1986, Gray could describe how barberry “is useful in a defensive hedge or as individual plants in a covert” (Gray, 1986, p. 159). Its employment in these ways starkly reflects the fact that large landowners had less concerns than their agricultural tenants about possible episodes of rust, but also perhaps a declining concern about its role as the frequency and severity of “blights” declined from the mid-nineteenth century.

## 5 | THE DISPERSAL OF BARBERRY

Quite how far and how fast barberry spread into the landscape through deliberate planting, and suckering or dispersal from gardens and orchards, is unclear and probably varied across the country. On the one hand, some descriptions and casual comments suggest a continued association with settlements, gardens, and orchards right through to the nineteenth century. Thus, John Baker (1839, p. 595) recalled how, in his childhood, his father had shown him a field of wheat blighted by stem rust with “a large barberry bush on one of the hedges, *near to a garden* [emphasis added], and directly opposite to the portion of the field that was diseased”. Most of the specimens described by Briggs and Archer in the Plymouth area as late as 1880 seem to have been close to orchards or houses:

On a hedge-bank, close to a garden plot, Forder, St Stephen. Hedge near Moditon Mill, for about 4 yards, near an orchard. Two bushes near a hedge by an orchard at Leigh. Hedge close to a ruinous house, Shevioc ... A bush in a hedgerow by the path to Warleigh House. A bush by a hedgerow by a garden at Honieknowle. Hedgerow close to an orchard, Milton, Buckland.... Hedge at Colebrook village, doubtless planted ... Many bushes in a hedge by an orchard at Spiddleston. (Briggs, 1880, p. 12)

On the other hand, there were clearly pockets of countryside where barberry had been widely adopted as a hedging plant. Gerard, as early as 1597, described how “The barberry bush grows of itself in un toiled and desart grounds, in woods and the borders of fields”, but continued “Especially a wood around a gentleman's house called Mr Menke, at a village called Iver two miles from Colebrooke, where most of the hedges are nothing else but barberry bushes” (Gerard, 1597, pp. 1144–1145). Much later, Joseph Banks drew attention to “The village of Rollesby in Norfolk, where barberries abound and wheat seldom succeeds ... called by the opprobrious appellation of Mildew Rollesby” (Banks, 1806, p. 402). John Baker in 1839 also discussed this example, and in addition described how he had, in 1812:

Bought an estate at Hockwold, in Norfolk, between 200 and 300 acres of which was so subject to mildew

when wheat was sown that this crop was very seldom ventured on. The hedges were some of them entirely composed of barberry-bushes: others had a mixture of them with other plants. I threw down the hedges where it abounded, and took it out of those where there was a less quantity. (Baker, 1839, p. 596)

It is, in fact, difficult to know how widespread barberry became in any area before the twentieth century because of the poor or elastic definition of terms employed by early writers, and their tendency to generalize from local experience. Barberry might have been common to the area in which the writer lived, but less so elsewhere; in addition, it might be considered “common” to a locality even if only found in close proximity to settlements. Thus, we need to be cautious about how we interpret suggestions that it was found “wild in many of our woods and hedges...” (Mawe and Abercrombie, 1778, unpaginated); was of frequent occurrence in England; or that it was not uncommon (Winch, 1819; Hooker, 1878). It is true that Watson in 1883 recorded its presence in every English county except Cumberland, Northamptonshire, and Lincolnshire (Watson, 1883), but its frequency evidently varied. It was thought common in Middlesex in 1869 (Trimmen and Dyer, 1869); common in Oxfordshire in 1833 (Walker, 1833), and frequent around Liverpool in 1830 (Hall, 1830), as it was in the London area in 1877 (de Crespigny, 1877), and in Suffolk in 1860 (Henslow, 1860). In contrast, in Sussex in 1887 it was described as rare, and doubtfully wild (Arnold, 1887), while in Hertfordshire in 1849 it was thought rather rare (Webb and Coleman, 1849), as it was in 1887 (Pryor, 1887). In the Malvern Hills it was thought of rare occurrence in 1852 (Lees, 1852); it was not common in Dorset in 1874 (Mansel-Playdell, 1874); rather rare in Herefordshire in 1889 (Ley and Purchas, 1889); rare in the Midlands in 1817 (Purton, 1817); found occasionally in hedges around Berwick upon Tweed in 1831 (Johnston, 1831); and found in hedges occasionally, and thought hardly wild, in Devon in 1829 (Jones and Kingston, 1829). Many botanists added observations that particular specimens had been doubtless planted in a hedge, or had probably escaped from gardens (Luxford, 1838; Salmon, 1863). The only examples recorded in the Tunbridge Wells area in 1845 were considered by Jenner to have been probably planted (Jenner, 1845); Swete in 1854 considered barberry naturalized in hedges and plantations in the Bristol area (Swete, 1854).

Interpreting such judgements is rendered more difficult by the effects of the widespread attempts at eradication, and several early writers thought its rarity was the consequence of farmers' actions. In Sussex in 1887, barberry was said to have been “formerly abundant ... but is now being generally cut down in or near fields, owing to the well-established fact that the cluster cups of the barberry are productive of mildew in corn growing near them” (Arnold, 1887, p. 5). Gibson recorded it in only eight locations in Essex in 1862, but thought that this was because it was being “extirpated in many places in consequence of the current opinion that it produces blight in the wheat crop” (Gibson, 1862). However, botanists occasionally qualified this suggestion. In Hertfordshire in 1849, and again in 1887, it was said that the rarity of barberry was perhaps the result of farmers' antagonism (Webb and Coleman, 1849; Pryor, 1887).

It is useful to compare these observations with the current distribution of *Berberis* in the landscape. A sample of 176 records relating to eastern England (Cambridgeshire, Essex, Hertfordshire, Norfolk, and Suffolk), taken from information held by the BSBI and local recording groups, was analysed. Around a third of the places where the plant was noted were away from farms and villages, mainly in hedges that appear to have been planted since c. 1750. However, 23% were within, or close to (within 200 m of) nineteenth or early twentieth century estate plantations or game coverts; roughly the same proportion were from near houses and gardens; while no less than 19% were within 100 m of orchards recorded on mid-twentieth century Ordnance Survey maps. A number were close to former commercial nurseries, including two within 100 m of the site of Balshaw's Nursery, Berkhamsted, Hertfordshire; one within 100 m of the Vineyard Nursery at Bracon Ash in Norfolk; and one within 170 m of the major early twentieth-century nursery at Broxbourne in Hertfordshire. The fact that the only records from Epping Forest come from within 300 m of the former Loughton Nursery may also be significant. Not too much can be made of this analysis, not least because of the lack of precise grid references for many of the records, but it is at least suggestive.

On balance, it seems likely that barberry was always—outside a few limited areas where it had been employed on a significant scale as a hedging plant—relatively rare in the countryside, and mainly found close to settlements, plantations, and orchards. Indeed, if it had once been widespread in woods and hedges then we might expect to find more evidence of systematic eradication rather than piecemeal removal. In America, as early 1726, legislation was passed in Connecticut to allow the destruction of the plant on private property, followed by similar acts in Massachusetts in 1754 and on Rhode Island in 1766 (Davis, 1907). In England, there is no record of corporate or collective action at national, county, or even parish level. Indeed, while many of the *General Views* published around 1800 discuss the relationship of rust and barberry, as we have seen, the majority—even of those dealing with mainly arable counties—conspicuously fail to do so. Even in the twentieth century, there was no state-directed policy of barberry eradication in England. Particularly striking is the fact that the removal of the shrub does not appear to be referred to in farmers' diaries and journals from the eighteenth and nineteenth centuries, even those of diligent arable farmers in the east, including those kept by Randall Burroughes of Wymondham in Norfolk in the years 1794–1798 (Wade Martins and Williamson, 1995), by William Goodwin of Earl Soham in Suffolk in the 1780s (Suffolk Record Office, Ipswich, HD 565/1), by Richard Girling of Kessingland in Suffolk in the 1830s (Suffolk Record Office, Ipswich, JA/159), or by William Wilshere of Hitchin in Hertfordshire in the early nineteenth century (Hertfordshire Archives and Local Studies 60105). The autobiography of Thomas Starling Norgate, who farmed at Hethersett in Norfolk in the early nineteenth century, refers to the recent research by Sir Joseph Banks into barberry and mildew but gives no indication that he, himself, was actively involved in eradicating the plant (Norfolk Record Office MC 175/3).

## 6 | CONCLUSION

The suggestion that *B. vulgaris* was always closely tied to human activity in England, and almost certainly in Britain more widely, and was never widely naturalized, has a contemporary relevance at a time when new virulent races of stem rust pose a threat to food security, and western Europe is under threat from the re-emergence of this previously vanquished foe. If barberry had become widely naturalized before attempts were made to eradicate it, then it might be possible to support a measure of deliberate planting in selected areas in order to sustain populations of the endangered barberry carpet moth (*P. berberata*). However, if neither moth nor plant ever became a significant part of our indigenous wildlife, such attempts become harder to justify. As we look forward, with the vast majority of our current wheat varieties appearing susceptible to stem rust infection (Lewis *et al.*, 2018), the pathogen's re-establishment in the United Kingdom could have very serious consequences for wheat production. As Biffen and Engledow noted: During the Napoleonic wars in the early years of the 19th century, the country could easily have fed itself from the great area then under wheat, had it not been for severe outbreaks of black rust which forced it to import grain at famine prices. There is no reason for considering such outbreaks to be impossible in the future; on the contrary, they are to be expected. (Biffen and Engledow, 1926, p. 74) Crop protection strategies should take heed of the actions of our predecessors, who constrained in-country disease inoculum by removing barberry from close proximity to cereal fields, and prevent barberry from once again acting as an emanating source of infection to blight English wheat fields.

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### CONFLICT OF INTEREST

The authors declare that they have no competing interests.

### DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analysed in this study.

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