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Why are plants named after witches and devils in north-western Europe?

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ABSTRACT

Ethnopharmacological relevance: Witches in Western Europe are associated with the use of medicinal, abortifacient, hallucinogenic, and toxic plants. Curiously, these associations are not backed up by first-hand evidence and historians are unconvinced that people convicted as witches were herbalists. Local plant names provide an untapped source for analysing witchcraft–plant relationships.
Aim of the study: We analysed vernacular plant names indicating an association with witches and devils to find out why these species and witchcraft were linked.
Materials and methods: We constructed a database with vernacular names containing the terms *witch* and *devil* in related north-west European languages. The devil was added because of its association with witchcraft. The plant species' characteristics (e.g., medicinal use, toxicity) were assessed to determine if there were non-random associations between these traits and their names.
Results: We encountered 1263 unique vernacular name–taxa combinations (425 plant taxa; 97 families). Most species named after witches and/or devils were found within the Asteraceae, Ranunculaceae, and Rosaceae. For Dutch, German and English we confirmed associations between witchcraft names and toxicity. Hallucinogenic plants do not appear to be associated with witch-names. For Dutch, we found significant associations between plant names and medicinal and apotropaic uses, although we did not find any association with abortifacient qualities.
Conclusions: This study demonstrates that there is a wide variety of plants associated with witches and the devil in north-western Europe. Plant names with the terms *witch* and *devil* were likely used in a pejorative manner to name toxic and weedy plants, and functioned as a warning for their harmful properties. Our study provides novel insights for research into the history of witchcraft and its associated plant species.

1. Introduction

In the north-western European context, the words *witch* (English), *heks* (Dutch) and *hexe* (German) historically often bear negative connotations alluding to people with supernatural powers (www.oed.com; www.vandale.nl; www.dwds.de; Hutton, 2018a). Witches in these different languages appear in fiction and folk traditions, often as malignant women intent on doing harm to others. In the 15th and 18th century, people were in reality persecuted for witchcraft in Europe and the USA, and some sources stated that the witches' powers came from a pact with the Devil (Hutton, 2018a). Evidently, the definition of 'witch' depends on the time period, region and social class of the discussant. While for centuries the term has borne negative connotations, from the 20th century onwards the word *witch* in different languages can also have a positive significance, meaning something like a herbal healer or ritual expert (Hutton, 2018a, 2018b; Smit et al., 2023). Indeed, witches in western Europe are currently associated with the use of medicinal, abortifacient, hallucinogenic, and toxic plants, reflected in popular culture such as books, movies, museum objects and art. Scientific publications on the history of European folk medicine and ritual plant use generally reinforce these associations (e.g., Müller, 1998; Lee, 2006, 2007; Fatur, 2020). Species frequently mentioned as witchcraft plants include the European members of the nightshade family (Solanaceae). Plants such as *Atropa belladonna* L., *Hyoscyamus niger* L. and *Mandragora*

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officinarum L. are often said to have been used by European witches for their medicinal or hallucinogenic effects (e.g., Rätsch, 2005; Schultes et al., 2001). These species are also named after witches in Dutch and German (Marzell, 1943–1979; www.meertens.knaw.nl/pland/). However, the claims that they were used by witches are scarcely backed up by first-hand historical sources. Historians have found little evidence that people considered to be witches in the past used these specific plants for such purposes (Ostling, 2014, 2016; Hutton, 2018b; Hofhuis, 2022). The persistence of the view that European witches were pre-Christian priestesses who used Solanaceae species and other toxic plants for ritualistic purposes, even held by ethnobotanists, is too restricted and historically inaccurate. Witchcraft trial documents from northern Norway and Poland that were assessed for their ethnobotanical content revealed that diverse plant species (not only nightshades) and even fungi (*Claviceps purpurea* (Fr.) Tul.), were mentioned by witnesses, suspects, and interrogators (Ostling, 2014; Alm, 2003). However, few recent studies specifically investigated associations between plants and European witchcraft based on original historical documents (Ostling, 2014; Alm, 2003). Thus, the question as to why these specific plant species were associated with witchcraft remains largely unaddressed.

There are many associations between plants and witchcraft in Europe that still deserve ethnobotanical attention. A major source of such associations can be found in local plant names, documented in folklore studies and national databases. Vernacular names, especially compound names consisting of more than one word, expose associations that people have with the plants in question, or, at least, associations of the persons who named them in the past (Hunn and Brown, 2011, Šeškauskaitė and Gliwa, 2006). Several motives can play a role in the process of naming plants: form, color, smell, or specific uses (Van 't Klooster et al., 2022; Najem et al., 2022). For example, *Digitalis purpurea* L. is called *witch's thimbles* for the form of its flowers and *Convolvulus arvensis* L. (Fig. 1) is called *duivelsnaaigaren* (devil's sewing thread) referring to its winding habit (Grigson, 1975; www.meertens.knaw.nl/pland/). So, vernacular names provide clues about the perceived characteristics of plant species, shedding light on the (forgotten) history of plants and people (Hunn and Brown, 2011; Van Andel et al., 2014; Van 't Klooster et al., 2022). In this paper, we discuss the broader associations between plants and witchcraft in vernacular plant names and statistically elucidate the reasons behind these associations.

Although no statistical analyses of reasonings behind plant names have been conducted so far, West European scholars were long intrigued by local plant names. In the Netherlands and Belgium, for instance, vernacular plant names were extensively collected in the 19th and 20th centuries by botanists, folklorists and linguists through interviews and questionnaires (e.g., Paque, 1896; Heukels, 1907; Franke and Van de Ploeg, 1955). These data were subsequently assembled and complemented into larger - sometimes online – databases or publications (for German plant names: Marzell, 1943–1979; English: Grigson, 1975; www.plant-lore.com; Spanish: Álvarez Arias, 2006; Dutch: www.meertens.knaw.nl/pland/; Brok, 1991, 2010). Some recent studies have analysed the different names in various languages for one species (Dafni et al., 2013, 2021). Other scientific studies on plant names in European languages have focused on names referring to animals and the possible motivations behind their selection. In the cases of plants named after dogs, horses and pigs, it appeared that these were often used in the pejorative sense to indicate that the plant was of inferior quality as food, considered a weed, or resembled a plant with these qualities (Haber, 1963; Stroop, 1969; Brok, 1991; Van Asseldonk, 2004). Plant species with the prefix bear often had a specific growth form, hairy stems or leaves or were believed to be eaten by bears, indicating an ecological component (Kolosova et al., 2017). Scholars hypothesized that plant species bear witches' names because they possess traits that people perceive as negative (e.g., toxic, weedy, thorny), but also apotropaic qualities (protecting against evil) have been proposed, such as *jaag-de-duivel* ('hunt the devil') in Dutch for *Hypericum perforatum* L. (Marzell, 1943–1979; Uittien, 1946; Grigson, 1975; De Cleene and Lejeune, 2000). However, this relation between plant traits and 'negative names' has never been statistically analysed.

The aim of this paper is to review vernacular names that indicate an association with witches and find out the reason why. For this, we broadened our study to include magic and the devil, because these concepts were historically strongly associated with witches (Hutton, 2018b). Our focus is on north-west Europe and Germanic languages, as extensive lists and databases with verified scientific plant names are available for these languages, and because we assumed that the etymologies and definitions of the words *witch* and *devil* are comparable. Our main research question was: Are plant species with a *witch* and/or *devil* component in their name more likely than other species to be abortifacient, apotropaic, foul smelling, hallucinogenic, medicinal, parasitic, thorny, toxic or weedy? To answer this question, we posed several sub-questions: Which plant species have a Germanic vernacular name that is associated with witches and devils? Do we find similar species in different languages? Do different plant characteristics predict if a species is named either after witches or devils?

We hypothesized that plant names referring to witches or devils are associated with species that have 'negative' traits (spines, toxic, weeds, foul smell, parasitic nature). The reason could be that plants with such characteristics or seemingly strange habits are often associated with witchcraft because people were angered by them or the plants were regarded with suspicion, thus attracting pejorative names (Haber, 1963). These names stuck because the associations with witches, devils, or other evil entities are more easily remembered (Uittien, 1946). Besides, to communicate and transfer plant knowledge, people may have included evil in vernacular names to function as a warning for the plant's dangerous properties. To communicate that a plant species can be used to protect against evil we likewise hypothesized an association between these plant names and apotropaic uses.

On the other hand, we did not expect plant names with witch and devil to be more often medicinal, abortifacient or hallucinogenic, as witchcraft trial documents have not provided evidence for this association (Ostling, 2014; Van de Garde and Ruijs-Janssen, 2014, 2015; Hofhuis, 2022). Furthermore, we investigated if the same species are named after witches and devils in different Germanic languages, to verify whether these associations with evil were consistent across languages. The official definition of witches explicated that they had a pact with the devil (Hofhuis, 2022), so they were tightly associated with each other. Therefore, we expected that the same plant characteristics drive the process of naming a plant either after a witch or a devil.

Fig. 1. *Convolvulus arvensis* (Convolvulaceae), known as *duivelsnaaigaren* in Dutch, climbing over a hedge. Photograph by I. Pombo Geertsma.

2. Methods

2.1. Collecting vernacular names and species

We performed a literature search in English, Dutch, German, Frisian, and Scandinavian databases and published and unpublished sources on 19th-21st century folk plant names (Table 1). Given the floristic similarity, we only included areas inside north-western Europe in which those languages are spoken and did not consider overseas areas (e.g., the USA, Suriname). We compiled a database with vernacular plant names containing the terms *witch* and *devil* and synonyms and cognates of these terms (e.g., *hag*, *sorcerer*) along with their associated scientific names. A major source for Dutch (The Netherlands and Belgium) and Frisian (The Netherlands) vernacular plant names was the database managed by the Meertens Institute, which contains more than 333,333 keyword entries based on surveys done in the 19th and 20th centuries with the help of local informants such as school teachers and approximately 530 (un) published sources (Brok, 2010; Meertens Instituut, n.d.). For further quantitative analysis, we combined Frisian and Dutch names. For the English vernacular plant names (limited to the United Kingdom), we consulted the Plant-Lore database (with a total of 14,294 vernacular plant names-taxa combinations) which is composed of the sources presented in Table 1 and unique unpublished material. Where possible, all English entries were checked in the original publications. The main German (Germany) source was a series of seven books (Marzell, 1943–1979) and is the most comprehensive source on German plant names, based on numerous sources such as newspaper articles, reader submissions and various (un)published works. This was complemented by literature on Austrian vernacular plant names (Smola, 1958; Korkisch, 1981). The Scandinavian (Norwegian and Swedish) database Diabas is a private database with plant names gathered from dialect and folklore archives and books. This data was supplemented with Scandinavian (Norway) plant names provided by Teixidor-Toneu et al. (2020). Danish was not included in our study because we did not have access to published Danish vernacular names due to COVID-19 restrictions. No information is provided on the number of speakers using certain plant names in the data sources used. Synonyms and cognates for terms referring to witch, devil, etc. were looked up in online dictionaries and etymology databases (Dutch: www.mijnwoordenboek.nl/synoniemen, www.etymologiebank.nl; German: https://synonyme.woxikon.de/synonyme, www.dwds.de/wb, www.openthesaurus.de; English: www.synonym.com/synonyms, www.collinsdictionary.com/dictionary/english-thesaurus, www.etymonline.com). Scandinavian names and plant species containing these terms were supplied by Lars-Erik Edlund of the Umeå Universitet, Sweden. When we encountered vernacular plant names with components signifying other mythological creatures, such as *fairy* and *elf*, we added these to the list because they were associated with evil as well, but they were not used in our further analysis. We merged names that were spelt similarly. The sources we consulted did not merge single and plural forms of plant names, nor possessive and non-possessive forms, for example, *duivel**s**kruid* and *duivelkruid* (Dutch for devil(s)weed), and we also kept these separate. As each folk name was to be linked to a species or genus, only vernacular name–taxon combinations were included for which the taxon was explicitly stated by the author. Combinations with uncertain identifications were omitted, because the folk names are not linked to herbarium vouchers or images. Scientific plant names were updated using the World Flora Online (WFO, http://www.worldfloraonline.org), and local country's floras in case of unresolved names.

2.2. Data analysis

To analyse the overlap of species named after witches or devils between countries, we made area-proportional Venn diagrams using DeepVenn for German, English and Dutch (Hulsen, 2022). To verify whether species were named after witches or devils because of their toxicity and/or weedy nature we conducted chi-square tests of homogeneity per language area in the R-base package stats (R Core Team, 2023). We omitted Swedish and Norwegian names from these analyses because we had too few species from these languages. Firstly, we collected the following information into a spreadsheet: total native flora lists for the UK and Ireland (Botanical Society of Britain & Ireland https://bsbi.org/taxon-lists), the Netherlands and Flanders (Belgium) (www.soortenbank.nl for the Netherlands; Van Landuyt, personal comm. 2021 for Flanders) and Germany (https://www.floraweb.de/). We checked and standardized scientific plant names between countries using the R-package "WorldFlora" v. 1.13–2 (Kindt, 2020), based on WFO v.2022.04. In exceptional cases, such as when a species name was unresolved (e.g., *Rubus fruticosus* L.), we checked the local country's flora and left the species in if it represented an accepted name.

Next, we compiled lists in a spreadsheet of native toxic plants and weeds per country or region (De Cleene, 2000; Hyppa, 2000; Duistermaat, 2020).- We analysed the relative frequencies of witch/devil-associated species found within the complete flora and subsections of this flora respectively containing all known toxic plant species or all weedy species. We performed each analysis twice, where we included or omitted the genera *Rubus*, *Hieracium* and *Taraxacum* for the total flora, as the nomenclature of these genera differs greatly between countries, and Dutch botanists accept fewer species in these genera than colleagues in the UK and Germany (Duistermaat, 2020; https://bsbi.org/taxon-lists; https://www.floraweb.de/). Furthermore, non-botanists likely fail to differentiate species within these genera.

Table 1
Sources used to retrieve vernacular plant names. Note that not all sources contained names referring to witches and devils. The languages are restricted to the geographical areas of the Netherlands, Belgium, England, Germany, Austria, Norway, Sweden and Finland.

Language	Source	Reference (n.d. = no date, unpublished)
Dutch, Frisian	Published	Heukels (1907)
Dutch, Frisian	Online database	PLAND, n.d. (https://www.meertens.knaw.nl/pland/); Soortenbank, n.d. www.soortenbank.nl
Dutch, Frisian	Unpublished	Fryske Akademy, n.d.
English	Published	Amphlett and Rea (1909); Arnott (1906a, 1906b); Bland (2012); Britten and Holland (1886); Cuddy (1991); Dacombe (1951); Davey (1909); Fowler (1890); Grigson (1975, 1987); Kenicer (2018); Laycock (1916); Mabey (1996); Macmillan (1922); Reid (1917); Sanford and Fisk (2010); Tangye (2008); Vesey-Fitsgerald (1944); Watts (2000); Wiltshire (1975).
English	Online database	Plant-Lore (www.plant-lore.com)
English	Unpublished	Britten & Holland (n.d.); Bulter (n.d.); Rowe (n.d.)
German	Published	Marzell (1943–1979); Korkisch (1981); Smola (1958)
German	Online database	Flora Germanica (www.flora-germanica.de)
Norwegian	Published	Teixidor-Toneu et al. (2020)
Swedish, Norwegian	Private database	Diabas Edlund (n.d.)

Table 2
Search terms related to witch, devil, magic and other closely related mythological creatures per language, including all known synonyms and number of plant names per term.

Language	Category	Component (# vernacular names–taxa combinations including this term)
Dutch, Frisian	Devil	Duivel (215), Duvel (18), Duyvel (2).
	Witch	Heks (40), Helleveeg (0), Kol (104), Col (3), Loeder (0), Tovenaar (1), Toveresse (1), Feeks (0), Haaibaai (0), Magi (sch/e) (0), Viswijf (0).
	Magic	Tover (5).
	Other	Alf (8), Elf (4), Oelk (2), Oerk (2).
English	Devil	Devil (140).
	Witch	Beldam (0), Crone (2), Enchanter (1), Hag (20), Hex (0), Sorcerer/Sorceress (1), Warlock (1), Witch (50), Wizard (1).
	Magic	Magic (1), Magik (0).
	Other	Drycraeft (0), Elf (3), Fairy (53), Necromancy (0), Occultist (0), Troll (1).
German	Devil	Diabolus (0), Luzifer (0), Satan (1), Teufel (355).
	Witch	Böse Frau (0), Drude (27), Hagazussa (0), Hazas (sa) (0), Hazussa (0), Hecse (0), Hesse (0), Hex(e) (125), Luder (0), Unholde (4).
	Magic	Magie (0), Zauber (6), Zauberin.
	Other	Elf (13), Nikromantie (0), Okkultismus (0), Schatskünstlerin (0), Scheusal (0), Schwartsmagierin (0), Schwarze kunst (0), Xanthippe (0).
Norwegian	Devil	Djävelun (0), Fan (0).
	Witch	Häx (1), Heks (3), Hex (0).
	Magic	Magi (0).
	Other	Troll (9).
Swedish	Devil	Djävelun (1), Fan (8).
	Witch	Häxe (0), Hekse (0), Hex (0).
	Magic	Magi (0).
	Other	Troll (28).

To verify whether species were named after witches or devils because of their medicinal and apotropaic qualities in the Netherlands, we performed Fisher's exact test in the R-base package stats (R Core Team, 2023). For this we first scored native plant species with Dutch vernacular names in our dataset if it was used to protect against witches (De Cleene and Lejeune, 2000) and if the plant species was used in Dutch folk medicine or abortifacients (Van Andel, 1909). To verify Van Andel's (1909) species, who was not a botanist but a physician, we searched for original voucher specimens collected by him and asked historians who were familiar with his work. However, he did not collect plant vouchers, so we were not able to verify his species identifications. For the analysis on associations between plants named after witches and medicinal plants and abortifacients, we did not include other languages, because no adequate sources were available to us.

Finally, we performed a detrended correspondence analysis (DCA) in the R-package "vegan" v. 2.6–4 (Oksanen et al., 2022) to verify whether there are certain characteristics that cause the difference between species with a name containing either *witch* or *devil* and species that have at least two names, one containing *witch* and another *devil*. For this, we scored all species for the following characteristics: toxicity for animals and humans separately, also specifying species that led to documented human deaths (De Cleene, 2000; Duistermaat, 2020); hallucinogenic uses (Schultes et al., 2001; herbarium voucher labels at Naturalis Biodiversity Center, Leiden, the Netherlands (L)); spines, thorns, stings or other prickles (field observations; herbarium vouchers (L); botanical illustrations; Google Images; sources Table 1); if it is considered a weed (Hyppa, 2000); if the plant species smells foul (floristic literature; vernacular name sources; herbarium vouchers (L); google searches on "foul smelling/stinking/malodorous/reeking/bad smelling/etc plants"); if it has a parasitic habit (Table 1; floras). This was also used to calculate the proportions of plants with the above-mentioned characteristics. All statistical analyses except the Venn diagrams were performed in R v. 4.3.1 (R Core Team, 2023).

3. Results and discussion

3.1. Vernacular names referring to evil creatures

We encountered 1263 unique vernacular name–taxa combinations (Supplementary file 1). These vernacular names contain *witch*, *devil*, magic components and components referring to other mythological creatures in Dutch (394), English (274), Frisian (13), German (531), Norwegian (13) and Swedish (37), in the Netherlands, Belgium (specifically Flanders), the United Kingdom, Germany, Austria, Norway and Sweden (Table 2). Of these vernacular plant names, 385 (31 %) referred to witches, 743 (59 %) to devils, 13 (1 %) to magic and 124 (10 %) to other mythological creatures such as elves (Table 2). The same vernacular name was often used for more than just one species. For example, the German vernacular name *hexekraut* (witches' herb) is associated with at least 38 different species (Supplementary File 1).

3.2. Obscure etymologies

Interpretation of these plant names was often obscured by confusing etymologies, and possibly not all plant names with a *witch* component refer to them. *Witchwood* is one of many names documented for *Sorbus aucuparia* L. (Fig. 2) in the UK, but it is unclear if *witch* in this name is a corruption of the Old English word *wicc*, which can mean pliant – the flexible branches of this tree were used to make bows (Grigson, 1975) – or "female magician, sorceress" in Old English (www.etymonline.com). This makes the interpretation in *witchwood* for *S. aucuparia* ambiguous, although we chose to keep it in our dataset. The English term *hag*, a synonym of witch and cognate of the Dutch *heks* and German *Hexe* (Alinei, 2001), in *hagbush* and *hag-tree* for *Crataegus monogyna* Jacq. (hawthorn), can also mean hedge (Massey and Degruy, 2015). Indeed,

Fig. 2. Flowering branch of *Sorbus aucuparia*. Its names in English are *witchen*, *witchin*, *witchwood*, *witchbeam*, *with-hazel*, *witch-wicken* and *witch-wiggin-three*. Photograph by C. van der Linden.

Fig. 3. A hedge made from *Crataegus monogyna* in Wageningen, the Netherlands. In English, the vernacular names are *hag*, *haggils*, *hag-bush*, *hag-tree*, *haggil*, *haggle berries*, *hag-thorn*, *haggalans*, *haglet* and *fairy thorn*. Photograph by I. Pombo Geertsma.

Fig. 4. Flower of *Papaver rhoeas*. We found 24 Dutch names for this species, including *kolbloem*, *kolle*, *kollebos*, *kollebosbloem*, *kollenbloem*, *kollenbrander*, *kolroos*, *rode-kol* and *wilde-kol*. The term 'kol' in Dutch can refer to its round seed capsule, or to a witch. Photograph by C. van der Linden.

C. monogyna was and is still used to delimit areas or to contain livestock (Fig. 3). So, its meaning remains obscure and the meaning(s) of 'hag' in *C. monogyna*'s vernacular names deserve further etymological consideration by linguists.

'Kol' is a widely-used synonym for witch in Dutch, but *kol*-in vernacular plant names such as for *Papaver rhoeas* L. (Fig. 4) may also refer to its capsule (Brok, 1991). In cases such as *kolbloem* or *rode-kol* it may indeed refer to its seedhead (Brok, 1991), but in the case of *kolroos* (*roos* refers to species of *Rosa*) it may be a way to indicate that this is the "lesser" rose, thus using 'kol' pejoratively. In German we documented two names for this species, *hexe* and *teufels-blume*, in Swedish *fans-örta* and English *devil's tongue,* both names referring to the devil, indicating that the species was seen in a negative light. Depending on the specific vernacular name, both meanings fit the corpus of Dutch *kol* names for *P. rhoeas*. So, we decided to retain all Dutch vernacular name cases containing the *kol*-component in our analysis. However, on the other hand, we chose to omit all German names containing the *kol* component, because here the etymology seems to be more robust. In plants, the term *kol* refers to the form of seed capsules: *Kol* or *Kolle* in German meaning "head; the uppermost part of plants" (Foerste, 1967).

Some vernacular plant names referred to elves, fairies and magic. In English and Scottish folklore, these beings were associated with witchcraft (Bonser, 1926; Hall, 2005). In Drenthe (the Netherlands), *oelk* and *oerk* (Table 2; *Glechoma hederacea* L.) refer to small benign creatures that have the ability to heal (Uittien, 1933), but it remains unknown whether these mythological creatures were associated with witchcraft.

3.3. Plant taxa related to witchcraft

The 1263 vernacular plant name–taxa combinations correspond to 380 species. An additional 45 taxa were documented only to genus level in the consulted sources (Fig. 5). These species and genera are scattered over 97 families. The best-represented families in the dataset were Asteraceae, with 41 different species (11 % of the total), followed by Ranunculaceae (29 species; 8 %) and Rosaceae (27 spp.; 7 %). The Solanaceae family had relatively few species (10 spp.; 3 %). The best-represented genera in our dataset were *Euphorbia* with 11 species, *Ranunculus* with 7 species, and *Silene* with 5 species. We found the greatest number of relevant vernacular names for *Lycopodium clavatum* L. (30), followed by *Papaver rhoeas* L. (28) and *Viscum album* L. (27). The species with the most German witchcraft-related names was *Lycopodium clavatum* (28), for Dutch names this was *P. rhoeas* (24), for English names *Digitalis purpurea* (13), most Swedish names for *Frangula alnus* Mill. (6) and most Norwegian names for *F. alnus* (2) and *Circaea alpina* L. (2).

The typical Solanaceae witchcraft plants mentioned in the literature (e.g., Schultes et al., 2001; Mann, 1996; Lee, 2007) were also called after devils, witches, magic, elves, and trolls. The (in)famous henbane, *Hyoscyamus niger* is called *heksenkruid* in Dutch, *devil's eye* in English, and in German: *teufel-auge, teufel-kraut, teufel-samen, teufel-wurz* (*el*). *Mandragora officinarum* is called *duiveljong* in Dutch, and in German: *hexekraut*, *unholden-wurz*, *teufelapfel* and *zauberwurz* (Supplementary file 1). *Atropa belladonna* has many local names in Dutch, English and German, but only with a devil component. Both *M. officinarum* and *A. belladonna* are also associated with witches and devils in folklore (Waniakowa, 2007). In an analysis of European and Arabic plant names for *M. officinarum*, Dafni et al. (2021) found names referring to witches only in Dutch, English and German. We believe this indicates that the association between this species and witches is something typical of north-western Europe. Nonetheless, our results represent a wide botanical diversity distributed over many families, not limited to Solanaceae. These species were not mainly found in the Solanaceae family as might be expected from their modern association with witches, but more in the species-rich Asteraceae, Ranunculaceae and Rosaceae families.

3.4. Overlap in species in different languages

There was little overlap between Dutch, German and English species bearing names with *witch* and *devil* components (Supplementary file 2). We excluded Scandinavian species-name combinations in the Venn-diagrams, because the limited amount of data did not allow for a reliable representation of area-proportional diagrams. We found a larger overlap between languages for plant names referring to the devil (Fig. 6, Supplementary file 2), than for species with a *witch* component in their name (Fig. 7, Supplementary file 2). This may be a chance effect resulting from the higher number of plant species with *devil*-related vernacular names (n = 264) than *witch*-related vernacular names (n = 148). Alternatively, it could be caused by the term *devil* being less ambiguous across languages than the term *witch*, due to its strong link with the dominant religions throughout the investigated region. The *witch* may be more subject to variations in its meaning from culture to culture, resulting in more variability in the set of plant species that are associated with it in different languages. Still, there are remarkably more shared devil-related vernacular names (n = 19) than witch-related vernacular names (n = 2) among all three languages (Figs. 6 and 7).

Only two species had witch-related names in the three languages: *Taraxacum officinale* F.H.Wigg. And *Circaea lutetiana* L. (Fig. 7). For *T. officinale*, the Dutch *toveraartje* (meaning either magician or magic spike) and *toverheksen* (conjunction of magic and witches) refers to its

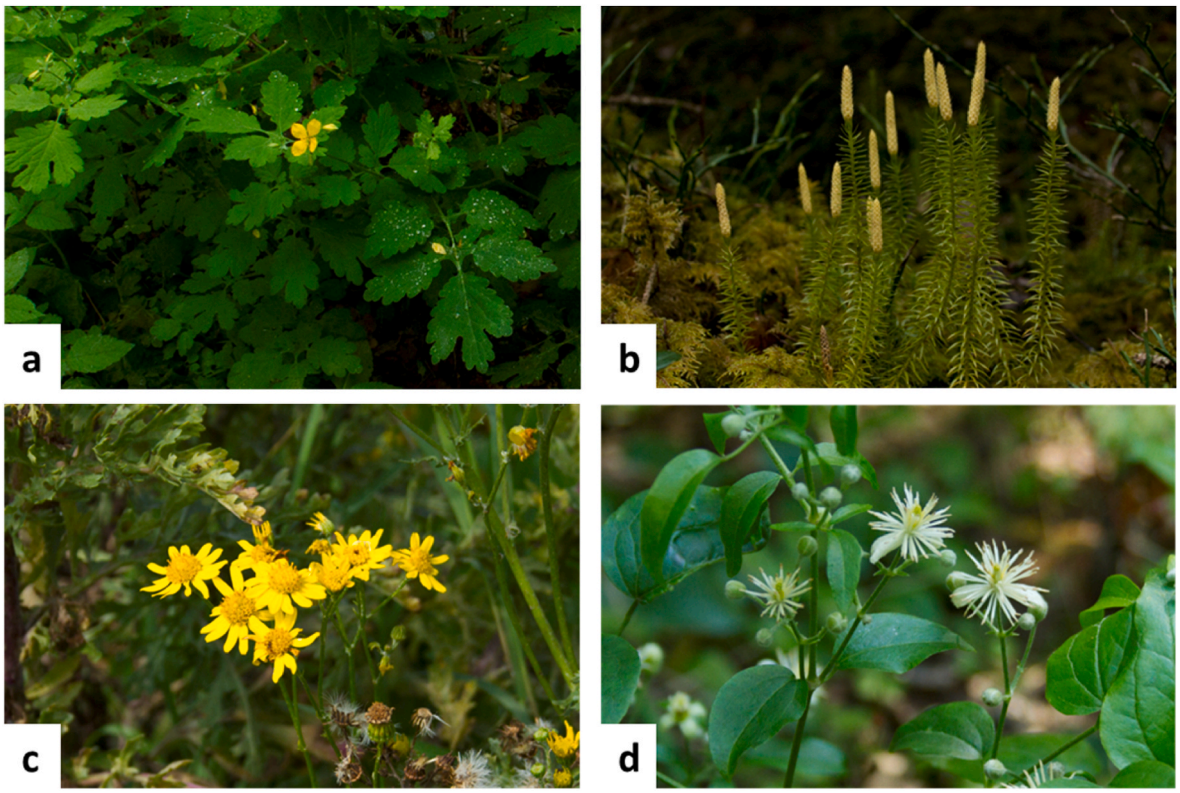

Fig. 5. Examples of plant species named after witches and devils. a) *Chelidonium majus* L., with 12 vernacular names, including *devil's milk*, *witch's flower*, *Hexekraut* (German) and *toverkruid* (magic herb in Dutch). b) *Lycopodium annotinum* L., named *heksemel* (witch's flour in Norwegian) and *drudenfuß* (witch's foot in German). c) *Jacobaea vulgaris* Gaertn., with seven witch-related names, including *fairy horse*, *duivelskruid* and *Teufel-kraut* (devil's herb in Dutch and German respectively). d) *Clematis vitalba* L., with 25 names related to evil, including *hexehaar* (witch's hair in German), *devil's guts* and *duivelskruid* (devil's herb in Dutch). Photographs: a & b by C. van der Linden, c & d by I. Pombo Geertsma.

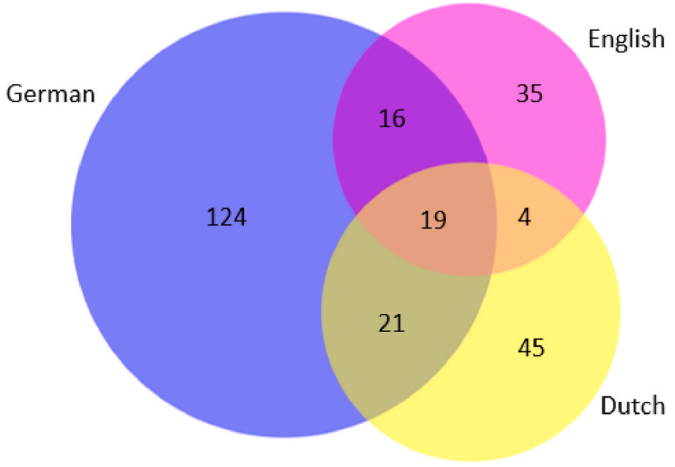

Fig. 6. Overlapping plant species per language with a *devil*-related vernacular name (N = 264).

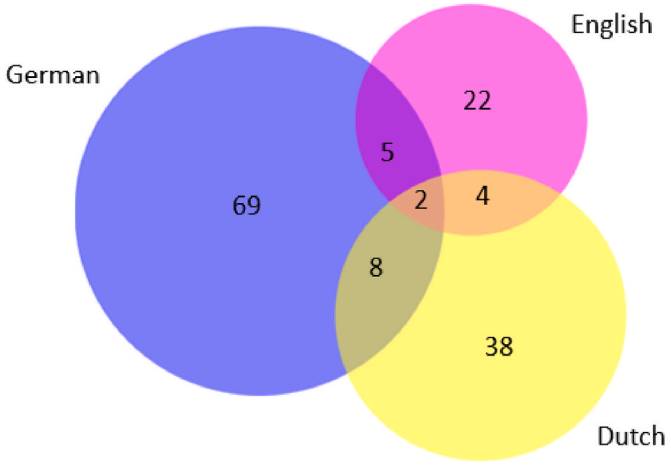

Fig. 7. Overlapping plant species per language with a *witch*-related vernacular name (N = 148).

use in future-predicting children's games, in which all the seeds were blown from the seedhead and the number of blows required gave answers to various questions (Brok, 1991). In Dutch we also found the name *kol* for *T. officinale* that finished flowering; however, it is unclear if it refers to a witch or to the round shape of the receptacle (Brok, 1991). Marzell and Paul (1979) does not give reasons for the *hex* component in the German names *hexelichter* (witch-lighter) and *hexemilch* (witches milk). In English, we found *witches' milk* and *witch gowan*. Gowan means yellow flower and *witch* in both names refers to the latex of *T. officinale* (Britten and Holland, 1886). Even though the 'witch' components for *T. officinale* overlap, the reasoning behind these names differ substantially, meaning that the reasons for associating witches with plants in different languages are diverse and ambiguous, even within one species.

The history of the association between witches and *Circaea lutetiana* follows a different path. We collected the names *toovenaarskruid* (Dutch, conjunction of wizard and herb), *enchanter's nightshade* and *Hexekraut* (German) and variants of these names. The genus name *Circaea* refers to the Greek goddess Circe, who was considered a witch and

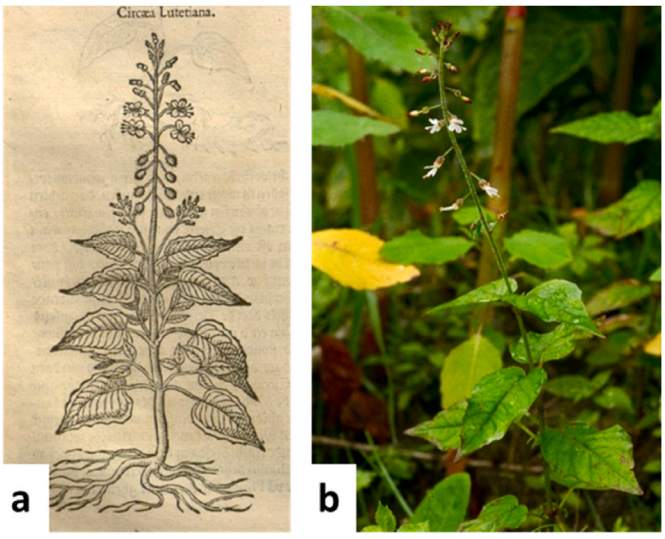

Fig. 8. a) Woodcut of *Circaea lutetiana* in De L'Obel (1581). b) Living individual of this species in Baden-Württemberg, Germany. Photograph by C. van der Linden.

knowledgeable about toxic plants. However, *C. lutetiana* is not toxic, does not have other notable (negative) characteristics and does not look like a plant that does have those characteristics. Several authors agree that the vernacular names of this species referring to witches and magic are translations of its scientific name as the plant hardly plays a role in folklore or folk medicine (Marzell, 1943; Grigson, 1975; De Cleene and Lejeune, 2000). In writing, the plant species *C. lutetiana* was first associated with Circe in the herbals of De l'Obel (1581; Fig. 8) and Dalechamp (1586) and later accepted by Linnaeus (1753). However, it was found impossible to clarify why this specific species was named after the Greek witch-goddess. An augmented investigation into other 16th-century herbals might elucidate this mystery. In this study we have hardly taken the influence of written texts on vernacular plant names into account, but *Circaea* is a likely example of a species bearing a scientific name influencing the associations people made – and still make – with this plant.

Because of the relatively little overlap of plant species named after witches (and to a lesser extent the devil), we tentatively conclude that naming plants after witches and devils has not followed a common pattern in these languages. It also indicates that these plant names are relatively young and were documented long after the three languages had differentiated. This, together with the frequent incidence of a large number of names per plant species and high regional diversity of plant names within languages, indicates that naming plants was often a local phenomenon.

3.5. Plant traits considered negative

Of the 380 plant species named after witches, the devil or other types of evil, we found 126 (33 %) to be toxic to humans, of which 48 (13 %) were reported as deadly, while 88 (23 %) are toxic to other animals, mainly livestock. Next, we found that 88 (23 %) species were considered a weed, 31 (8 %) species had spines, thorns, prickly and/or stinging hairs, 10 (3 %) were said to emit a foul smell and 8 (2 %) were (hemi-) parasitic.

Chi-square tests of homogeneity revealed that there was a significant association between toxicity and vernacular names referring to evil in German, Dutch and English (Table 3; Supplementary file 3). We also recovered a statistically significant association between weeds and vernacular names referring to evil in German, Dutch and English (Table 4; Supplementary file 3). We quantitatively established that the proportion of species with vernacular names referring to evil was consistently higher within subsets of the toxic and weedy species per language than when considering the complete flora of each respective country. For thorny, foul smelling and (hemi-)parasitic plant species we could not test its association with *witch*- and *devil*-names because we were unable to construct the necessary total plant species lists with these characteristics per country.

The consistent correlation of toxic plants and weeds more frequently bearing evil vernacular names, suggests that toxicity and weediness could be drivers for attributing these names to particular plant species. This finding would then agree with our hypothesis that plants with such characteristics obtain pejorative names alluding to witchcraft because they were considered harmful to people and livestock and a major threat

Table 3
Two by two tables of toxic native German, Dutch and English plant species respectively in relation to vernacular plant names. In all tested languages toxicity is associated with vernacular names referring to witches and the devil (German: χ^2 (1) = 84,573, $p < 2{,}2$ e−16; Dutch: χ^2 (1) = 77,948, $p <$ 2,2e-16; English: χ^2 (1) = 72,073, $p <$ 2.2e-16). The species in the genera *Rubus*, *Hieracium* and *Taraxacum* were discarded (see section 2.3). For the full flora results see Supplementary file 3.

		Witch/Devil name	
		present	absent
Flora Germany (2588 spp.)	not toxic	126	2121
	toxic	67	274
Flora the Netherlands and Flanders (Belgium) (1650 spp.)	not toxic	61	1367
	toxic	44	178
Flora United Kingdom (1376 spp.)	not toxic	53	1174
	toxic	33	116

Table 4
Two by two tables of native German, Dutch and English plant species considered weeds in relation to vernacular plant names. In all tested languages, weediness is associated with vernacular names referring to witches and the devil (German: χ^2 (1) = 33,276, p = 7,995e-09; Dutch: χ^2 (1) = 23,082, p = 1,662e-06; English: χ^2 (1) = 72,073, $p <$ 2.2e-16). The species in the genera *Rubus*, *Hieracium* and *Taraxacum* were discarded (see section 2.3). For the full flora results see Supplementary file 3.

		Witch/Devil name	
		present	absent
Flora Germany (2588 spp.)	not weedy	143	2118
	weed	50	277
Flora the Netherlands and Flanders (1650 spp.)	not weedy	62	1223
	weed	43	322
Flora United Kingdom (1376 spp.)	not weedy	66	1128
	weed	20	162

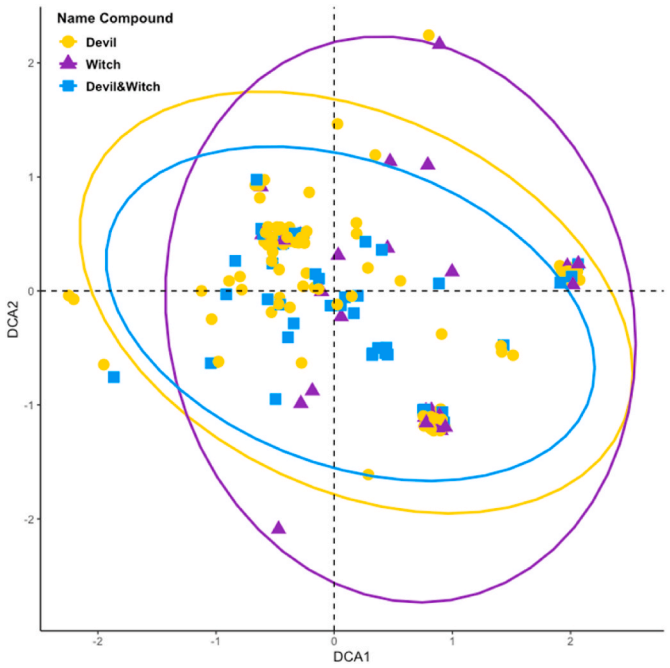

Fig. 9. DCA ordination diagram of plant species with vernacular plant names containing witch and/or devil or synonyms thereof. Each dot represents one species. The large overlap between ellipses for each set of plant species (devil, witch or both) demonstrates that the different scored characteristics (toxicity to humans/toxicity to animals/causing death to humans/hallucinogenic uses/foul smell/prickly/weedy/climbing habit/(half)parasitic habit) do not explain why a species is named after either a witch, the devil or both. In other words, not one of these characteristics explain the differences between species that are named after witches, devils or both. The axes represent standard deviations to visualize variation and similarity in plant composition. [COLOR SHOULD BE USED IN PRINT]. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

to agricultural productivity. Their vernacular names may have subsequently been kept because 'witch', 'devil', their synonyms and cognates may have been taboo words, which are more easily remembered (Jay et al., 2008). Uittien (1946) noted that agricultural weeds have far more vernacular names than species that were considered beautiful. Agricultural weeds have existed for millennia close to humans and therefore probably carry more vernacular names than species lesser known to humans. Should this be the case, it would then bias the weeds subset in our analysis, as they did not only receive a witch/devil name because they are "evil", but also because the probability of receiving a name is higher, and thus also an "evil" name. To clear this up further investigation is necessary. Still, such vernacular names would serve to advertise the plant's dangerous properties in society. This would be in line with other descriptive ethnobotanical studies on plant names, where negatively perceived properties are encapsulated in vernacular names, seemingly to serve as a reminder of certain plant properties (Haber, 1963; Stroop, 1969; Brok, 1991). Plants toxic to livestock may have also received their association through witch trials, as these historic documents reveal that supposed witches were occasionally blamed for enchanting cows (Deschrijver and Vanderheyden, 2012). This may have indirectly led to an association between witches and plants that are toxic for livestock, in turn ensuring that these plants obtained witch-related names.

3.6. Plants reported as hallucinogens

Testing the association between hallucinogenic properties and plant species with a witch or devil name was not possible due to too few species (8 spp.; 2 %) in our dataset. To what extent these species were historically used as hallucinogens remains unclear, as there are only a few first-hand historical reports of such uses in Western Europe. Here too, vernacular names could offer a glimpse into the historical uses of these plants as hallucinogens. Some Dutch plant name components refer to hallucinogenic uses of plants, such as the term *vaal-* and *val-* (for *Papaver rhoeas* and *Convolvulus sepium* (L.) R. Br.) referring to a Germanic term * *walha*-meaning "numbness, intoxication". Another example is *mal-Willempjes-kruid* (crazy-William's-herb; www.meertens.knaw.nl/pland/) for *Hyoscyamus niger,* likely referring to hallucinogenic, or at least toxic, effects. Elucidating which plants were historically used as hallucinogens is an essential first step in studying the associations of hallucinogenic plant species with witches or devils. The species that are hallucinogenic in our present dataset may therefore be an inaccurate reflection of the total hallucinogenic flora, as this selection is based on modern and non-exhaustive references, which do not reveal their historical use (Schultes et al., 2001; herbarium voucher labels at Naturalis). However, based on this set of plant species, we conclude that hallucinogenic plants are not frequently linked to witches and devils through their vernacular names. This stands in stark contrast to the attribution of such characteristics to typical witches' plants in popular culture and literature sources.

3.7. Witches' or devil's plant?

We encountered 47 species with two or more names, of which at least one had a devil component and another a witch component. The DCA ordination revealed that none of the scored plant species characteristics (Supplementary file 4) predicted whether a species was either named after the devil, after a witch or both (Fig. 9). This finding corresponds to our hypothesis that both witches and devils were used in the same manner to convey negatively perceived traits in a pejorative vernacular plant name. This is not surprising, due to the tight link between witches and devils throughout the history of witches. In the Early Modern Period (c. 1400–1800) witches were defined as people who collaborated with the devil to perform their evil deeds towards others (Hutton, 2018b; Hofhuis, 2022). Possibly, other plant traits we did not account for could distinguish between the witch and devil plant species assemblages. Suggestions for such plant traits include: (micro)-habitat, such as its proximity to water (dangerous for inattentive children that could drown there (Brok, 1991)), presence of latex, flower color and leaf structure.

Table 5
Two by two tables of Dutch medicinal plant species in relation to vernacular plant names. In Dutch, medicinal plants are associated with vernacular names referring to witches and the devil (Fisher's test: $p = 2{,}337\text{e-}10$). The species in the genera *Rubus*, *Hieracium* and *Taraxacum* were discarded (see section 2.3). For the full flora results see Supplementary file 3.

		Witch/Devil Name	
		present	absent
Flora the Netherlands and Flanders (Belgium) (1650 spp.)	not medicinal	84	1497
	medicinal	21	48

3.8. The Dutch link between medicinal and abortifacient plants and witchcraft

When examining the plants named after witches/devils in the Netherlands (129 spp.), 21 (16 %) of the species bearing such names were used medicinally in this country (Van Andel, 1909). A Fisher's exact test revealed that there was a significant association between species bearing witches and devil names and medicinal use (Table 5). This indicates that a higher proportion of witch and devil name-bearing species is medicinal than would be expected based on the proportion of plants bearing such names in the total country flora. This suggests that witches were associated with herbal medicine, something that contradicts the historians' claim that Dutch witchcraft trials' documents do not show that accused witches generally had knowledge about herbal medicine (De Blécourt, 1994; Hofhuis, 2022; Van de Garde and Ruijs-Janssen, 2014, 2015). Nowadays, witches are viewed as women that had knowledge of herbal medicine, and this is actively advocated in popular literature (Smit et al., 2023), but we have no written evidence that people who first attributed these plant names also made the same association. It is likely that people gave these names to certain species to communicate that a plant was medicinal and possibly people who were seen as witches used these plants medicinally. These associations do seem to confirm the popular idea (Smit et al., 2023) that people who were regarded as witches were knowledgeable about healing plants. On the other hand, we must take into account that the association may be caused by toxicity as a confounding factor: 76 % of the medicinal plants in this dataset are also toxic, meaning that there is a high probability that the association is not caused by a direct relationship between medicinal plants and witches' or devil's names.

Historical evidence of an association between witches and herbal medicine seems to differ across Europe. In the Netherlands and Scotland, there is little historical information confirming that people accused of witchcraft had anything to do with herbal medicine (De Blécourt, 1994; Goodare et al., 2003; Van de Garde and Ruijs-Janssen, 2014, 2015; Hofhuis, 2022). In countries such as England, Germany, Switzerland and Austria, there does seem to be some indication that people tried for witchcraft were sometimes knowledgeable about healing herbs and that having this knowledge put these people in more danger of being accused of witchcraft (Horsley, 1979). This illustrates that the study of associations between witches and medicinal plants should not be generalised at this point, and would benefit from a more local research approach. To understand the associations between medicinal plants and witchcraft through their vernacular names, it is necessary to take other countries than the Netherlands into account as well.

We only found two species with witch/devil names that were used as abortifacients: *Papaver somniferum* and *Brassica oleracea* (Van Andel, 1909). However, these two species have names with the *kol* component, possibly alluding to the form of *P. somniferum*'s seedhead, and a form of *kool* (=cabbage) for *B. oleracea*. As the vernacular names of both species likely do not refer to witches, we found no solid connection between *witch*- and *devil*-names and abortifacient characteristics, implying that people did not associate witches with the knowledge of performing abortions, knowledge commonly attributed to midwives. Although there are some examples of midwives being accused of witchcraft in Europe, our findings are largely in agreement with sociological analyses of accused witches in witchcraft trial documents (Horsley, 1979; Harley, 1990; De Blécourt, 1994). There seems to be unison among historians that there is no evidence in primary trial sources indicating that midwives were picked out for witchcraft accusations (Horsley, 1979; Harley, 1990; De Blécourt, 1994; Ostling, 2014).

Fig. 10. *Hypericum perforatum,* used throughout Europe to protect against evil, including the devil and witchcraft. Photograph by I. Pombo Geertsma.

Because the Dutch vernacular names in our list were mainly collected from the late 1800s to the middle of the 20th century (Heukels, 1907; PLAND), we only included species that were used medicinally in this time period by the Dutch population (Van Andel, 1909). However, we could not verify the botanical identifications of these medicinal plant species listed in Van Andel (1909), who studied contemporary folk medicine in the Netherlands. A discrepancy exists between botanists and folklorists, in which folklorists are interested in plant names and uses, but do not collect plant vouchers, and botanists that did collect vouchers do not link ethnobotanical information to their specimens (Łuczaj, 2010). This may have been the case for the databases we used to collect data on vernacular names. Nevertheless, plant diversity in the Netherlands is relatively low and plant names were in a process of national standardization in the 19th century (Heukels, 1907), meaning that potential misidentifications are likely to be rare.

3.9. Traditional uses in the Netherlands: apotropaic plants

Eleven species (9 %) bearing witch/devil names were used to protect against evil in the Netherlands and Flanders (Belgium), and used as amulets or hung in the house as a charm (De Cleene and Lejeune, 2000). Chi-square tests of homogeneity showed that there was a significant association between plants used for protection against evil and devil- or witch-related names in the Netherlands (Table 6). Dutch names such as *jaag-den-duivel* and *duvelsjacht* (both conjunctions of devil and hunt) for *Hypericum perforatum* (Fig. 10) may well expose this symbolic use. It was found that accused witches in Poland sometimes confessed to using herbs to protect themselves from witchcraft (Ostling, 2014). Interestingly, these species are generally the same as the species that are

Table 6
Two by two tables of apotropaic plant species in relation to vernacular plant names. In Dutch, apotropaic plants are associated with vernacular names referring to witches and the devil (χ^2 (1) = 7,445, p = 0,006361). The species in the genera *Rubus*, *Hieracium* and *Taraxacum* were discarded (see section 2.3). For the full flora results see Supplementary file 3.

		Witch/Devil Name	
		present	absent
Flora the Netherlands and Flanders (Belgium) (1650 spp.)	not apotropaic	94	1475
	apotropaic	11	70

currently used as ingredients in herbal bouquets blessed in churches in Poland (Ostling, 2014). These herbal bouquets existed in several European regions and were used to protect against witchcraft and the devil, they were blessed on Mary Assumption Day, Pentecost and Saint John's Day (Korkisch, 1981; Łuczaj, 2011, 2012; Ostling, 2014; Stryamets et al., 2021). However, no vernacular plant names were listed in the mentioned literature that linked these plant species to witches or the devil.

4. Conclusion

Our study revealed that a wide range of plants (425 plant taxa in 97 families) is associated with witches and devils in northwest Europe through their vernacular names. Plants associated with witches and devils were not restricted to members of the Solanaceae, which with 10 plant species only made up 3 % of our total dataset. We found significant associations between names alluding to witches and devils with toxicity and weediness, a link that has long been proposed by botanists (Marzell, 1943–1979; Uittien, 1946; Grigson, 1975), but was never quantitatively established. The terms *witch* and *devil* were likely used in a pejorative manner to name toxic and weedy plants, and could also function as a warning for their harmful properties. Furthermore, there was a significant association between plants named after witches and devils and their use for protection against evil, including witchcraft itself, indicating that these names can also refer to these apotropaic uses, not just their harmful characteristics.

Although historical research has so far found little evidence that people who were accused of witchcraft generally practiced (or were specialists in) herbal medicine in the Netherlands, our results indicate that medicinal plants were proportionally more likely to have vernacular names referring to evil creatures than would be expected based on probability. However, we remain hesitant to conclude that this is solely due to their medicinal uses, as these plants are frequently toxic, and it is uncertain from which characteristic their vernacular names are derived. We did not find a link between these plant names and abortifacient and hallucinogenic plants, indicating that people did not associate these uses with witches. This contrasts with the modern perception of witches' plants, highlighting that different associations with witches and plants were made in the past. As the process of naming plants in history has hardly been documented, the reason why some species have certain names frequently remains difficult to elucidate. Future research could investigate how old most of these names are by comparing them to names in witchcraft trial documents and in 16th-century herbals, a time when the first witches' trials were held in Europe. However, the plants in these herbals have not yet been properly identified to the species level, and witchcraft trial documents are hard to study as they are often unavailable online. Our study provides new insights for research on the history of witchcraft and associated plant use in north-western Europe by showing that the story of *witches' plants* is more diverse than previously thought.

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CRediT authorship contribution statement

Isabela Pombo Geertsma: Conceptualization, Formal analysis, Investigation, Methodology, Project administration, Resources, Writing – original draft, Writing – review & editing. **Corné F.H. van der Linden:** Conceptualization, Formal analysis, Investigation, Methodology, Writing – review & editing. **Roy Vickery:** Data curation, Writing – review & editing. **Tinde R. van Andel:** Conceptualization, Formal analysis, Supervision, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jep.2024.117804.

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