In 65 CE the Emperor Nero sentenced to death Lucius Annaeus Seneca, a Stoic philosopher and a Roman politician.\(^1\) In acknowledgement of Seneca’s status, Nero granted his former adviser the privilege of dying by his own hand.\(^2\) Seneca chose first to cut his veins in an effort to bleed to death,\(^3\) this being the method of suicide (whether forced or voluntary) in favour at the time.\(^4\) Having survived haemorrhage he turned to hemlock. Poisoning by hemlock had been the state method of execution in ancient Athens, and famous as the cause of death of Socrates. Both methods then were apparently tried and true and yet both failed in Seneca’s case.

Hemlock is one of the most toxic plants known.\(^5\) Why did it not kill Seneca? It had killed Socrates as well as an unknown number of others who had been condemned to death by the Athenian state.\(^6\) In later centuries people have died after consuming hemlock mistaken for one of the edible plants that hemlock so closely resembles: its

\(^1\) Tac. Ann. 15.61.
\(^2\) ibid.
\(^3\) ibid., 15.63.
\(^4\) Calpurnius Piso (Tac. Ann. 15.59); Julius Vestinus Atticus (15.69); Lucan (15.70); L. Vetus and his family (16.11); Ostorius Scapula (16.15); Petronius (16.19); Publius Anteus who tried poison first, then, because it was too slow, opened blood vessels (16.14); Thrasea who, like Seneca, died slowly and painfully (16.34).
\(^5\) T. Larsson, ‘Some History and Effects of *Conium maculatum* L’, a Literature Work in Pharmacognosy C, Department of Medicinal Chemistry (Uppsala University, 2004), http://www.fkog.uu.se/course/essays/conium_maculatum.pdf.
taproots can be confused with those of wild parsnips or carrots;7 its leaves have been mistaken for parsley, which is a member of the same family.8 This paper investigates possible reasons for the failure of hemlock to kill Seneca. Research for this study has involved forays into veterinary and plant science as well as medical jurisprudence and a fascinating venture into nineteenth century medical treatment and research.

**Cassius Dio and Tacitus**9

Dio’s *Roman History* contains one of the two descriptions of Seneca’s death that survive from the ancient world. It was written in Greek about 200 CE.10 The other is included in the *Annals* composed by the Roman historian Tacitus at some time between 116 CE and 120 CE, perhaps even later.11 Dio’s report is briefer than that of Tacitus and has Seneca killed by an impatient soldier when he took too long to bleed to death. The only mystery here is the question of why the haemorrhage was not fatal. Tacitus, on the other hand, describes how Seneca asked for hemlock when he survived what was intended to be a fatal loss of blood. When the poison also failed, he was suffocated in a steam bath:12

>Seneca, in the meantime, as death continued to be protracted and slow, asked Statius Annaeus, who had long held his confidence as a loyal friend and a skilful doctor, to produce the poison—it had been provided much earlier—which was used for despatching prisoners condemned by the public tribunal of Athens. It was brought, and he swallowed it, but to no purpose; his limbs were already cold, and his system closed to the action of the drug…He was then lifted into a bath, suffocated by the vapour, and cremated without ceremony.13

This discussion is based on Tacitus’ account, as it is likely to be more reliable than

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7 [Hemlock@3Dchem.com](http://www.3dchem.com/molecules.asp?ID=119).
8 ibid.
12 Tac. *Ann. 15.64.*
that of Dio. Tacitus wrote about fifty years after Seneca’s death. The time lapse alone does not necessarily lead to greater trustworthiness. It does mean, however, that it is within the bounds of possibility that there was a witness still living whom Tacitus could have questioned. It is possible and even likely that the historian had to be content with a second-hand account of Seneca’s death, along the lines of the information on the death of Pliny the Elder as supplied in his nephew’s letter. That is, a description supplied by someone who had heard it from a witness. It is also possible that he had a first-hand account written by an actual witness who had since died.

If Seneca’s last message was as readily available as Tacitus claims, then his account of the philosopher’s last hours can probably be depended upon. It is unlikely that Tacitus would invent, or repeat, details that could so easily be challenged by contemporaries. Dio, on the other hand, wrote later and for a largely Greek-speaking audience, an audience that would have had little interest in Latin philosophy. It is unlikely that Dio’s Greek readers would have gone to the trouble of reading Seneca’s dying words, or any other of his works, even if they could read Latin. It is equally unlikely that they were translated into Greek.

There were many potential witnesses to Seneca’s death, including his dinner guests and their entourages, as well as the members of Seneca’s own household. His wife, Pompeia Paulina, had her own attendants, enslaved and freed. There was also an unknown number of soldiers whose task it was to ensure that Seneca died in obedience to Nero’s orders and who were prepared to kill him themselves if necessary. Any of these individuals could have been a source for Tacitus. Tacitus also had access to Seneca’s last work, written while he was waiting to die:

\[\text{et novissimo quoque momento suppeditante eloquentia advocatis scrip} \text{toribus ple} \text{raque tradidit, quae in vulgus edita eius verbis invertere supersedo}\] (‘Even at the last moment his eloquence remained undimmed; he summoned his scribes and dictated a long discourse, which has been

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15 Griffin, Seneca, 73 with note 4.
16 Plin., Ep. 6.16.
17 Tac. Ann. 15. 63.
18 There was a persistent attitude that philosophy should be written in Greek: Griffin, Seneca, 7–8.
publicly issued in his own words, so I shall not paraphrase it’).\textsuperscript{19} This document has not survived, or has not yet been identified. Its value as a source, if any, is therefore unknown. It is clear from Tacitus’ account that by his time there were differing versions of Seneca’s death, not all of them flattering to the two principals. The historian dismisses at least some of them as discreditable stories.\textsuperscript{20} The implication is obvious; his account holds the true and accurate record.

There is a hint in the \textit{Annals} to indicate how Dio’s hostile report could have arisen. Pompeia Paulina chose to die with her husband and by the method that was his first choice, that is, haemorrhage, despite the fact that she was not under sentence of death.\textsuperscript{21} Her life was saved on Nero’s orders. Tacitus records the opinion of those who believed that Paulina was pleased and grateful that her life had been saved. As the historian points out, discreditable stories are always popular.\textsuperscript{22} It is easy to see how such rumours could be preserved by sources hostile to Seneca. Like all powerful figures Seneca had made enemies in the course of his career.\textsuperscript{23} Tacitus, however, goes on to record that Pompeia Paulina spent the few years left of her life as a living ghost in mourning for her husband and with her health destroyed by the blood loss she had suffered.\textsuperscript{24}

According to Tacitus, when Seneca survived haemorrhage he decided to imitate Socrates. He asked his doctor, Annaeus Statius, to provide him with hemlock: \textit{provisum pridem venenum quo damnati publico Atheniensium iudicio extinguerentur promeret} (‘to bring him the poison which killed those who had been condemned by the Athenian public tribunal; the poison which had been provided earlier’).\textsuperscript{25} Tacitus does not use the Latin word for ‘hemlock’ (\textit{cicuta}) but that for ‘poison’ (\textit{venenum}). The original audience for whom Tacitus wrote would have known the name of the poison used by the Athenian executioner. They may not have been as knowledgeable when it came to identifying the actual plant from which the toxin was extracted. This brief state-

\textsuperscript{19} Tac. \textit{Ann.} 15.63. All translations are my own except where indicated.
\textsuperscript{20} ibid., 15.64.
\textsuperscript{21} ibid., 15.64.
\textsuperscript{22} ibid.
\textsuperscript{23} Tacitus mentions one: Suillius Rufus (Tac. \textit{Ann.} 13. 42); Pliny the Elder has also been thought by some scholars to have been hostile to Seneca (Ker, \textit{The Deaths of Seneca}, 18, with note 4; Syme, \textit{Tacitus}, vol. I, 292, with note 4).
\textsuperscript{24} Tac. \textit{Ann.} 15.64.
\textsuperscript{25} ibid.
ment also presents a puzzle. It does not tell us in what form the hemlock had been kept, or how long since it had been provided. Nor is any information given on who collected the ingredients and prepared the draught. Since Seneca asked Statius to bring him the poison it may be assumed that by now the doctor had assumed responsibility for the hemlock, but we do not know if he played any part in the collection or the processing of the ingredient(s). Seneca himself was interested in science, including medicine.26 He knew Celsus’ *De medicina* 27 and had himself written a lengthy treatise, *Naturales quaestiones*, dealing mainly with the physical sciences, especially what we might term cosmology and the earth sciences but also containing scattered references to medical matters.28 His knowledge was probably largely theoretical and it seems doubtful that it included the ability to distinguish hemlock accurately from very similar plants. In the absence of any evidence we must conclude that we cannot know who identified the plant used as poison hemlock. This lack of information has a direct bearing on the difficulty of answering the question of why Seneca did not die from the effects of hemlock poisoning.

By Seneca’s time the Athenian state’s method of execution was already long in the past and it is not known how much practical expertise had been lost. Expert knowledge is required to differentiate between plants that are very similar in appearance.29 It is possible that the executioner’s skill had been transmitted orally and by practical training by means of a kind of apprenticeship system. Socrates’ executioner had had sufficient practice at his trade.30 It is worth noting that Socrates was prevented from offering a libation before he drank from the cup, for the very practical reason that there might not have been enough poison left to cause death.31 The attendant claimed to be confident of his ability to gauge the exact amount required,32 but he may have feared that Socrates would spill so much of the poison that he would be forced to prepare more.

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27 ibid., 60, 90.
30 Pl., *Phd.* 116C.
31 ibid., 117B.
32 ibid.
Despite the knowledge and experience that had been lost since Socrates’ day there was more information available to Seneca, and to Statius, than now survives. That is clear from Pliny’s *Natural History*. How much of that information pertained to hemlock is uncertain. Recognising the dangers of hemlock, Pliny refrains from providing details on remedies made from the herb that are to be given by mouth. It is unclear whether this is self-censorship because of a reluctance to relay dangerous information that could be misused, or whether his sources themselves lacked such details. There is no overt discussion of poisoning in the Hippocratic corpus, for example. On the other hand, some recipes have survived and were at least potentially available in Seneca’s day.

**The hazards of hemlock**

This is a suitable point at which to digress in order to discuss some of the pitfalls associated with research into hemlock. Hazards include problems of nomenclature as well as difficulties in the actual identification of the plant. Nomenclature is a minefield. It is often difficult to be sure exactly which plant an author is referring to. It is a complex matter to describe a plant accurately and ancient writers had nothing similar to the modern standardised methods of description. There was no officially established method of classifying or naming plants and, just as we ourselves do, the ancient classical world had multiple popular and local names for the same plant. The situation is further complicated by the practice of modern taxonomy that uses (mostly) Latin, or Latinised, scientific names. Hemlock itself provides an example. Poison hemlock is assigned to the genus *Conium*, a Latinised version of the Greek word for poison hemlock (κώνειον). The Latin word for hemlock, *cicuta*, is used for the genus to which water hemlock belongs.

It is by no means safe to assume that any plant so classified is identical to that to which some Romans gave the same name. It is very tempting to believe that if the names are the same then the plants must also be the same. This is not always the case.

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34 Bloch, ‘Hemlock Poisoning and the Death of Socrates’, 269.
To add further to the confusion, the English word ‘hemlock’ is used to refer to poison hemlock, water hemlock, hemlock water dropwort, lesser hemlock (also known as fool’s parsley) and other herbs as well. Water hemlock is also potentially lethal, but its toxins differ from those of poison hemlock and, not surprisingly, the symptoms of poisoning are different also. To confuse matters even further, there are conifers in North America called ‘hemlock trees’, which are unrelated to the family to which poison hemlock belongs. In this discussion the word ‘hemlock’ refers to poison hemlock, *Conium maculatum* (L). This is the plant whose toxins killed Socrates and that Seneca also requested when he survived the attempt to die from haemorrhage.

How did Seneca know that the poison had been ineffective? The answer lies in Plato’s description of the death of Socrates with its accurate report of the first symptom of hemlock poisoning. When, after a reasonable length of time, this symptom had not appeared, Seneca would have known that the poison too had failed him.

Plato’s account was well known in Seneca’s world. Its accuracy was unquestioned and remained so for many centuries. In more recent times it has come under attack, with Plato being accused of sanitising, and even of romanticising, Socrates’ death. Plato was not present when Socrates was executed and his account is at second hand. Modern historians are sometimes too quick to question various descriptions left to us by ancient authors. We should not believe everything they tell us, but nor

40. Pl. *Phd.* 117E. This point will be discussed in more detail below.
41. What constitutes a ‘reasonable length of time’ is estimated in the next section.
should we be overly sceptical and ready to assume that they considered the production of a sophisticated literary work to be of greater importance than an accurate record. Bloch provides convincing evidence for the accuracy of Plato’s vivid report.44

**Hemlock and John Harley**

A nineteenth-century physician named John Harley provides us with invaluable evidence on the length of time between ingestion and the appearance of the first symptoms of hemlock poisoning, evidence that corroborates Plato’s description of the first symptoms Socrates suffered. Harley was an enthusiastic advocate for the therapeutic use of poison hemlock.45 He experimented on himself as a ‘normal control’ and on animals of various species, keeping detailed records of both his clinical work and of his experiments. These records supply the most complete and up-to-date information on the results of hemlock poisoning on human beings that I have been able to discover. Although there has been much recent research done on the hemlock poisoning of livestock, there has been little investigation on how its toxins affect humans. There are several reasons for this apparent neglect. In some parts of the world livestock losses from hemlock poisoning are economically significant. People, however, rarely eat hemlock plants, repelled usually (although not always) by the unpleasant odour. Since the abandonment of the therapeutic use of hemlock in the early decades of the twentieth century, medical research into the plant and its toxins appears to have ceased. In fact there appears to have been little research done in any case, except for Harley’s experiments. John Harley’s work, therefore, is the authoritative text on the effects of hemlock on human beings. He was arguably more knowledgeable in this respect than later medical practitioners and probably more expert than most ancient ones, as far as we can judge.46

Harley believed that hemlock was clinically ineffective unless it was given in amounts sufficient to cause at least the first symptoms of poisoning.47 Sometimes the doses he administered were dangerously high. The result is a record of a number of cases

46 ibid., 1.
47 ibid., 22.
demonstrating the effects of hemlock poisoning on people of both sexes, various degrees of health and ill-health and all ages, including children and infants. The effects that are of interest for this investigation are the initial symptoms. Would Seneca have been able to recognise them, if they had occurred, from Plato’s description?

The first symptom noted by Socrates, according to Plato, was the heaviness of his legs. ‘He walked about and, when he said his legs were heavy, lay down on his back, for such was the advice of the attendant.’48 Plato indicates nothing about the lapse of time so it is probable that Seneca did not know how long it would be before he experienced the same symptom. He would, however, have known from Plato’s description that this was, in fact, the first symptom.

The experiments Harley conducted on himself confirm this ‘leaden leg’ feeling as one of the first responses to a sufficient, although in his case, non-lethal, dose of hemlock. The first effect, writes Harley, is ‘a depression of the motor function.’49 Harley describes this symptom as ‘a heavy clogging sensation in my heels.’50 His legs became ‘shaky’, his movements clumsy and he began to feel giddy.51 Harley was walking during this experiment, as Plato describes Socrates as having done. It is not known whether Seneca was walking. Had he been able it is almost certain that he would have done so, as he would have followed Plato’s description as faithfully as he could. It is possible that he was no longer able to walk by this stage, after blood vessels had been cut in his ankles and behind his knees. Much depends on whether tendons had been damaged and also on how much blood he had lost. The blood loss could not have been severe as he was still coherent and rational.52 Fortunately Harley once again provides invaluable evidence. On another occasion after dosing himself with hemlock he rested to gauge the effects of the drug on an inactive subject.53 His first sensation was a feeling of giddiness.54 He was then affected by ‘a general muscular lethargy.’55 He next experienced a feeling of weakness in the legs.56 One

48 Pl., Phd. 117E.
49 Harley, The Old Vegetable Neurotics, 3.
50 ibid.
51 ibid.
52 Tac. Ann. 15.64.
53 Harley, The Old Vegetable Neurotics, 4.
54 ibid.
55 ibid.
56 ibid.
and a quarter hours after ingesting the hemlock Harley was ‘cold, pale and tottering’ and felt as though in a short while his legs would no longer be able to support him.\textsuperscript{57} This is one of the occasions when the dose he had taken was almost lethal.\textsuperscript{58} He was probably lucky to have survived this experience.

Harley’s work provides a guide for estimating the length of time required for the first symptoms to appear. This time lapse may then provide a clue on the question of whether Seneca was prepared, or permitted, to wait for as long as an hour. Harley’s adult patients complained of ‘heaviness in the legs’ after a period of time ranging from twenty minutes to an hour. Harley recorded similar symptoms and after a comparable lapse of time when he dosed himself.\textsuperscript{59} Harley had no intention of killing his patients, or himself, and therefore was careful to prescribe less than a lethal dose.\textsuperscript{60} He noted that an increased dose resulted in the more rapid onset of intensified symptoms.\textsuperscript{61} Harley claimed that ‘the operation of hemlock is uniform and invariable in man,’\textsuperscript{62} an observation borne out by his clinical and experimental results.

Socrates had been given at least enough toxins to kill an adult. Athens’ official executioner had had considerable experience in his profession and made no error in Socrates’ case.\textsuperscript{63} Socrates, therefore, probably felt the ‘heaviness’ in his legs after the lapse of less than half an hour. Surely Seneca would have waited at least as long as that. The failure of the hemlock to act would have been obvious when these symptoms did not appear. Tacitus does not spell this out; perhaps he considered it unnecessary. It has already been noted that the details of Socrates’ death were well-known in this world.

\textbf{How to prepare hemlock}

There are a number of possible explanations for hemlock’s failure to kill Seneca. An obvious problem is shelf life. What is the use-by date for a preparation of poison

\textsuperscript{57} ibid.
\textsuperscript{58} ibid., 5.
\textsuperscript{59} ibid., 2–5.
\textsuperscript{60} ibid., 3–4, 6. However, he did sometimes come very close.
\textsuperscript{61} ibid., 5.
\textsuperscript{62} ibid., 6.
\textsuperscript{63} Pl. \textit{Phd} 116C, 117–117B.
hemlock? Tacitus tells us that the poison had been provided earlier, but supplies no information on how much earlier, how long Seneca’s hemlock had been kept, or in what form. It is possible that a dose had been prepared in advance and stored. A couple of possible techniques survive from the ancient world; in Seneca’s time there may have been more.

Thrasyas of Mantineaia claimed that his preparation of hemlock kept indefinitely: ‘it will keep any length of time without losing its virtue at all.’ His was not pure hemlock, however, but a compound consisting of the juices of hemlock, poppy and other unspecified herbs: ‘he (sc. Thrasyas) used the juices of hemlock poppy and other such herbs, so compounded as to make a dose of conveniently small size.’ Theophrastus reports that a small dose of this mixture produces an easy and painless death: ‘Thrasyas of Mantineaia had discovered, as he said, a poison which produces an easy and painless end.’ It is unknown if there was a natural preservative in the mixture. Thrasyas lived in the mid-fourth century BCE, not very long after Socrates’ death, and might have known something of the methods used by Athens’ state executioner.

Theophrastus provides a simple method of preparation. Juice is extracted from the roots of the herb by pouring water over them, filtering off the fluid and retaining the sediment. Even a small amount of this sediment will cause a quick and easy death: ‘In most “roots” the juice thus extracted is less powerful than that of the fruit, but in hemlock it is stronger and it causes an easier and speedier death even when administered in a quite small pill’. An older and even easier method involved shredding the plant for use without further processing. This was an old-fashioned method no longer in use according to Theophrastus. Confirmation of the lethal properties

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64 Tac. Ann. 15.64.
66 ibid.
67 ibid.
68 Theophr. Hist. pl. 9.8.2 ‘In some cases there can be no collection of juice, but there is a sort of extraction of it, for instance in the case of plants which are cut down or bruised; they then pour water over them and strain off the fluid, keeping the sediment’ (trans. Hort).
69 ibid.
70 Theophr. Hist. pl. 9.16.9: ‘the people of Ceos formerly did not use hemlock in the way described (sc. Thrasyas’ method above), but just shredded it up for use, as did other people’ (trans Hort). See also Théophraste, Recherches sur les Plantes, Amigues trans., vol. 9, 210–211, note 31.
71 Theophr. Hist. pl. 9.16.9: ‘but now not one of them would think of shredding it, but they first strip
of such simple methods for processing the hemlock comes from a modern source. *Taylor’s Principles and Practice of Medical Jurisprudence* reports on a case of suspected murder when the victim was killed by a ‘decoction’ of hemlock.\(^72\) The plant had been boiled in water and the resulting infusion killed the victim in one hour. Since the victim was a child, a lesser dose could be expected to act more speedily than it would in an adult. This case provides a chilling demonstration of the lethal properties of poison hemlock.

Dioscorides also presents a method for preparing a liquid extract for later use.\(^73\) He extracted juice from the top foliage of plants before their seeds had dried.\(^74\) The resulting juice was condensed in the sun.\(^75\) Harley believed that ‘a tablespoon or two’ of such a preparation would be lethal.\(^76\) We may have faith in his opinion if only because Dioscorides’ method of preparation is comparable to that of Harley’s own hemlock juice that had a shelf life of up to five years.\(^77\) The juice used by Harley in his investigations was prepared from fresh plants just coming into bloom.\(^78\) The plants were pulped, then pressed by ‘a very powerful’ hydraulic press.\(^79\) The juice was mixed with spirit and placed in a cellar to be subsequently filtered and bottled.\(^80\) Coniine, the main toxin of poison hemlock, dissolves more easily in alcohol than in water.\(^81\) Alcohol also acts as a preservative, and would have helped to disguise the musty smell of hemlock. The weight of evidence, therefore, suggests that it is possible to make preparations of the juice of hemlock that keep well.

Harley had a problem that was of no concern to Seneca. He needed a standardised solution so that he could work out with some degree of confidence the appropriate

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73 Dioscorides, *De materia medica*, 4.78.
74 ibid.
75 ibid., Pliny the Elder describes a similar method: Plin. *HN* 25.151.
76 Harley *The Old Vegetable Neurotics*, 80.
77 ibid., 68, 70.
78 ibid., 68.
79 ibid.
80 ibid.
81 *Taylor’s Principles*, 684.
dose for individual patients. Sufficient toxin was required to cause the initial symptoms of hemlock poisoning, but not enough to kill. This problem of dosage, enough but not too much, was of no concern to Seneca. Death was the objective so it was difficult to have too much when the lethal amount seems to be quite modest. What, then, is the lethal amount? This is not known exactly. It is thought to be somewhere in the order of six to eight fresh leaves.\textsuperscript{82}

Storing dried hemlock plants seems to be an obvious way of having the poison readily available. Modern research indicates that there is a loss of toxicity when hemlock plants are dried,\textsuperscript{83} but the toxins do not disappear and livestock has been poisoned after eating too much hay contaminated by hemlock.\textsuperscript{84} There is no evidence that the dried plant was used in antiquity. Fresh material was required to extract the juice. It is unlikely, therefore, that Seneca had organised a stock of dried hemlock plants to be preserved for future use. It is possible that fresh plants were kept. These seem to remain fresh for a long time and no doubt could be replaced by new material as they dried out.

It is also possible that seeds were stored. There is at least ancient evidence for this. ‘Thirteen small terracotta bottles of a type certainly used in antiquity for drugs and which perhaps in this case were intended to hold the powerful and carefully measured juice of the hemlock plant’ were found in what was probably the site of the state prison in the Athenian agora.\textsuperscript{85} A similar bottle has been found containing hemlock seed.\textsuperscript{86} Perhaps the seed was kept until an execution was scheduled, then ground in a mortar and dissolved (probably) in wine. That would explain the length

\textsuperscript{82} IPCS Inchem, \textit{Conium maculatum} L. (PIM 144) 8, \url{http://www.inchem.org/documents/pims/plant/conium.htm}: Three mg of conine are said to produce symptoms in an adult, 150 mg have been tolerated; 30–60 mg may be considered dangerous, death has been caused by doses greater than 100 mg.


\textsuperscript{84} Lopez et al., ‘Biochemistry of Hemlock’; Peters and Bouska, ‘Silage will not reduce the toxin’.


\textsuperscript{86} Athenian Agora Excavations, \url{http://www.attalos.com/cgi-bin/image?lookup=2004.01.1186}.
of time before Socrates’ executioner appeared with the poison.

I have been unable to uncover any information on how the seeds were identified as hemlock. It is difficult to distinguish between hemlock and several other very similar plants. Until there is more information on these seeds it would be preferable not to place much weight on them.

Whoever prepared Seneca’s dose would have followed the method hinted at by Plato as closely as possible on the information available. That means crushing or grinding the plant material using mortar and pestle.\(^{87}\) Even Socrates (or Plato) was unsure whether the dose had been prepared in advance, or just before ingestion.\(^{88}\) It was probably the latter since some time elapsed after Socrates indicated that he was ready and before the executioner returned with the dose.\(^{89}\)

The next possibility to be considered is the part of the plant recommended for use. Perhaps Seneca’s doctor, Annaeus Statius, prepared the dose from a harmless part of the plant. I shall begin with the recommendations of the ancient authorities: that is, those Seneca or Statius could have consulted. Pliny the Elder wrote that although its seed is poisonous, the stem of the hemlock is edible either as a salad or as a cooked vegetable.\(^{90}\) Theophrastus believed that hemlock root was more toxic than the fruit.\(^{91}\) He stresses the importance of the cold and shady conditions under which the plant was growing and the method of preparation.\(^{92}\) Discorides recommends pressing juice from the ‘top foliage’, presumably the leaves, and from the ‘herb itself’, by which he means the stem.\(^{93}\) He also has his favourite locations from which to gather plant material. His, however, are geographic rather than environmental.\(^{94}\)

\(^{87}\) Bloch, ‘Hemlock Poisoning and the Death of Socrates’, 258.
\(^{88}\) Pl. Phd 116D.
\(^{89}\) ibid., 117A.
\(^{90}\) Plin. HN 25.151.
\(^{91}\) Theophr. Hist. pl. 9.8.2.
\(^{92}\) ibid., 9.16.8, 9: ‘He (sc. Thrasyas of Mantinea) used to gather his hemlock, not just anywhere, but at Susa or some other cold and shady spot; and so too with the other ingredients’ (trans Hort).
\(^{93}\) Dioscorides, De materia medica, 4.78.1–2: ‘Before the seed has dried out, juice is extracted from the top foliage...the herb and the foliage, ground up’ (trans Beck).
\(^{94}\) ibid., 4.78.2: ‘Most potent are the Cretan, Magarian, Attic, and those growing in Chios and Cilicia’.
Modern medical opinion errs on the side of safety, declaring that all parts of the plant are poisonous. According to one study seeds contain the highest concentration,\textsuperscript{95} according to another young leaves in spring are the most toxic and roots the least.\textsuperscript{96} Yet another modern study found that the root contains the greatest concentration of toxin, although all parts are poisonous.\textsuperscript{97} A further study claims that the whole plant is toxic, especially its roots and seeds.\textsuperscript{98}

There is disagreement not only between ancient and modern sources but also amongst modern authorities. One problem is that the concentration and the proportions of the toxins vary widely. It is now known that the active ingredients, or toxins, are several volatile alkaloids.\textsuperscript{99} The most important are coniine that causes initial stimulation followed by depression of the nervous system and \(\gamma\)-coniceine (effects similar to those of nicotine).\textsuperscript{100} These alkaloids are neurotoxins and cause death by respiratory paralysis.\textsuperscript{101} The concentration and proportions of these toxins in the plant depend on numerous factors including temperature, soil moisture, stage of plant growth, the part of the plant analysed, time of year and even the time of day.\textsuperscript{102} This is not surprising. Plants are living organisms with their own metabolic requirements. Although it is possible that insufficient poison was administered to Seneca it does seem unlikely. The totality of the evidence indicates that it is more probable that Seneca’s dose was prepared from the wrong plant.
Fatal confusion

Poison hemlock is closely related to various edible plants, including wild carrot (Daucus carota), so-called ‘fool’s parsley’ (Aethusa cynapium), parsnip, caraway and fennel. It bears a close resemblance to its harmless relatives. It grows easily, and prolifically, especially in disturbed soil. Most modern cases of human poisoning have been accidental and due to mistaken identification, like that of a four-year-old boy who ate the green tops of ‘wild carrots’ growing in the backyard of his home.\(^{103}\) The ‘wild carrots’ were in reality hemlock plants.

In another modern example hemlock was mistaken for parsley. This is an interesting case study in that Bennett, the pathologist who performed the autopsy, carried out a thorough investigation of the cause of death and has left a detailed description of his findings.\(^{104}\) About eleven ounces of ‘some raw green vegetable resembling parsley’ was discovered at the post-mortem examination of the body.\(^{105}\) Using various methods he was able to identify the vegetable matter in the stomach contents as consisting of *Conium maculatum* (L).\(^{106}\) In order to obtain ‘a perfect history’ Bennett interviewed everyone who saw the victim, a man named Duncan Gow, from the time he ate the hemlock until he was taken to the Royal Infirmary of Edinburgh where he was declared dead.\(^{107}\) Less than an hour after Gow ate the plants the first symptoms of hemlock poisoning were evident, although they went unrecognised. Several of Bennett’s informants assumed the victim was staggering because he was intoxicated.\(^{108}\) Approximately two hours after the ingestion of the poison there was complete paralysis of both legs and both arms; Gow, however, remained mentally alert.\(^{109}\) He was pronounced dead some three and one quarter hours after eating the hemlock.\(^{110}\) Bennett also visited the place from which the plants had been collected, finding a ‘considerable quantity’ of hemlock growing close by,\(^{111}\) although he was

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\(^{103}\) Frank et al., ‘Ingestion of Poison Hemlock’, 573.


\(^{105}\) ibid., 461.

\(^{106}\) ibid., 461–462.

\(^{107}\) ibid., 459, 462.

\(^{108}\) ibid., 460, 461.

\(^{109}\) ibid., 460.

\(^{110}\) ibid., 461.

\(^{111}\) ibid., 460.
unable to ascertain how much hemlock Gow had eaten. In yet another instance, members of the same family suffered hemlock poisoning after they ate a dinner of fish and parsley; hemlock had been mixed in with the parsley. The people who had collected the herb, which was growing in the middle of a patch of parsley, had failed to distinguish the minor differences between the two species.

There is a tendency to believe that people in pre-modern societies, whether ancient or contemporary, were and are more adept at the identification of plants than most people in technologically advanced societies. This is not always so. In his *Natural History* Pliny reports that whole households and all the guests at banquets have been killed by eating poison mushrooms in mistake for edible varieties. He cites specifically Annaeus Serenus, the prefect of Nero’s guard, along with his tribunes and centurions. In recent times in rural Africa wild-derived herbal remedies are more common than in our own society. Yet here, too, people have died when a toxic plant has been wrongly identified as a therapeutic herb of similar appearance and used in its place. One of the results of this study has been a demonstration of some of the limitations of Seneca’s society in the practical skill of accurately identifying some plants, even those commonly used as food or as therapeutic drugs, as well as those known to be toxic.

**Seneca’s hemlock**

It is not difficult to imagine that Seneca had hemlock growing in the garden. It has been in the past regarded as an ornamental plant. That is the reason it was introduced into the United States and Oceania. In Roman times it was also used as a medicinal herb. These are two good reasons it might have been found in a Roman garden. Tacitus tells us that Seneca had provided himself with hemlock some time before. What better way to have it always on hand than to have it growing in the

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112 ibid.
113 *Taylor’s Principles and Practice of Medical Jurisprudence*, 682.
114 ibid. Some of the symptoms reported by Taylor are not consistent with poisoning by *Conium maculatum*. There may have been other factors involved. The entry in Taylor indicates that the original source suspected another source of poison as well as the hemlock; it notes that the fish were ‘quite fresh’.
115 Plin. *HN* 22.47.
Thus far I have had little success in finding evidence that would indicate the presence of hemlock in Roman gardens. Jashemski notes the presence of various weeds, including wild carrot, in a vineyard belonging to the villa of L. Crassus Tertius.\textsuperscript{118} If wild carrot had been growing in Seneca’s garden it is possible that it was mistaken for hemlock.\textsuperscript{119} In this instance perhaps the reverse occurred and a harmless plant was wrongly identified as the toxic herb. Was Seneca’s ‘hemlock’ really wild carrot?

**Conclusion**

Tacitus’ account omits one vital piece of evidence which could indicate whether the potion given to Seneca was prepared from hemlock. He does not record whether Seneca felt the first symptoms of hemlock poisoning, symptoms which then wore off in the manner described by Harley because he had not ingested a lethal amount of the toxins. Without this information it is not possible to settle beyond reasonable doubt the question of whether Seneca was given hemlock that was too degraded or too diluted to be lethal, or whether his drink was made from a harmless vegetable like wild carrot or parsley mistakenly identified as hemlock. Making a lethal draught from parts of the fresh hemlock plant is a simple matter. A dose which was too diluted to kill seems less likely than using the wrong plant. Little material is required and all parts of the hemlock plant are toxic. Since the aim was to kill there would have been no hesitation in using more material than the minimum thought to be necessary. Theophrastus provides two simple and rapid methods of preparation which he claimed would be quickly fatal, one of which has been confirmed by a modern example. If the poison had been provided in the form of pills which had been prepared in advance, there were two methods potentially available in Seneca’s time. Both result in a stable compound which would have lasted for several years at least. The case studies presented demonstrate how easy it is to gather the wrong plant, with fatal results, even when the hemlock is growing amongst edible herbs. The reverse can apply: a harmless plant can be mistaken for hemlock.


\textsuperscript{119} Frank et al., ‘Ingestion of Poison Hemlock’, 573.