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REMEMBERING DARNEL, A FORGOTTEN PLANT OF LITERARY, RELIGIOUS, AND EVOLUTIONARY SIGNIFICANCE

Howard Thomas^{1*}, Jayne Elisabeth Archer², and Richard Marggraf Turley³

*This paper explores the complex interactions between people and the psychotoxic crop contaminant and wheat mimicker darnel (*Lolium temulentum*). Bringing together knowledge from literary, historical, religious, medical, and scientific sources, we trace the ways in which the plant's cultural story has been informed by its cultivation (accidental and otherwise) by humans. Darnel is a man-made plant that evolved from a perennial progenitor and was subject to the same human-mediated selection pressures as the ancestral cereal species it infested. The toxicity of darnel grains is due to a cocktail of phytochemicals secreted by genetically complex endophytic fungi of the genus *Epichloë*, closely related to ergot (*Claviceps purpurea*). We show how darnel's reputation as a poisonous cereal mimic that corrupts the food-chain made the plant a symbol of malign subversion, notably invoked in crises around religious heterodoxy and political subversion. We consider the ways in which literary allusions, from Shakespeare to Dickens, identified the corrupting influence of darnel with psychological and social breakdown. Darnel is classified as extinct in the United Kingdom and other developed countries with intensive agriculture, and its significance as a food chain contaminant and literary and religious symbol is vanishing from experience and understanding. This paper, then, is intended to serve as a textual seed bank to collect darnel's cultural traces, and to demonstrate the ways in which the plant has annotated key debates and moments of crisis in human history.*

Keywords: *Lolium, darnel, wheat, toxin, madness*

Introduction: Darnel-Human Engagements over Time

Je hais les crimes de la génération nouvelle: ils sont ingrats et stériles comme de l'ivraie

(How I hate the crimes of the new generation: they are dry and sterile as darnel)

Jean-Paul Sartre *Les Mouches* (Sartre 1963:85)

Darnel (Figure 1) is a member of the ryegrass (*Lolium*) family. Throughout history, it has had the reputation of being one of the few poisonous grasses, and the psychotoxic symptoms of ingestion—usually via bread or ale in humans—are reflected in its species name, *Lolium temulentum* (“*temulentus*” is Latin for drunk or intoxicated). Darnel is a mimic weed of cereal crops and is almost entirely reliant on human agency for its propagation and continued existence (Tominaga and Yamasue 2004). Modern methods of intensive crop production have virtually

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Figure 1. *Lolium temulentum*.

Illustration from Britton and Brown (1913:i 282), available online at USDA, NRCS. 2014. The PLANTS Database [website]. <http://plants.usda.gov>. Accessed 10/02/2015. National Plant Data Team, Greensboro, NC 27401-4901 USA.

eliminated darnel from the United Kingdom and Europe, where it is classed as rare or extirpated. It remains, however, a serious pest in the developing countries of the Middle East and Africa (Holm et al. 1977; Thomas et al. 2011).

Darnel represents a unique case-study in the rise and fall of a plant-human relationship founded on a record of coexistence in changing cultures throughout recorded time. The connection between darnel and humans has a long history, reaching back to the dawn of farming and the birth of agricultural civilizations. Over the millennia, since the earliest encounters between people and the plant, the influence and socio-cultural significations of darnel have developed—sometimes, but not always, in response to its impact on food security. In this paper, we trace this story from the abundance of archeological, historical, religious, literary, pharmacological, and agricultural records in which darnel features. In particular, we examine the ways in which darnel's complex role in human civilization was translated into metaphor, as classical and biblical constructions of the plant were deployed to articulate contrasting responses to ideological and socio-economic conformity and dissent.

The history of darnel, traced through its biochemistry alongside its representation in historical and cultural records, illustrates the way in which human-plant

relationships are formed through the agency both of humans and of plants. Moreover, it provides insights into how human perceptions of darnel's agency have changed in accordance with socio-economic conditions as well as discoveries in plant science. Agency is not solely a human characteristic. The pre-industrial world, in which darnel was characterized as typically, although not exclusively, a "malign" influence, was alert to this fact. The perceived "malignity" of darnel testifies to its success. When it comes to fitness and survival, there is always agency. Crop plants have been selected to minimize antinutritional and antibiotic defenses; they cannot survive without human intervention (which includes both cultivation and adding back defense chemicals in the form of pesticides). Humans have exploited cereals, including darnel; in turn, darnel has exploited humans and cereals. This mutualistic agency and exploitation is at the heart of darnel's significance to human life and thought.

Archaeological Origins and Phytochemical Properties of Darnel

Botanical Characteristics, Evolution, and Domestication of Darnel

Darnel's nearest taxonomic relatives, with which it can form interspecific hybrids, include the outbreeding, perennial *Lolium* species *L. perenne* and *L. multiflorum*. Unlike these grasses, darnel is strikingly cereal-like in form and life-cycle. It is a fast-growing self-fertile annual with hypertrophied grains and foliage, non-shattering heads, and a high harvest-index. These traits collectively represent the so-called domestication syndrome that also distinguishes wheat, barley, and other graminaceous grain crops from their wild progenitors (Allaby et al. 2008; Evans 1993). By co-selection with the crops it infests, the ancestor of darnel (probably an invasive *L. multiflorum*-like perennial) has been converted into a cereal analogue. DNA analyses of taxonomic relationships within the wild and cultivated grasses, together with archaeological and anthropological reconstructions of the diffusion of agriculture, provide evidence that darnel originated at least 10,000 years ago in the genus *Lolium*'s center of diversity. Co-evolving with wheat in the Fertile Crescent, it then radiated outward following the spread of cereal cultivation (Pinhasi et al. 2005; Thomas et al. 2011).

Darnel, then, is a human-made plant. From the perspective of humans throughout history, it is wheat's malign twin. Its anthropophytic origin is illustrated by the nature of its mimicry. For example, the grains of some genotypes of darnel have awns (slender, bristle-like appendages that extend from the spikelets of grasses), whereas those of others are awnless. Genetic analysis shows that the awnless genotype is a loss-of-function derivative of awned. The awned trait closely simulates the morphology of emmer wheat grains, whereas darnel types that lack an awn are associated with free-threshing wheat. The processes of cultivating and threshing wheat and barley crops of diverse morphologies exert selection pressures that favor propagation of one or other form through granaries and fields (Senda and Tominaga 2003).

Darnel's close physical and agronomic resemblance to its host crop, together with its cryptic corruption of the food chain, has led to the weed developing

a sinister and subversive reputation. It has been a trope for evil and sedition throughout literary history, and in particular has been used to identify and vilify heterodoxy and heresy (Archer et al. 2014). With distinct roles in classical and Christian traditions, darnel has been used to figure both religious dissent (and scapegoating) and political sedition. For example, the conspirators in the Gunpowder Plot of 1605, who sought to reinstate Roman Catholicism in the Protestant England of King James I, were accused of sowing “Popish Darnell” (Gamage 1613:signs A7r-A7v). The message did not escape those unable to read: in one of a handful of visual representations of darnel outside of herbals during the early modern period, Gamage’s poetic allusion to “Popish Darnell” is accompanied by an image depicting the plant burning in place of the martyr at the stake.

Darnel in Ancient Cultures

Darnel was a pernicious weed of crops before agricultural intensification in the developed world. *L. temulentum* kernels have been identified in charred cereal assemblages at archaeological sites in Cyprus (dated to 8,700–6,200 BCE; Wilcox 2001), Jordan (6,200–5,000 BCE; Neef 2001), Egypt, and Italy (5,000–3,000 BCE; Costantini 2002; Fahmy 2003; van Zeist and de Roller 2003). A recent study reports identifiable residues of *L. temulentum* and *L. multiflorum* among a collection of “proto-weeds” and wild cereal ancestors from Ohalo II, a 23,000 year old hunter-gatherer site on the Sea of Galilee (Snir et al. 2015). Accounts of darnel’s medicinal and botanical properties occur in European herbals and *materia medica* throughout antiquity (Dioscorides; Theophrastus; and Galen) and, via Islamic medicine, into the Middle Ages (*Tractatus de herbis* c. 1280-1310:fol. 55v). From the latter period, analyses of the species composition of plant remains from thatch in England have identified the presence of darnel (Letts et al. 2000:1, 39–41). Herbals and recipe books from the early modern period indicate that the plant continued to be a familiar sight in Europe well into the eighteenth and early-mid nineteenth centuries (Dodoens 1595; Gerard 1597:72; Robinson 1870:92).

All of the textual sources mentioned above identify darnel’s defining characteristic as being its toxicity. Darnel poisoning belongs to a family of chronic diseases called *Raphania* (originally defined by Linnaeus), caused by ingestion of the toxic seeds of wild plants (Hartmann 1849:iv 153). When darnel enters the food chain, most often in bread or ale, symptoms of its consumption include visual impairment, disorientation, headaches, and even (at high concentrations) hallucinations and loss of consciousness. These and similar effects have been recorded throughout history, in literary as well as medical texts (Betts 1968; King 1968). Writing in the first century CE, Ovid alludes to “eye-blighting darnel,” and a character in *Miles Gloriosus* by Plautus (c. 254–184 BCE) asks: “Why do you eat so much darnel? ... it’s bad for the eyes” (Ovid 2000; Plautus 1965:321–323). Into the early modern period, John Gerard, in his *Herball*, notes that darnel causes “drunkennes” and “hurteth the eies and maketh them dim” (Gerard 1597:72), and Thomas Cooper, using the Latin name for darnel in 1565, observes that “*lolium*,” if consumed in “hote bread ... maketh the heade giddie” (Cooper 1565). Perhaps most memorably, Joshua Sylvester, translating Du Bartas, calls it “dizzie Darnell” (1605:630).

There is a long history of deliberate intake of darnel for entheogenic, medicinal, or social purposes. Darnel has been identified as the *tekh*-plant, residues of which have been excavated in Egyptian remains of the Predynastic period (over 3,400 BCE). The placement of these plant remains suggest that *tekh* was consumed with forms of beer, possibly in a ritual context (Goyon 1992). In Classical Greece, darnel was known as “*αἶρα*” (*aira*), the plant of frenzy, and was again used in a ritual setting, this time associated with the Eleusinian rituals of the cults of Demeter and Persephone (Wasson et al. 1978). It was used as an anesthetic in medieval Arab-Islamic medicine (Haddad 2005), and in works such as Celsus’ *De Medicina* (c. 47 CE) is listed among the ingredients of Mithridate, the mythical universal antidote to poisoning attributed by Celsus to the first century BCE King of Pontus, Mithridates VI (Celsus 1935). Formulations of Mithridate were administered widely in medieval and Renaissance times and featured in pharmacopoeias as recently as the nineteenth century.

Endosymbiotic and Phytochemical Basis of Darnel Toxicity

The pharmacological origins of darnel’s toxicity have been much studied and debated and are yet to be fully resolved. Evidence for the transition from superstition and myth-making towards a systematic materialistic understanding of the biological and chemical causes of darnel’s toxicity is recorded in herbals, medical treatises, and scientific publications from the early modern period to the present day (Thomas et al. 2011).

Darnel’s toxicity is associated with the presence of a mutualistic fungal mycelium located immediately outside the aleurone layer of the grain, first described by Guérin (1898), Vogl (1898), and Freeman (1904). From these early observations has developed the ever-growing field of study of endophytes across the range of temperate grass species (Schardl et al. 2013a). An endophyte is an organism—often, as in this instance, a fungus, or a bacterium, actinomycete, or mycoplasma—that lives within a plant for at least part of its lifecycle. Recent research has shown that the fungal endophyte of *Lolium*, far from being a passive resident of the grass plant body, exerts an appreciable influence (has agency, one might say) over the host’s development and stress tolerance through genetic reprogramming (Dupont et al. 2015). The taxonomy of grass endophytes has been subject to frequent revision. Until recently, the fungus of darnel was classified as *Neotyphodium occultans*, an asexually propagated congener of the *Epichloë* spp. that form endophytic associations with many grasses. The latest proposal (Leuchtmann et al. 2014) realigns this monophyletic group, classifying all members of this clade into a single genus, *Epichloë*, comprising 43 unique taxa including distinct species, subspecies, and varieties. The asexual epichloae are passed from generation to generation almost exclusively by vertical transmission, which makes them very difficult to remove from the lineage. Many such endophytes are interspecific hybrids with genomic contributions from two or three ancestral *Epichloë* species, with the consequence that there is extensive diversity in the amount and chemical variety of alkaloids they produce. *Epichloë* (formerly *Neotyphodium*) *occultans*, the most common endophyte in darnel and other annual ryegrass species (*Lolium multiflorum*, *L. canariense*, and *L. rigidum*), has an *E. bromicola* genome, along with a second genome from another *Epichloë*, most closely related to *E. baconii* isolates from *Agrostis* spp. (Schardl et al.

2013b). The toxicity and tenacity of darnel in cereal crops owe much to the mode of propagation and genomic complexity of its endophyte.

Several attempts were made in the early nineteenth century to isolate the active principle(s) from darnel grains (described in Pereira 1854). One of the uncharacterized substances was a water-soluble material named loliin, a small amount of which, when taken, was said to cause “an acrid sensation in the throat, followed by an affection of the head and weakness of the whole body, which effects continued only for a short time” (Pereira 1854:ii 35). The first chemical isolation and characterization of the presumptive active principle from grains of *Lolium temulentum* was made by Hofmeister (1892), who called a novel compound purified from grain extracts “temuline” (it is now named nor-loline). The bioactive compounds from the endophytes of *Lolium* spp. have been classified more recently into four chemical groups: lolines, indole diterpenes, ergot alkaloids, and peramine (Schardl et al. 2012). Inclusion of ergot bioactives in this list is significant, since the genus *Epichloë* is within the fungal family Clavicipitaceae, which includes the ergot organism *Claviceps purpurea* (Kuldau et al. 1997). The symptoms of darnel and ergot poisoning are closely similar. Indeed, in view of the recent research alluded to in this section, it is likely that historical accounts of madness—including St Anthony’s Fire and choreomania (the “dancing plague”)—have been routinely conflated with those of ergot intoxication (Thomas et al. 2011).

Biblical, Historical, and Literary Uses and Abuses of Darnel

Darnel as a Symbol of Heresy

Darnel has many names in world languages (Thomas et al. 2011), but, just as importantly, it has many names, and variations on names, within the same language. As demonstrated by this paper’s epigraph, in French, darnel was sometimes called “*l’ivraie*.” English has more variants for darnel than any other language. In the *Douay-Rheims* (or “Vulgate”) text of Matthew 13:24-30, it is called “cockle”:

But while men were asleep, his enemy came and oversowed cockle among the wheat and went his way ... And the servants said to him: Wilt thou that we go and gather it up? And he said: No, lest perhaps gathering up the cockle, you root up the wheat also together with it ... Gather up first the cockle, and bind it into bundles to burn, but the wheat gather ye into my barn (Douay-Rheims 1582).

In bible commentary and exegesis, this parable was traditionally used to explain the presence of evil in the world (in particular, the threat of heresy amidst orthodoxy), and to describe the kingdom of Heaven (McIver 1995). Notably, in the parable, weeds are introduced by an unnamed “enemy.” They are not generated within the field as part of the crop but represent a malicious introduction over which the farmer has no control until the field is fully grown, at which point darnel seems to be distinguishable from wheat. Scripture is unequivocal on the latter point. The farmer must not attempt to eradicate the weed early on; human judgment is fallible at this early stage in the growth cycle, and only when crop and weed have revealed their true nature is it safe to reap the field and consign the twin harvests to their appropriate ends.

This example from Scripture illustrates the slippery relationship between agricultural advice as metaphor and as fact. Biblical exegesis advocates many other approaches to cultivation, including the example of Adam as gardener, perpetually vigilant. In reality, few farmers were willing to leave the removal of weeds until the crop was fully grown. Augustine (354–430), commenting on Matt. 13:24–30, further distances metaphor from practice. Likening the act of distinguishing between truth and heresy to that of differentiating a food crop (“good” seed) from its weeds (“evil” seed), he urges Christians to resist the temptation to identify and denounce heretics:

... be ye the good ground ... and it may so be, that they who today are tares, may tomorrow be wheat. ... The harvest will soon be here. The angels will come who can make the separation, and who cannot make mistakes. ... I tell you of a truth, my Beloved, even in these high seats there is both wheat, and tares, and among the laity there is wheat, and tares. Let the good tolerate the bad; let the bad change themselves, and imitate the good. (Augustine 1888:vi 334–335)

In what could be seen as a defense of religious tolerance, Augustine argues that God is the only farmer who can truly distinguish between wheat and tares, good and evil. “Tares,” which replaces the Vulgate’s “cockle,” was sometimes conflated with, or used as a synonym for, darnel.

As bible translators and commentators reached out to new audiences, the names of the weeds of the sower parables proliferated almost as quickly as the weeds themselves. The weeds of Matt. 13:24–30 were typologically mapped onto the fall of humankind in Genesis and the exile of Adam and Eve from Eden. Christian tradition appears to have appropriated an earlier, classical association between the origins of weeds and the loss of the Golden Age, an association in which darnel once again takes center stage. In Book 1 of the *Georgics* (c. 29 CE), Virgil, echoing Hesiod’s *Works and Days* (c. 700 BCE), uses the emergence of darnel (“*infelix lolium*”) and other weeds as a sign of the translation of Astraea, goddess of justice, from earth to heaven, and the end of the Golden Age (Virgil 2009:56). Henceforth, it is explained, farmers will need to plough the soil and weed crops in order to keep hunger at bay. In the classical tradition, human intervention, in the form of identifying and removing weeds, is imperative, and seemingly at odds with the non-interventionist approach urged in Matt. 13:24–30. Nevertheless, the classical and Christian traditions of representing darnel were able to co-exist, perhaps reflecting a fundamental uncertainty with regard to the origin of weeds and the nature of their relationship with the host crop. Typically, the former tradition was adopted by Christian writers in order to add color and detail to their retellings of the fall of humankind: Du Bartas, whose *La Semaine; ou, Création du monde* (1578) influenced Milton’s *Paradise Lost* (1667), combines the two inheritances in his account of the “grieved Earth,” which turns “our seed-Wheat-kernel/ To burn-grain Thistle, and to vapourie Darnel,/ Cockle, wilde Oats, rough Burs, Corn-cumbring Tares” (Du Bartas 1605:630).

Darnel as a Symbol of Political and Religious Dissent

Protestant poets like Du Bartas were clearly aware that darnel, cockle, and tares are different plants. A recurring question therefore arises: why has the Greek for

darnel, ζιζάνια (*zizania*), in the sower parables been translated as “tares” (also called vetch, genus *Vicia*)? The reason, we suggest, was an attempt by Church and State in the Middle Ages to disentangle religious from political dissent, and thus weaken a newly-radicalized Commons. For those who lived in close proximity to the worked land, “tares” was unlikely to be comprehensible as a translation of *zizania*. Farmers and millers had little to fear from tares—it was inconvenient, certainly, if tares invaded cereal fields, but because its physical appearance is distinct from wheat, it is easy to weed out. This contradicts the parable, which would be meaningless if “good” and “evil” were not virtually indistinguishable from one another. Indeed, vetch has been part of the human diet since Neolithic times and, because it is a legume, it can even improve the fertility of the soil by fixing atmospheric nitrogen (Zohary and Hopf 2000:119). Campbell (1988) has shown that the cultivation of vetches in England steadily expanded in the thirteenth and fourteenth centuries as part of a general diffusion of agricultural technologies at that time, and agricultural manuals of the late-eighteenth and nineteenth centuries testify to the continuing importance of this crop in the rural economy. It seems highly unlikely, therefore, that medieval farmers, millers, and consumers would confuse darnel, the more familiar and dangerous weed alluded to in the *zizania* of Matt. 13:25, with tares. John Wesley (1818) argued for the use of “darnel” in bible translations and commentaries, not simply on linguistic grounds but because of his (and, presumably, his congregation’s) knowledge of plants. In his notes on Matt 13:25 he wrote: “His [the farmer’s] enemy came and sowed darnel—This is very like wheat, and commonly grows among wheat rather than among other grains: but tares or vetches are of the pulse kind, and bear no resemblance to wheat” (Wesley 1818:59).

In the final decades of the fourteenth century, the decline in arable farming, and heightened awareness of the fragility of food supply, contributed to the politicization of Matt. 13:24-30, which, in the wake of the 1381 Peasant’s Revolt, was adopted by all sides of the conflict in order to conceptualize challenges to authority and orthodoxy. With politicization came polarization (Aston 1994). For Pope Gregory XI, judgment was not to be left to God, as Augustine had urged, nor was this parable to be taken as an endorsement of religious tolerance. The papal bulls issued in 1377 instructed the Church authorities in England to identify and uproot the “tares” of heresy. The sower parables were re-appropriated in sermons associated with the 1381 Uprising, and those by the English reformer John Wyclif and his followers, the Lollards, to describe as well as prophesy the death and disorder that would result from a continuation of the current inequities. Darnel was a fulcrum around which assertion of, and challenges to, authority oscillated. Writing in 1377, Gregory XI addresses the “Masters of Oxford” (Oxford being Wyclif’s *alma mater*):

... you through a certain sloth and neglect allow tares to spring up amidst the pure wheat in the fields of your glorious university aforesaid; and what is still more pernicious, even continue to grow to maturity. (Gregory XI 1980)

The Lollard priest John Ball delivered a Corpus Christi Day sermon at Blackheath, London, in June 1381, in which Gregory XI’s rhetoric is used against itself:

... be prudent, hastening to act after the manner of a good husbandman, tilling his field and uprooting the tares that are accustomed to destroy

the grain ... act after the manner of a good husbandman, tilling the field.
(Hudson and Gradon 1983-1996:ii 287)

The term "Lollard" was first applied to followers of John Wyclif in 1387 (Patterson 2005). The derivation of the term is debated by modern scholars, but given the correspondences between, on the one hand, what might be called the arable poetics of the sower parables and, on the other, contemporary radical politics and religion, it is entirely conceivable that "*lolium*" is the origin of the movement's name (Archer et al. 2015b). This certainly seems to have been accepted by many earlier writers with good understanding of the biblical and botanical contexts. Writing in 1793, Milne and Gordon were in no doubt:

It was in allusion to the parable where [*zizania*] is used, and to its Latin signification, that the followers of Wickliffe, one of the first reformers of religion in England, were called LOLLARDS; that is, the Lolium, Darnel, or pernicious weeds, which were supposed to infest the field of the Christian world, and to choak and destroy the pure wheat of the Gospel. (Milne and Gordon 1793:139)

Between the first and second versions of the Wyclif bible, "darnel or cokil" had become "tares." We have seen that, to the contemporary audience for the bible and the sermons that sought to interpret it, the distinction between darnel and tares was all too intelligible. A more plausible reason for the substitution was to avoid any connections being made between the Wyclif bible and the Lollard heresy (Archer et al. 2015b).

Classical and Early Modern Literary References: Darnel and Madness in Great Ones

Through scriptural exegesis, husbandry manuals, and literature in the Georgic tradition, darnel came to signify the spirit of revolt, civil discord, and political corruption. In the works of Shakespeare and his coevals in the early modern period, darnel's symbolism is no longer solely concerned with the "fall of man" but may now speak of the fall of a man, becoming a potent metaphor for subversion and psychological disintegration projected onto a world perceived to be in disarray. We see this clearly in the plays of Shakespeare, most notably in *King Lear* (c. 1608), which explores the relation between darnel as a signifier of betrayal and the deteriorating psychology of a monarch responsible, in all senses, for the condition of his land and subjects (Archer et al. 2012). The acute psychological and political symbolism of darnel is crystallized in the appearance of this species in Lear's crown of "idle weeds." This is Cordelia, describing her father:

... he [Lear] was met even now,
As mad as the raked sea, singing aloud,
Crowned with rank fumitor and furrow-weeds,
With burdocks, hemlock, nettles, cuckoo-flowers,
Darnel, and all the idle weeds that grow
In our sustaining corn. (Shakespeare 2008:18.1-6)

In the fusion of herbal lore and bible commentary by Levinus Lemnius, a chapter about cockle and darnel notes that, in the sower parables, Jesus uses “the nature and qualitie of these noisome weedes” as a metaphor for “dangerous, hurtfull, pernicious, corrupt and vnsincere doctrine” (Lemnius 1587:229). The parable, Lemnius states, reminds Christians of the necessity in a well-ordered state of measured and judicious governors: “yet for due punishment doth he [Christ] subiect and referre to the authoritie of the magistrate, all those that be factious disturbers of the peace and tranquillitie, both of the Church and Commonwealth” (Lemnius 1587:229). For *King Lear*, then, as head of “Church and Commonwealth,” to wear darnel—an emblem of the machinations of “sathan”—is truly shocking, reinforcing the play’s themes of madness and blindness (King 1968). It is implicit in the mystical and political doctrine of the king’s two bodies and the intertwining of the body politic and the body natural, that a deranged king and a sick land will become one.

The significance of darnel within *King Lear* is further underlined by the likely influence on Shakespeare of Gerard’s *Herball* (1597). Under that volume’s entry for “darnel,” Shakespeare would have found Gerard’s taxonomic division of plants into “fools,” “kin,” and “bastards,” a tripartite classification system that provides an organizing principle for the dramaturgy. “Fools” such as darnel mimic true forms like wheat. *King Lear*, of course, features a Fool, who in his own cryptic fashion attempts to lead his monarch towards the perspicuity of vision necessary to distinguish between his true and false daughters. The conundrum is echoed in the subplot, where a father, Gloucester, attempts to distinguish the good son, Edgar, from the bad, Edmund—who in the play is referred to as “bastard.” “Bastard wheat” was another name for darnel (Archer et al. 2012).

Shakespeare deploys botanical images of corruption in other history plays to register and articulate enduring anxieties over relations between court and country, legitimacy and bastardy, elite power and popular resistance, and the spiritual and physical health of monarch and realm. *Henry VI Part 1* (1592) and *Henry V* (1598-9), from the first and second tetralogies respectively, use darnel and related imagery to underline the correspondences between good husbandry and good government. This is demonstrated by the Duke of Burgundy’s speech in *Henry V*. A once “fertile France” (Shakespeare 1988:5.2.37), he laments, has gone to ruin during the recent warfare, and weeds grow unchecked in its cornfields. This imagery anticipates the language of *Hamlet* (1600-1), in which the Danish prince complains of the world: “’tis an unweeded garden/ That grows to seed; things rank and gross in nature/ Possess it merely” (Shakespeare 1988:1.2.135–137).

Hibbard notes that Shakespeare found the word “cockle” in his principal source for *Coriolanus*, Thomas North’s translation of Plutarch’s *Lives of the noble Grecians and Romanes* (1579), in which the eponymous Roman general warns his fellow senators against “the naughty seede and cockle, of insolencie and sedition” (Shakespeare 1967; Plutarch 1579:245–246). *Coriolanus* was written during the Midlands food riots of 1607-08, and Gurr (1975) and subsequent commentators have argued convincingly that the play constitutes a response to those tumultuous events. In Shakespeare’s historical drama, Coriolanus argues that, by distributing corn to plebeians as well as patricians, the ruling class has “nourish[ed] ‘gainst our Senate/ The cockle of rebellion, insolence, sedition,/ Which we ourselves

have ploughed for, sowed, and scattered” (Shakespeare 1988:3.1.69–72). It seems that, more than two centuries on from the Great Schism, darnel had retained its metaphorical power as a malign influence on the health of the state, its people, and rulers. The weed not only provided a way of thinking about the world, but also shaped that way of thinking. Moreover, freighting darnel with responsibility for a world gone bad makes a moral case for driving it to extinction. The Red List status of the species in the developed world today speaks of the success of this objective (Cheffings et al. 2005).

Darnel, then, has provided writers with a rich source of imagery and metaphors, informing some of our best-known literature. Beyond that, though, darnel’s (arguably self-seeding) presence in our literary heritage testifies to the profound ways in which it has insinuated itself into our cultural imagination.

Darnel in the Eighteenth and Nineteenth Centuries

Darnel retained its literary resonance into the eighteenth, nineteenth, and early twentieth centuries, featuring in poems by Percy Bysshe Shelley, Henry Charles Beeching and Walter de la Mare, among others. In Tobias Smollett’s *The Life and Adventures of Launcelot Greaves* (1762), the eponymous hero, an English Don Quixote, is driven to a state of madness by his unconsummated love for the suggestively-named beauty Aurelia Darnel (who goes by the equally suggestive pseudonym “Miss Meadows”). While Smollett draws on the intoxicating properties of darnel to describe the state of love melancholy, it seems likely that Shelley, Beeching, and de la Mare, given their use of the plant as one among a litany of weeds, drew on earlier literary mentions of darnel, particularly in Virgil and Shakespeare, rather than direct observation or personal experience. Nevertheless, darnel clearly remained part of the physical, as well as literary, landscape. The long-standing tradition of cultivating darnel for the express purpose of mixing with beer in order to enhance its intoxicating properties, and for deliberately or fraudulently adulterating grain for bread-making, continued from the earliest times for which we have archaeological records up to the threshold of the era of industrialization. The following observation is reported by James Johnson:

We fear that beer not unfrequently owes its powers to darnel; being credibly informed, by an eminent practical botanist, that two acres of ground in Battersea fields were lately cultivated with it; and we know no other purpose to which it could be applied. (Johnson 1827:99–100)

An account of darnel in brewing and bread-making appears in the miscellany of anecdotes and lyrics collected by W. T. Marchant:

Darnel, or *lolium timulentum* [sic], which is vulgarly known under the name of sturdy when malted with barley, a process which the seeds of it often undergo, causes the ale brewed from it to be speedily intoxicating. It produces the same effect when mixed with bread and eaten hot. (Marchant 1888:39)

Tales of the deliberate introduction of darnel into bread and ale are further supported in 1858 by John Gamgee who—recounting the poisoning of a pig that had been fed barley “in which was a great quantity of ‘sturdy’ (*Lolium temulentum* L.)”—speculates on how “sturdy” beer received its name:

It is very often remarked by old people that they were formerly in the habit of mixing the lolium with malt, when brewing beer, as its intoxicating nature is very great; hence, I suppose, its name “sturdy”. (Gamgee 1858: 235)

Gamgee’s reference to “old people” dates the practice to the 1810s and 1820s. This is the period in which George Eliot set the main events of her novel *The Mill on the Floss* (1860), in which the central character, Maggie Tulliver, is described as having a taste for bitter-tasting bread. Maggie’s dark coloring, which identifies her as a Tulliver rather than a Dodson—her father’s daughter rather than her mother’s—is explained in terms of the contrast between varieties of wheat (red and white) and bread (dark and white): “the child’s healthy enough,” Mr. Tulliver declares, responding to his daughter’s unorthodox behavior; “there’s nothing ails her. There’s red wheat as well as white, for that matter, and some like the dark grain best” (Eliot 2010:68). The uneducated, undisciplined, and spirited Maggie is associated with red wheat and her more docile and socially adept (but, perhaps, less engaging) brother, Tom, with the white. This metaphor echoes and plays with the sower parables, but also reflects contemporary experience, for in certain parts of England (particularly Cheshire, for some reason), red wheat was identified with darnel, a traditional belief that may be traced to the botanical works of Theophrastus (c. 371–c. 287 BCE): “they say that wheat and barley change into darnel, and especially wheat; and that this occurs with heavy rains and especially in well-watered and rainy districts” (Theophrastus 1916:ii 183). It also anticipates what we now know about the origin of red pigmentation in grasses. The white testa character in cereals (not only wheat, but also rice, maize, and barley) is derived secondarily from the more primitive red trait. The red testa color is due to phlobaphene, a reddish brown pigment derived from tannin (Miyamoto and Everson 1958). Expression of red color in bread wheat is under the control of a series of R genes, located on chromosome 3 of each of the three genomes. R encodes a regulatory factor that turns on the biochemical pathway for phenylpropanoid biosynthesis leading to tannins. In white wheat, each of the R genes carries a mutation and so the pathway is not expressed (Himi and Noda 2005). The presence of tannins and other phenylpropanoids gives red wheat its bitter, astringent taste (Chang and Chambers 1992). Because it is less susceptible to pre-harvest sprouting, red wheat is better suited to wet and cold summers (Groos et al. 2002). Like red wheat, the dark, purplish grain of darnel (Caldararo, no date) is bitter and, by tradition, *Lolium temulentum* was said to flourish in a cold and wet growing season (Henslow 1901:180–181; Tristram 1911:487–488). Historically, the dark, dense, bitter bread made with red wheat, similar to bread made with grain infiltrated by darnel, was always cheaper than bread made with uncontaminated flour and flour made from white wheat. The “bitter,” “coarse,”

“dark,” and “black bread” consumed by the starving peasants of St. Antoine in Charles Dickens’s *A Tale of Two Cities* (1859) is associated with, and contributes to, the frenzy and bloodshed of the storming of the Bastille (Dickens 2003:132, 230). But Eliot’s novel suggests that some people, including Maggie Tulliver it would seem, acquired a taste for this cheaper type of bread and, perhaps, for the flouting of social conventions and orthodoxies it came to represent (Archer et al. 2015a), a habit reminiscent of that of the country mouse in Horace’s first-century BCE satire, who “spelt and darnels ate” and for whom “tares and vetches still have charms” (Horace 1874:84–86).

Conclusion: Darnel - Forgotten but not Gone

Darnel and its near relative ergot dance through history like the frenzied grinning skeletons that are their traditional symbolic representations. Spiritual and literary sources caution about the agricultural, religious, and socio-political hazards of allowing the weed to insinuate itself into the food-chain. On the other hand, from the time of the earliest agricultural societies, traditions abound that have embraced deliberate administration of darnel as a hormetic measure, a medicine or a means of achieving altered consciousness. Piero Camporesi has written of the “unsuspected artificial paradises (that) were opened up to the undernourished and starving” through the intentional consumption of “dazed bread” in pre-industrial Europe (Camporesi 1989:16).

Where there is intensive agriculture, darnel has been all but eradicated. Urbanization and detachment of populations from the origins of their food, and from the unrelenting pressure of biological threats to food production, have further weakened awareness of the plant and its meaning. Approaching the present day, at the same time as scientists have begun to unlock the secrets of darnel’s biochemistry and as the plant has begun to fade from common experience in the developed world and heads towards extinction, the word “darnel” persists as a free-floating signifier in given names and surnames (see, for example, Lower 1860; Smith and Conley 1954, 1979). The fate of darnel has been to become a melancholy exemplar of the loss of vegetation diversity and the knowledge systems that go with it. What do people of the developed world understand by the word “darnel(l)”? If they know it at all, it may be as the name of a sportsperson, an actor, or a musician. By our naming babies and families for darnel, this plant, long perceived as sinister, with murderous associations, achieves a kind of redemption. But we would be the poorer if, in choosing to remember darnel’s name, we allow the rich biological, cultural, and social history associated with the plant to pass utterly out of memory.

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