Sweetness Beyond Desserts: The Cultural, Symbolic, and Botanical History of Angelica (Angelica archangelica) in the Nordic Region

Authors: Teixidor-Toneu, Irene, Kjesrud, Karoline, and Kool, Anneleen

Source: Journal of Ethnobiology, 40(3) : 289-304

Published By: Society of Ethnobiology

URL: https://doi.org/10.2993/0278-0771-40.3.289

Journal of Ethnobiology

2020 40(3): 289–304

Sweetness Beyond Desserts: The Cultural, Symbolic, and Botanical History of Angelica (*Angelica archangelica*) in the Nordic Region

Irene Teixidor-Toneu[1,2*], Karoline Kjesrud[3], and Anneleen Kool[1]

Abstract. Throughout Nordic history, angelica (*Angelica archangelica*) has been a valued resource, often referred to as sweet. This article is inspired by multispecies studies and examines the role of sweetness in the relationship between this plant and Nordic peoples. A review of the ethnobotanical literature is woven together with historical, philological, and ethnographic data to trace angelica's properties and uses throughout Nordic history. Angelica's area of distribution expanded over time and its carbohydrate content increased in some semi-domesticated varieties. In turn, humans relied on it as a food source and conveyor of cultural meaning and value. We find that the plant has been associated with different qualities at different times and that it became sweet through time both materially and symbolically. However, angelica has now mostly disappeared from Nordic diets, while other ingredients in early twentieth century dessert recipes have remained. Our interdisciplinary analysis indicates that symbolism, rather than taste, may explain the sweet character that is associated with angelica in the Nordic region.

Keywords: interspecies relationship, multispecies studies, interdisciplinarity, *Angelica archangelica*, plant history.

Introduction

It has been argued that the Anthropocene, the present time when human activity alters the physical structure and substance of the Earth, demands that we pay attention to the fact that we are a result of our relationships with more-than-human others (Van Dooren et al. 2016). Who we are biologically and culturally depends on a multitude of interspecies relationships (Haraway 2008; Tsing 2012). We are entangled with the microbiome in our guts (Lorimer 2016), the game we hunt (Ingold 2000), and the crops we cultivate (Miller 2019). In Donna Haraway's (2008:244) terms, in becoming who we are, we "always become with" other species. Ontological approaches that emphasize the agency of nonhuman beings and multi-species relations in shaping existence have recently been proposed to enrich the field of ethnobotany (Daly et al. 2016). A multispecies approach allows tracing how aspects of the human being come to be in tandem with other species, and vice versa (Hayward and Kelley 2010). Examples of such ethnobotanical work include the study of bi-directional domestication of humans and wheat (Barnes 2016), people-plant kin relationships (Miller 2019), and communication between people and plants being mediated by chemosensory queues (Daly and Shepard 2019). These journeys take place through a reciprocal process of sensation forged by shared relationships across time that shape all species' genetics and behavior (Hayward 2010).

It is through sensation that many interspecies relationships are built. Sensation is bound to the properties of the sensory organs; organisms living in the same place and time may perceive completely different worlds (Stevens 2013), yet sensation acts as the practical medium for cohabitant relationships. Exploring the sensory is key to addressing human-environment inter-

[1] Natural History Museum, University of Oslo. Sars Gate 1, 0562 Oslo, Norway.
[2] Naturalis Biodiversity Center. Leiden, the Netherlands.
[3] Museum of Cultural History, University of Oslo, Norway.
[*] Corresponding author (i.t.toneu@nhm.uio.no)

actions (Shepard 2004) and both people and plant experiences of these interactions (Miller 2019). The ways in which plants are perceived through the senses determines their usage (Shepard 2004). For example, medicinal plants are selected and classified in culture-specific ways according to their organoleptic, or sensorial, properties (Geck et al. 2017; Shepard 2004). Sensation can vary with age, sex, individual experience, and culture (Wysocki et al. 1991), taste and smell being socially and culturally constructed (Majid and Burenhult 2014; McCook 2013; Mosby 2017). Sensation may also change through time. Transformations and continuities of human-plant experiences and relationships result in changes of the sensory perception of plants over time (Miller 2019) but, to the best of our knowledge, no study has explored these transformations and continuities through the lens of the sensorial in a deep, multi-century timeframe. Transformations in plant-culture relationship continuities leave linguistic, historical, biogeographical, cultural, evolutionary and, sometimes, archaeological traces. Plant names are kept and loaned as plant material and related knowledge travel (Teixidor-Toneu et al. 2018), permeating the land as place names (Ouren 1973). Intimate entanglements of human and plant trajectories figure in myth, epic, law, and religious texts, and impregnate all forms of art.

In order to reveal a living history of how "sweetness" has steered human-angelica interdependence in the Nordic countries, we employ a combination of philological, historical, ethnobotanical, and ethnographic methods to follow angelica across land, sea, and time. With this study, we engage new evidence by exploring the role of sensation in establishing, maintaining, and adapting multi-species relations in our research context. Specifically, we ask: 1) why and since when has angelica been associated with sweetness; 2) how do plant organoleptic properties shape values and uses throughout centuries; and 3) how have Nordic people and angelica influenced geography, biology, and culture? By exploring these questions, we show how our approach to engaging the past and the present value of a culturally important plant in tandem sheds light on ways to keep meaningful relations with it in the future.

Angelica in the Nordic Region

Angelica archangelica (angelica) is a bi-annual plant from the Apiaceae family that has been appreciated for its scented stems and roots. Up to 2 m tall, the herb has broad divided, serrated leaves and white flowers in large umbels. Angelica flowers and fruits in July and August. It contains a variety of secondary metabolites, as well as several sugars and produces a large aromatic root. There are two subspecies of angelica. *Angelica archangelica* subsp. *archangelica*, which occurs predominantly in alpine habitats, has slightly smaller fruits and a less pungent flavor than *A. archangelica* subsp. *litoralis*, which occurs along the coast. *Angelica archangelica* subsp. *archangelica* grows along streams, in meadows, and in willow thickets in alpine areas (Figure 1). It is common in the Scandinavian mountains, the Faroe Islands, Iceland, and Greenland. Given uncertainty on subspecific identification from many bibliographic sources, we do not discriminate between the two subspecies.

Angelica seems to be native from northern Fennoscandia to Eastern Siberia, including a population in the Himalayas (Ojala 1986). Other authors have described its native range as spanning from Norway, Sweden, Iceland, Greenland, the Faeroes, Finland, and Russia to eastern parts of continental Europe, having been introduced and sometimes naturalized to the south and west of these areas (Hegi 1965), including Denmark (Brøndegaard 1978) and Great Britain (Mabberley 2008). Native species are considered to occur naturally in a specific area, but usually the boundary between native and

Figure 1. *Angelica archangelica* growing wild in the Finse mountainous area, Norway. Photo by Anneleen Kool.

naturalized is rather opaque. Its apparent native range in the wider Nordic region contradicts assumptions of the plant being spread by Viking Age travel, which we will discuss shortly.

Methods

By exploring the past and present relationships between Nordic populations and angelica through time, we evaluate in what ways multi-species relations craft shared, tangled histories (Kirksey and Helmreich 2010). To maximize time depth, we engage sources documenting angelica and its uses mainly from three epochs: ethnobotanical twentieth century literature, floras from the eighteenth century, and medieval texts. Medieval texts cover a variety of genres, from laws to saga narratives, where plants' characteristics and uses are not necessarily outlined explicitly. The plant mentions are interpreted according to the literary context. Since the medieval text transmission did not follow rules of word-by-word copying, but rather favored individual adjustments of the text content, the data collection has included all medieval manuscripts (text bearers) of the different text witnesses mentioning the Old Norse for angelica, *hvǫnn* (f.) and *hvannir* (pl.), alone or in compound nouns, and considered them as separate sources in accordance with a new philological perspective (Nichols 1990). Interestingly, however, the content in the angelica descriptions appears stable in the text transmission with few adjustments.

A brief cataloging of Norwegian place names and farm names related to angelica, including the modern Norwegian plant name "*kvann*," have been conducted, consulting the digital database of Norwegian place names[1] and Oluf Rygh's collection of Norwegian farm names[2].

Ethnobotanical data from Sweden, Norway, Denmark, Faroe Islands, Iceland, and Greenland were compiled from two eighteenth century floras, *Flora Norvegica* by J. E. Gunnerus (1766-1776) (Jørgensen et al. 2016) and *Svensk Flora* by C. von Linnaeus (1745) (Jørgensen 2011), and eight twentieth century national encyclopedic works and academic articles (Bjarnadóttir and Hilmarsson 2018; Bonneval and Robert-Lamblin 1979; Brøndegaard 1978; Høeg 1974; Jóhansen 1994; Svanberg 1998, 2011; Svanberg and Ægisson 2012). Some ethnobotanical literature cites literary sources from the past, and they were revisited whenever possible.

To add a contemporary perspective, we conducted four structured interviews (Bernard 2011) with four chefs working in New Nordic Cuisine restaurants (Tholstrup Hermansen 2012) in Iceland and Norway. Interviewees were asked how angelica is used in New Nordic Cuisine kitchens, where is it sourced, where knowledge about its use comes from, and how they would describe angelica's taste and smell. New Nordic Cuisine cooks were addressed because of their role in shaping modern food trends in the Nordic Countries (Tholstrup Hermansen 2012). Prior Informed Consent and agreement for publication was obtained, and we followed the ISE Code of Ethics (International Society of Ethnobiology 2006).

All data were collated in a joint table allowing diverse bodies of knowledge from different time periods (historical, philological, ethnobotanical, and ethnographic) to be brought into conversation (Van Dooren et al. 2016). The resulting table (Supplemental Table 1) is organized with one dated and localized mention of use, taste, or harvesting of angelica per row, and allows inferring changes in sensory perceptions (Research Question [RQ] 1) and uses (RQ 2) over time. With this, we can narrate how human-angelica relationships have influenced each other's lives (RQ 3). Data were organized according to their reference to one of three levels of human-angelica entanglements discussed here: 1) sensorial; 2) utilitarian and symbolic (from practical uses to symbolic meanings); and 3) geographical (Table 1). Categories used to classify data and link different kinds of evidence were adapted from standard ethnobotanical classification methods (see references in Supplemental Table 1).

Table 1 elucidates how different types of data (historical texts, ethnobotanical literature and interviews, and botanical and archaeobotanical studies) contribute to the understanding of the three themes of human-angelica relations studied here over time. With this combination, we discuss how the plant's own "sweetness" of taste and smell, but also the "sweetness" of the managing, eating, and sharing angelica as a holistic experience, played a role in the use, abandonment, and value for the plant across time and space.

Our final dataset catalogs 210 different entries (Supplemental Table 1) of angelica based on data gleaned from historical and ethnobotanical sources, as well as interviews. Each entry includes a description of how angelica has been used in a specific location from a single written source or interview. Entries are organized systematically under types of use, showing varied uses of angelica. Cultivation or wild harvest of the plant is mentioned in medieval sources, as well as ethnobotanical literature. Because of its importance in human-plant relations, mentions of taste were systematized as entries separate from those of use. Explicit mentions of taste appear in sources going back to the seventeenth century. Taste is also mentioned in two floras (Jørgensen 2011; Jørgensen et al. 2016) and during interviews.

Results

Results summarize and weave together our multiple sources. First, we present how sweetness has both mediated the relations

Table 1. Overview of the data collected using different sources and methods.

Contribution to understanding	Sources of Data			
	Historical medieval texts	**Modern ethnobotanical literature (review)**	**Modern botanical and archaeobotanical literature (review)**	**Ethnobotanical interviews**
Sensorial perceptions of angelica	Context of use	Descriptions of organoleptic properties, context of use	Chemical profiles	Descriptions of organoleptic properties, context of use
Angelica's cultural value (utilitarian and symbolic)	Citations in stories and events, laws, diplomas, riddles	Past uses	Population management, semi-domestication, selection	Current uses in New Nordic Cuisine
Geographical distribution, dispersal, population, and management	Recorded localities or areas of occurrence, accounts of management and cultivation, laws, diplomas, place names	Recorded localities or areas of occurrence, accounts of management and cultivation, plant names	Area of distribution, dispersal routes, genetic diversity	Sources for angelica (wild collected, cultivated)

between angelica and the Nordic peoples and resulted from those relations. Then, we discuss the plant's broader significance in many aspects of Nordic life past and present. Finally, we evaluate the role of human-angelica relations to plant dispersal and selection, demonstrating how angelica and the Nordic peoples' cross-species relations have shaped each other's histories.

Relatedness: Sensory Perception of Angelica across Centuries

Angelica is presented in medieval, Enlightenment, and early twentieth century literature as a source of joy and is sometimes explicitly described as sweet. In the nineteenth to early twentieth centuries, angelica was the best you could offer an honorable guest, a treat, a delicacy, and a source of joy and pride. Eaten eagerly and fondly, the stems and petioles have sweetened Nordic lives as raw snacks when hiking in the mountains, as a prized and protected cultivated crop, and cooked as a dessert. Peasants in Norway used to "feast on angelica stems" on Midsummer Day (Fosså 2004:134) and the plant was "much sought-after" in other times of the year too (Fosså 2004:134). Fishermen from Hillesøy and Nesseby, in Norway, ate the stalks in fish liver oil "fondly" in the early to mid-twentieth century, as they considered them a purifying treat (Høeg 1974). Peeled angelica stems were eaten "eagerly" by Sámi people, according to Linnaeus (Jørgensen 2011:79). In the seventeenth century, angelica stems were "the delightful snacks and summer fruits" of the Sámi (Svanberg 2011:187). In Forsand (Norway), wild-collected angelica was "sweet and had a good taste" (Høeg 1974). The Ammassalik Inuit in Greenland appreciated this plant "deeply" and, in the early twentieth century, it was in great demand in Greenland (Bonneval and Robert-Lambin 1979; Brøndegaard 1978), where people consumed it raw and children dipped the stems in powdered sugar to eat them. In *Ólafs saga Tryggvasonar* (fourteenth century; Halldórsson 1961),

the king requests an angelica stalk from a man carrying a bundle of stalks near a church. The king brings the stalk to his wife, who suddenly remembers the possessions she had received as a childhood present and she now encourages her husband to reclaim those possessions (Figure 2). Within the literary context, the motivation for Óláfr serving his wife the piece of *hvanniola* (angelica stems) is not outlined, rather the plant appears as a rhetorical device in the narrative of recalling sweet memories of the past.

Angelica's use as a dessert also indicates its sweet qualities. In the Faroe Islands, the plant was served as a dessert, with cream or thick sour milk (*rómastampur*) and sugar at least between the eighteenth and early twentieth centuries (Svanberg 1998). This was offered as a treat and a refreshment, especially to visitors and travelers (Brøndegaard 1978; Svanberg 1998). In the 1850s, the usual breakfast for St Hans (June 23rd) to St Olaf's day (July 29th) in the Faroe Islands was angelica stems alone or with *tykmælk* (literally, "thick milk"); consuming them with sugar and cream was reserved for the wealthy (Brøndegaard 1978). In northern Norway, angelica stalks were peeled, cut into small pieces and cooked into a porridge that was eaten as a dessert with milk or cream (Høeg 1974). More recently (early and mid-twentieth century), jams have been made out of it (Høeg 1974).

Angelica's sweetness is also evident in its local names. In Faroese, the lower part of the leaf stalk is the "sweet bite" (*søtabiti, grand, skálkur,* or *goturstykki*; Fosså 2004:134) and in the Shetland Islands, the plant was called *sweetaks* (Brian Smith, pers. comm., October 2019), possibly meaning "sweet-spike." Sweetness is also explicitly mentioned in the ethnobotanical records in relation to the lack of other sweet foods. In Iceland and the Faroe Islands, angelica stems were the only sweet foods available before trading posts made sugar available in the seventeenth century (Svanberg 1998, 2011). Angelica's sweetness stems from the plant's ethereal oil that gives it a strong aromatic scent, a powerful flavor, and a "bigger or smaller content of sugar" (Høeg 1974:202). Homegrown varieties in Norway were far sweeter than wild angelica (Høeg 1974). At least some of the cultivated populations have been semi-domesticated, with sweetness and fleshiness achieved through selection (Fægri 1951). Specifically, a cultivated variety grown in Voss (Hordaland, Norway) has almost solid petioles, contrasting with the hollow ones from wild populations, and approximately a 50% higher sugar content (Fægri 1951).

Figure 2. Queen Thyra is being offered an angelica stalk from her husband Olav Tryggvasson, by Erik Werenskiold (Sturlason 1899). The collection of Norwegian kings' sagas from the Middle Ages has been published several times, including this 1899 magnificent edition published with contributions from six renowned Norwegian authors of that time.

While the sweet qualities of angelica are reflected in these many ways, angelica's sweetness is not straightforward. Angelica's flavor has been compared to that of celery (Fosså 2004), juniper berries (Grieve

1977), and musk (Fosså 2004), sweet-like and fruity, but also bitter and acrid. According to Linnaeus, the Sámi ate both sweet plant parts "like an apple" or "like a turnip" (Fosså 2004:135). Currently, New Nordic Cuisine chefs describe it as a "slightly overly aromatic celery," having a "powerful floral flavor," perhaps bittersweet, almost like licorice and dill, but not quite. Angelica's taste and smell are distinct.

> I always think of it as a quite aromatic celery…. But it is not concise. It's quite confusing because it feels like something that could almost be licorice, but it is not. And it is a bit towards dill, but not. (G. V., June 12, 2019)

> It's a fresh leaf, it's very floral, it's very green… it's fruity as well… a little bit cardamom, a little bit cumin, especially when it is dried in the seeds. Sometimes it tastes a bit like licorice, but I think it is very distinct in its own right. It is not something that tastes like something else. I would always think that something tasted like angelica. But it is very sweet; it is a sweet, fresh plant, I think. (T. S., August 15, 2019)

> It is very floral and very powerful. I think that's… the two important things about the angelica. Really, really floral, really powerful…. (G. K. G., August 20, 2019)

> It has a very distinctive taste, distinctive smell, it's kind of bittersweet, with a very floral flavor, sometimes I feel like there is a hint of licorice in it…. But I am not sure how to describe it. Bittersweet, I guess. (A. J., July 21, 2019)

Significance: Angelica's Multifaceted Permeation into Nordic Life from the Middle Ages to Today

From dessert to vegetable and condiment, liquor aromatizer and famine staple food, angelica has played an important role in Nordic medicine, food security, enjoyment, and gastronomic identity (Supplemental Table 1). Angelica has been a valuable crop across the Nordic region (Supplemental Table 1) and this culinary multi-functionality is put to use today in New Nordic Cuisine kitchens. Seeds, stems, petioles, leaves, and roots are used in soups, brines, pickles, oils, infusions, desserts, rubs, salts, and sauces (Figure 3). For example, butter is flavored with "a lot of the plants around the area including angelica root… because [in a traditional recipe where butter was stored underground] the butter would naturally take on all the flavor from what's around it" (T. S., August 15, 2019).

Although rarely used in modern-day cooking, angelica culinary uses keep being innovated. A Sámi informant of Rautio et al. (2016) developed new uses as an ingredient in "non-Sámi" recipes besides using angelica in a traditional manner. Through the New Nordic Cuisine movement, angelica reaches restaurant tables as an ingredient of old recipes, such as candied angelica, but in non-traditional recipes. Traditional food plants have almost disappeared from European diets but are being put back into focus by innovative cuisine trends (Łuczaj et al. 2012). And innovation is ever ongoing.

> In restaurants like Maaemo here, or the ones around Scandinavia, you take the time to look back in order to move forward. (T. S., August 15, 2019)

Angelica's strong fragrance was employed to bestow its protecting power against ill health, in general, and infectious disease, specifically. Its "floral flavor" protected against smelling "anything nasty" (Svanberg 2011:187–188) and its fragrance was said to keep the smell of death away (Bjarnadóttir and Hilmarsson 2018). Laid in doorways and hallways, "the strong smell prevented infections from spreading" (Brøndegaard 1978:297). Angelica was likely used medicinally in Scandinavia and the North Atlantic isles before making

Figure 3. (a) "Celeriac and angelica" (*Sellerirot og kvann*), Brutus Bar (Oslo, Norway). Fried celeriac root with angelica: pickled stems, fresh leaves, and a sauce made from stems, leaves, and "angelica capers." Photo by Hans Petter Hval. (b) "Cured and hung smoked Arctic char, angelica, and goat cheese," Dill Restaurant (Reykjavík, Iceland). Photo by Sverrir Arnar Friðþjófsson.

its way into the European pharmacopoeia. In the British Isles, for example, its folk uses are surprisingly few considering how strongly the plant was recommended in written texts and by medical practitioners (Allen and Hatfield 2004). Unknown to the Greeks and Romans, it is not included in classical *materia medica* (e.g., Matthioli; Staub et al. 2016). Harpestreng, who wrote the first vernacular herbal in Scandinavia in the thirteenth century (the oldest manuscript preserved dates to the second half of the thirteenth century), does not mention it, perhaps because the book is influenced by the southern *materia medica* (K. Kjesrud, unpublished MS). Probably it came to be known outside Nordic areas during the medieval ages, through the travels of monks from Scandinavia to other parts of Europe (Fosså 2004).

The role of angelica has extended well beyond food and medicine, being worn against spells and as a charm, used as a toy, substituted for tobacco, burned as an incense, crafted into flutes, and more (see Supplemental Table 1 for a comprehensive referenced list). It even has been a tool for torture in the aforementioned *Ólafs saga Tryggvasonar* (Halldórsson 1961), which describes how the king punishes a man because he did not want to be baptized. The king takes a snake in his hands and directs it into the man's mouth. The man was initially able to prevent the snake from entering his mouth, but the king ordered an angelica stalk be put in the man's mouth so that the snake could enter through the hollow center of the stalk and the man could not avoid his punishment. For different reasons, both hollow stalks and the solid petioles have been recognized as important qualities of the plant: the first to be used as a rigid tube, the second for a higher carbohydrate yield.

Another example that angelica's cultural value extends beyond usage is its appearance in a riddle in a row of riddles that Gestumblindi made for king Heiðrek in *Hervarar saga ok Heiðreks* (Helgason 1924). The king is supposed to guess which two women or two maidens are having children together without a man involved,

because they do not have a husband. The king guesses the riddle right: "There are two angelicas, with a younger plant in between them" (Helgason 1924:10). The plant is described to have the symbolic value of a fertile woman, and thus to also be a symbol of fertility. The smaller plants, *hvannkálfr* in Old Norse, are symbolic of maidens. The fertility association may draw on the way the plant spreads from the rich number of seeds the flower produces. Moreover, the vase shape of the flower top can be associated with feminine figures.

Movement and Change: Entangled Plant and Human Dispersal and Domestication

Angelica was likely an important resource in Viking times. Some authors have written that it was a major export commodity from Norway at the time, especially to France (Jóhansen 1994) and the Faroe Islands (Svanberg and Ægisson 2012), but there is no historical evidence grounding this claim. The economic value related to the plant can be recognized from several laws that were formulated in Norway and Iceland in the twelfth century and from the earlier mentioned example of the literary description of a man bringing a bundle of angelica stems outside the church (in *Ólafs saga Tryggvasonar*; Halldórsson 1961), a typical medieval meeting place for exchange and trade. Furthermore, a legal document from the late fifteenth century mentions harvested angelica as the church's property and implies that angelica has served as an income for the church and a way of paying tax by local farmers to the church (DI V, Þórkelsson 1893-1907). Angelica must have been an important resource for the Norse settlement of the Faroe Islands and Iceland. While no written sources from the Middle Ages indicate that angelica was exported or transported in maritime travels, genetic evidence does draw a picture of the dispersal across the North Atlantic that matches people's travels during the Viking age (Alsos et al. 2015; Haywood 1995). The genetic analyses in Alsos et al. (2015) identify a Nordic and central European population of angelica that disperses from Norway to Iceland and the Faroe Islands, and also from the Faroe Islands to Iceland. A Norwegian and Faroese subpopulation is differentiated from individuals in Iceland and Greenland, further strengthening the idea of a Viking dispersal. However, this possibility is not mentioned by the authors, who assume the plant was predominantly dispersed by birds (Alsos et al. 2015) and genetic data provides little insight into the timing of dispersal events.

Despite angelica's assumed importance during the Viking age, its archaeobotanical record is scant. Seeds are the most likely plant part preserved, as all other plant parts are fleshy and it is likely that any trade for horticulture would have involved seeds. However, only one seed of angelica has been excavated from a Viking Age site (Hedeby; Behre 1983). Given that the vegetative parts of the plant were the most commonly used and that it was common practice to remove the inflorescences to keep the plant from dying (Rautio et al. 2016), this is perhaps not surprising, nor does it contradict historical records of the importance of the plant. Therefore, it appears likely that the plant was traded as a raw material.

Linguistic evidence can also point to ancestral distribution of angelica (Teixidor-Toneu et al. 2018). Names deriving from the Old Norse, *hvǫnn* (f.) and *hvannir* (pl.), exist in all major North Germanic languages (Icelandic, Swedish, Norwegian, Faroese, and Danish) as well as Inuit, while the Sámi name has a proto-Norse origin (see Supplemental Table 1). These names support the idea that angelica has been used since at least the Viking age. Place names that include the vernacular name for angelica may also indicate where the plant has been recognized as valuable. While place names are not easily dated, they do showcase a long tradition of recognizing angelica in the surroundings, either cultivated or wild. Taking Norway as an example, there are 720

place names including the stem "*kvann*," angelica's name in Norwegian. The majority of them are from the counties Hordaland (214) and Sogn og Fjordane (156), located on the western coast of Norway. Angelica is common in these two areas today, as it is common almost everywhere in Norway. However, Voss, the putative center of angelica domestication, is located in the north of Hordaland, close to the border with Sogn og Fjordane, confirming that angelica was particularly important in these regions. Analysis of place names also suggests a link between the cultivation of a sweeter variety with a widespread or abundant angelica population. In Oluf Rygh's collection of Norwegian farm names[2], 25 names include "*kvann*," but only one refers to cultivation, *Kvangarsnes*[2]. This name is derived from the Old Norse *hvanngarðr*, literally meaning the garden for cultivation of angelica. The rest indicate areas where the plant was growing, perhaps because the majority of the angelica used was harvested from the wild. Wild collected angelica is mentioned in one Old Norse saga, the *Fóstbræðra saga* (manuscripts preserved from the fourteenth century onwards), where the foster brothers Þorgeirr and Þormoðr went to a mountain to collect angelica (Þórólfsson 1925-1927).

Dispersed with human assistance or not, angelica populations have been managed across the Nordic countries. Selected organisms were harvested, competitors removed, and plants thinned and pruned (Fægri 1951; Rautio 2014; Rautio et al. 2016). "*Rótarfjall*" or "going mountain rooting" was the expression used for gathering angelica roots in Iceland (Guðjónsson 1941). In Norway, going on long collective trips to harvest the plant in the wild and bring it home to sell it was a historic tradition (Høeg 1974). Sámi tended angelica in the wild, harvesting it selectively and sustainably, and spreading it to new areas (Rautio et al. 2016). Isolated populations of angelica still exist in the Sápmi (Sámi territory spanning from the northern parts of Norway, Sweden, and Finland to the Kola Peninsula in Russia) and are understood as anthropogenic relics (Almark 2006; Ericsson 1984).

While the notion of taste and the characteristics of cultivated or wild collected plants are not outlined in the medieval sources, the quest for sweeter and fleshier stems that we hear about in younger sources may have fueled cultivation efforts. Still, we do not know exactly when or where cultivation of angelica began. The Old Norse records of angelica take us back to the mid-twelfth century (1150–1175) in a law describing the penalty for people who steal the plant (*Grágás and Kristinna laga Þáttr*; Finsen 1852). Sentences referring to a specific *hvanngarð* (literally, "angelica garden") in various Old Norse laws from Iceland and Norway up until the eighteenth century (Supplemental Table 1) regulate the ownership of cultivated angelica plants that were valued as an agricultural resource belonging to the farmer. The mentions of cultivated angelica in legal documents, literature, and the stated reasons for laws regarding it, make it clear that the cultivation of angelica must have been wide-ranging. In 1500s Denmark, "everyone want[ed] it in their garden" (Brøndegaard 1978:295) and, over time, "well-kept angelica-gardens enclosed with stones" became the "pride of a Faroese household" (Svanberg and Ægisson 2012:236).

The Present Moment for this Multi-Species Relation

Angelica was key to world-making in the Nordic countries since the Viking age and angelica's populations are, to an important extent, a legacy of their relationship with humans. Many authors have mourned the disappearance of angelica traditions and gardens (e.g., Fægri 1951; Fosså 2004; Høeg 1974). Angelica is very rarely used today in Nordic diets and has been replaced by rhubarb to some extent (Fosså 2004; Svanberg and Ægisson 2012).

Changes in taste preferences and food sourcing may be at the bottom of this shift, as explained by one of the interviewed chefs.

> I just think it is the flavor profile. It's disappeared from what we want. Sometimes when I have served angelica a lot of the guests are kind of 'oh, I haven't had this in a very long time. This reminds me of my childhood.' And it's just kind of lost out…. And then of course it is not in your day-to-day supermarket, and… it goes away. (T. S., August 15, 2019)

Nonetheless, in the past decades, there has been an interest in reviving angelica gardens in the Faroe Islands (Jóhansen 1994; Svanberg 1998; Svanberg and Ægisson 2012) and semi-domesticated varieties are being cultivated again in Norway through the main seed exchange association, perhaps unsurprisingly called "KVANN Norwegian Seed Savers." Since 2014, people adhered to KVANN have retaken active selection of varieties of angelica with non-hollow stems. Seeds from populations of semi-domesticated angelica in three localities around Voss that had survived neglect were used. Seeds from these varieties are now available from the seed exchange society, grown by a handful of members. Interest is steadily growing; angelica is becoming popular again (Karl Aakerro, KVANN, pers. comm., September 2019), and its special taste may provide clues to its future life.

Discussion

Given angelica's multiplicity of uses and its symbolic value, it is not surprising that human and angelica populations have profoundly depended on and shaped each other. This article has shown that weaving together different kinds of evidence of angelica uses and descriptions that are rarely brought into conversation with one another allows for the tracing of its cultural significance through centuries. Old Norse sources in different genres, from laws and diplomas to entertaining saga literature, ethnobotanical literature from the eighteenth to twentieth centuries, and interviews from today have been collected, systematized, and analyzed with regard to three different research questions: one concerning the actual taste of the plant, the second concerning the evolution of people-plant relations through time, and the third on how this reflects people and plant-travels. Within this quilt-work of sources, the notion of "sweetness" tracked the transformations and continuities of human-angelica experiences and relationships over time. It is impossible to say with certainty when angelica was first sweet: medieval sources on *hvann* do not say anything about its flavor. Yet this does not mean that the plant was not used as a sweetener in this period, as it had been in the Faroe Islands and Iceland prior to other sources for sweetness. What we can say is that, since the Viking age, a bidirectional relationship has been established between humans and angelica. The plant was likely dispersed by humans, wild populations harvested and probably carefully managed, and gardens established throughout Nordic countries. In turn, humans came to depend on it for food, medicine, social status, and a myriad of other purposes.

Our findings shed light on the changing role of organoleptic properties and sensation in shaping human-plant relations through time, and the impact this has on both landscapes and culture. We find that organoleptic perceptions mediate people-plant relations (e.g., Geck et al. 2017; Shepard 2004), but only in part. While sensation determines the ways plants will be used by a specific culture, sensation is not just based on physical properties. Angelica's sweetness is not only sweet in taste, but linked to sweet, pleasant experiences of harvesting and feasting. While plants' chemical profiles contribute to defining their cultural roles (e.g., Daly and Shepard 2019), so do their attributed

symbolism and historical roles in culture. Angelica has accumulated a sweet significance from a number of directions. Its coumarins, essential oils, and carbohydrates (Wahlin and Blixt 1994) are likely to play a role in the plant's taste. Its morphological qualities symbolize feminine and fertility characteristics, attributes that, together with taste, bestowed sweetness to the plant—so strong that the sight or the taste of angelica evokes pleasant memories from the past to New Nordic Cuisine clients, as well as medieval queens.

So why is there not angelica ice-cream being sold in Oslo's squares? Taste preferences are shaped early by dietary experience in humans (e.g., Stein et al. 2012): the lack of direct experience with certain plants during childhood may rule out ingredients from later diets. As an example of an individual experience of the crafting of angelica's sweetness during childhood, we refer to one report from Iceland. Illugi Jónson explained to a local newspaper in 1988 that angelica is given to children when they are young, because if given to adults who have never eaten it before, they will usually dislike the flavor (Halldórsson 1988). Illugi's granddaughter remembered the last time she met her grandfather, when she was five (Hildur Hauksdottir, pers. comm., November 2019). He took her for a walk in the area where he lived his whole life to get angelica stalks for her to take to the city. She still eats angelica stalks every time she gets a chance—the sweetness of a family memory is driving the taste for the plant.

Our results also show that people-plant relations shape supposedly wild plant distribution, genetic and phenotypic diversity and, in turn, human livelihoods (e.g., Levis et al. 2017). Human and plant trajectories become materially dependent through sensation first and then through adaptive management (Rautio et al. 2016) strategies such as domestication (Cassidy and Mullin 2007; Rival 2007). The wide range of uses and the associated qualities connected to the plant have possibly directed the distribution and semi-domestication of the plant. *Ólafs saga Tryggvasonar* (fourteenth century; Halldórsson 1961) presents a hollow angelica for which we have evidence of cultivation in the sixteenth century (Brøndegaard 1978:295). Modern forgotten, semi-domesticated varieties have been selected for solid stems with higher carbohydrate content (Fægri 1951). The sweet associations have directed the selection and cultivation of plant types that qualified for sweetness.

People-plant bonds can weaken and be forgotten during periods of abandonment, when plants and landscapes "rewild" (Rival 2016). Vast regions of the world are regarded as untouched wilderness because the impact and role of traditional plant management practices have been underestimated (Fowler and Lepofsky 2011; Levis et al. 2017). In the current social, political, economic, and cultural contexts, symbolic meanings of most traditionally used plants are lost (Kujawska and Svanberg 2019). We observe this precise phenomenon in our research context. In parallel, new definitions of a plant's properties are in place: angelica is labeled as potentially toxic by the European Medicine Agency because of its furarocoumarins content (EMA 2007). While *Angelica archangelica* is not considered dangerous and can be sold without restriction in Norway (Lovdata 2005), this new framework for people-plant relations can contribute to weaken more-than-human relations. Despite the current neglect and loss of value of angelica when compared to earlier times, angelica clings to Nordic life through intimate links to specialized groups of people. Through them and through the palates of Nordic peoples, angelica may continue to entangle with Nordic peoples in the Anthropocene.

Plants' sweetness is not just a matter of taste, as it carries the flavors, smells, and textures of the natural environment and

its symbolic associations to the palate. It is never unidimensional. Impossible to measure on a kitchen scale, sweetness is crafted while managing plant populations, during planting or harvesting, outdoors, and only sometimes brought onto the dining table. Angelica's sweet deliciousness is often experienced in the open air. The gardening that turned angelica's wild populations into a crop also provided food security, a source for candied pleasure, and a household's pride. We show here that angelica has shaped what it means to be Nordic, thereby contributing to the understanding of multi-species relations and the role of sensation in ethnobotany.

Notes

[1] www.edd.uio.no.

[2] https://www.dokpro.uio.no/rygh_ng/rygh_felt.html.

Acknowledgments

This research has been funded by the Research Council of Norway through their SAMKUL program (Research Project "People and Plants—Rediscovering and safeguarding Nordic ethnobotanical heritage"; Project Number: 283364). We thank our project collaborators, Krupali Parekh and Lara Estupinan, for their contribution in collecting and translating information, and Hildur Hauksdottir for sharing her family experience, a key, and serendipitous insight, and our interviewees: Arnar Jakob (Brutus Bar), Gaute Vindegg (independent chef and professional forager), Gunnar Karl Gíslason (Dill Restaurant) and Thomas Swanborough (Maaemo), without whom understanding what angelica means in the present would have been tasteless. Thanks to Karl Aakerro from KVANN Norwegian Seed Savers for information on the current cultivation of angelica in Norway, Brian Smith, archivist at the Shetland Museum and Archives, for information on Shetland plant names, and the editors handling this manuscript for their invaluable comments.

References Cited

Allen, D. E., and G. Hatfield. 2004. *Medicinal Plants in Folk Tradition. An Ethnobotany of Britain & Ireland*. Timber Press, Portland and Cambridge.

Almark, L. 2006. *Kvanne och andra angelicaarter: Apiaceae, familjen flockblommiga växter*. Almark förlag, Trollhättan, Sweden.

Alsos, I. G., D. Ehrich, P. B. Eidesen, H. Solstad, K. B. Westergraad, P. Schönswetter, A. Tribsch, S. Birkeland, R. Elven, and C. Brochmann. 2015. Long-distance Plant Dispersal to North Atlantic Islands: Colonization Routes and Founder Effect. *AoB PLANTS* plv036:1–19.

Barnes, J. 2016. Separating the Wheat from the Chaff: The Social Worlds of Wheat. *Environment and Society* 7:89–106.

Behre, K.-E. 1983. *Ernährung und Umwelt der wikingerzeitlichen Siedlung Haithabu*. Wachholtz Verlag, Neumünster, Germany.

Bernard, H. R. 2011. *Research Methods in Anthropology—Qualitative and Quantitative Approaches*, 5th edition. Altamira Press, New York.

Bjarnadóttir, G., and J. O. Hilmarsson. 2018. *Plants of Iceland: Traditional Uses and Folklore*. Forlagið, Reykjavik, Iceland.

Bonneval, L., and J. Robert-Lambin. 1979. Utilisation des végétaux à Ammassalik (Est Groenland). *Études/Inuit/Studies, Quart Monde nordique / Northern Fourth World* 3:103–117.

Brøndegaard, V. 1978. *Folk og flora: Dansk etnobotanik*, 4 volumes. Rosenkilde og Bagger, Denmark.

Cassidy, R., and M. Mullin, eds. 2007. *Where the Wild Things Are Now: Domestication Reconsidered*. Berg, Oxford.

Daly, L., K. French, T. M. Miller, and L. Nic Eoin. 2016. Integrating Ontology into Ethnobotanical Research. *Journal of Ethnobiology* 36:1–9.

Daly, L., and G. J. Shepard. 2019. Magic Darts and Messenger Molecules: Toward a Phytoethnography of Indigenous Amazonia. *Anthropology Today* 35:13–17.

EMA (European Medicine Agency). 2007. Reflection Paper on the Risks Associated with Furocoumarins Contained in Preparations of *Angelica archangelica* L. URL: https://www.ema.europa.eu/en/documents/scientific-guideline/final-reflection-paper-risks-associated-furocoumarins-contained-preparations-angelica-archangelica-l_en.pdf. Accessed on April 14, 2020.

Ericsson, S., ed. 1984. *Åsele Lappmarks kärlväxter. Västerbottens Botaniska Förening*. Norrlands Entomologiska Förening, Umeå, Sweden.

Finsen, V. 1852. *Grágás: Elzta lögbók íslendinga ... eptir skinnbókinni í bókasafni konungs*. 2 ("Ib"). Copenhagen.

Fægri, K. 1951. Kvanngarden, en parkhistorisk relikt. *Lustgården* 5:5–17.

Fosså, O. 2004. Angelica: From Norwegian Mountains to the English Trifle. In *Wild Food: Proceedings of the Oxford Symposium on Food and Cookery*, edited by R. Hosking, pp. 131–142. Prospect Books, Devon, England.

Fowler, C. S., and D. Lepofsky. 2011. Traditional Resource and Environmental Management. In *Ethnobiology*, edited by E. N. Anderson, D. M. Pearsall, E. S. Hunn, and N. J. Turner, pp. 285–304. John Wiley & Sons., Hoboken, New Jersey.

Geck, M. S., S. Cabras, L. Casu, A. J. Reyes García, and M. Leonti. 2017. The Taste of Heat: How Humoral Qualities Act as a Cultural Filter for Chemosensory Properties Guiding Herbal Medicine. *Journal of Ethnopharmacology* 198:499–515.

Grieve, M. 1977. *A Modern Herbal*. Penguin, London.

Guðjónsson, S. V. 1941. *Folkekost og sundhedsforhold i gamle dage: belyst igennem den oldnordiske litteratur*. Arnold Busck, Copenhagen.

Halldórsson, Ó. 1961. *Óláfs saga Tryggvasonar en mesta*. Munksgaard, Copenhagen.

Halldórsson, Ó. 1988. Sækist eftir ætinjóla á hverju sumri: "Eins og hvert annað hollt grænmet"-segir Mývetningurinn Illugi Jónsson. *Dagur*, June 15, 1988, p. 13. Available at: http://timarit.is/view_page_init.jsp?pageId=2682746. Accessed on November 15, 2019.

Haraway, D. 2008. *When Species Meet*. University of Minnesota Press, Minneapolis, MN.

Hayward, D. 2010. *Fingeryeys*: Impressions of Cup Corals. *Cultural Anthropology* 25:577–599.

Hayward, E., and L. Kelley. 2010. Carnal Light: Following the White Rabbit. Paper presented at the Meetings of the *Society for Cultural Anthropology*, Santa Fe, New Mexico, May 7.

Haywood, J. 1995. *The Penguin Historical Atlas of the Vikings*. Penguin Group, New York.

Hegi, G. 1965. *Illustrierte Flora von Mitteleuropa*, vol. V part 2. Paul Parey, Berlin.

Helgason, J. 1924. *Heiðreks saga: Hervarar saga ok Heiðreks konungs*. Copenhagen.

Høeg, O. A. 1974. *Planter og tradisjon: Floraen i levende tale og tradisjon i Norge 1925-1973*. Universitetsforlaget, Oslo, Bergen Tromsø.

Ingold, T. 2000. *The Perception of the Environment: Essays in Livelihood, Dwelling and Skill*. Routledge, London and New York.

International Society of Ethnobiology. 2006. International Society of Ethnobiology Code of Ethics (with 2008 additions) [website]. URL: http://ethnobiology.net/code-of-ethics/. Accessed on June18, 2019.

Jóhansen, J. 1994. Medicinal and Other Useful Plants in the Faroe Islands before AD 1800. *Botanical Journal of Scotland* 46:611–616.

Jørgensen, P. M. 2011. *Svensk Flora. Med et innledende essay av Per M. Jørgensen*. Bokklubbens Kulturbibliotek, Norway.

Jørgensen, P. M., E. Weidemann, and E. Fremstad. 2016. Flora Norvegica av J.E. Gunnerus På norsk og med kommentarer. NTNU University Museum *Gunneria* 80:1–505.

Kirksey, S. E., and S. Helmreich. 2010. The Emergence of Multispecies Ethnography. *Cultural Anthropology* 25:545–576.

Kujawska, M., and I. Svanberg. 2019. From Medicinal Plant to Noxious Weed: *Bryonia alba* L. (Cucurbitaceae) in Northern and Eastern Europe. *Journal of Ethnobiology and Ethnomedicine* 15:22.

Levis, C., F. R. C. Costa, F. Bongers, M. Peña-Claros, C. R. Clement, A. B. Junqueira, E. G. Neves, et al. 2017. Persistent Effects of

pre-Columbian Plant Domestication on Amazonian Forest Composition. *Science* 355:925–931.

Lorimer, J. 2016. Gut Buddies: Multispecies Studies and the Microbiome. *Environmental Humanities* 8:57–76. DOI:https://doi.org/10.1215/22011919-3527722.

Lovdata. 2005. Forskrift om legemiddelklassifisering (legemiddellisten, unntakslisten og urtelisten). URL: https://lovdata.no/dokument/SF/forskrift/1999-12-27-1565?q=urtelisten. Accessed on April 14, 2020.

Łuczaj, Ł., A. Pieroni, J. Tardío, M. Pardo-de-Santayana, R. Sõukand, I. Svanberg, and R. Kalle. 2012. Wild Food Plant Use in 21st century Europe: The Disappearance of Old Traditions and the Search for New Cuisines Involving Wild Edibles. *Acta Societatis Boranicorum Poloniae* 81:359–370.

Mabberley, D. J. 2008. *The Plant-Book*. Cambridge University Press, Cambridge, UK.

Majid, A., and N. Burenhult. 2014. Odors are Expressible in Language, as Long as You Speak the Right Language. *Cognition* 130:266–270.

McCook, S. 2013. The Ecology of Taste: Robusta Coffee and the Limits of the Speciality Revolution. In *Coffee: A Comprehensive Guide to the Bean, the Beverage, and the Industry*, edited by R. W. Thurston, J. Morris, and S. Steinman, pp. 248–261. Rowman & Littlefield, Lanham, MD.

Miller, T. 2019. *Plant Kin: A Multispecies Ethnography in Indigenous Brazil*. University of Texas Press, Austin.

Mosby, I. 2017. Eat Your Primary Sources! Researching and Teaching the Taste of History. In *Methodological Challenges in Nature-Culture and Environmental History Research*, edited by J. Thorpe, S. Rutherford, and A. Sandberg, pp. 166–172. Routledge, Abingdon, UK.

Nichols, S. 1990. Introduction: A Philology in a Manuscript Culture. *Speculum. A Journey of Medieval Studies* 65:1–10.

Ojala, A. 1986. Variation, Reproduction and Life History Strategy of *Angelica archangelica* subsp. *archangelica* in Northern Fennoscandia. Unpublished Doctoral Dissertation, Department of Biology, University of Turku, Turku, Finland.

Ouren, T. 1973. Navn fra topografiske kart som hjelpemiddel til å finne nye lokaliteter for enkelte plantearter, *Norsk Geografisk Tidsskrift-Norwegian Journal of Geography*, 27:47–50. DOI:10.1080/00291957308551952.

Rautio, A-M. 2014. People-Plant Interrelationships: Historical Plant Use in Native Sami Societies. Unpublished Doctoral Dissertation, Department of Forest Ecology and Management, Swedish University of Agricultural Sciences, Umeå, Sweden.

Rautio, A-M., W. A. Linkowski, and L. Östlund. 2016. They Followed the Power of the Plant: Historical Sámi Harvest and Traditional Ecological Knowledge (TEK) of *Angelica archangelica* in Northern Fennoscandia. *Journal of Ethnobiology* 36:617–636.

Rival, L. 2007. Domesticating the Landscape, Producing Crops and Reproducing Society in Amazonia. In *Holistic Anthropology: Convergence and Emergence*, edited by D. Parkin and S. Ulijaszek, pp. 72–90. Berghahn Books, New York and Oxford.

Rival, L. 2016. Botanical Ontologies Special Section of the Journal of Ethnobiology Post-Face. *Journal of Ethnobiology* 36:147–150.

Shepard, G. J. 2004. A Sensory Ecology of Medicinal Plant Therapy in Two Amazonian Societies. *American Anthropologist* 106:252–266.

Staub, P. O., L. Casu, and M. Leonti. 2016. Back to the Roots: A Quantitative Survey of Herbal Drugs in Dioscorides' De Materia Medica (ex Matthioli, 1568). *Phytomedicine* 23:1043–1052.

Stein, L. J., B. J. Cowart, and G. K. Beuchamp. 2012. The Development of Salty Taste Acceptance is Related to Dietary Experience in Human Infants: A Prospective Study. *The American Journal of Clinical Nutrition* 95:123–129.

Stevens, M. 2013. *Sensory Ecology, Behaviour and Evolution*. Oxford University Press, Oxford, UK.

Sturlason, S. 1899. *Snorre-Norges kongesagaer*. J. M. Stenersens Forlag, Oslo.

Svanberg, I. 1998. The Use of Wild Plants in the Faroe Islands 1590-1990: A Contribution to Scandinavian Ethnobotany. *Svenska Linnésällskapets Årsskrift* 1996:81–130.

Svanberg, I. 2011. *Folklig Botanik*. Dialogos Förlag, Stockholm.

Svanberg, I., and S. Ægisson. 2012. Edible Wild Plant Use in the Faroe Islands and Iceland. *Acta Societatis Botanicorum Poloniae* 81:233–238.

Teixidor-Toneu, I., F. M. Jordan, and J. A. Hawkins. 2018. Comparative Phylogenetic Methods and the Cultural Evolution of Medicinal Plant Use. *Nature Plants* 4:754–761.

Tholstrup Hermansen, M. E. 2012. Creating Terroir: An Anthropological Perspective on New Nordic Cuisine as an Expression of Nordic Identity. *Anthropology of Food* S7. Available at: https://journals.openedition.org/aof/7249#abstract.

Tsing, A. 2012. Unruly Edges: Mushrooms as Companion Species. *Environmental Humanities* 1:141–154.

Þórólfsson, B. K., ed. 1925-1927. Fóstbrœðra saga, Samfund til udgivelse af gammel nordisk litteratur, 49. Jørgensen, Copenhagen.

Þórkelsson, J. 1893-1907. *Diplomatarium Islandicum*. Kaupmannahöfn:Í prentsmiðju S. L. Möllers, Reykjavík, Iceland.

Van Dooren, T., E. Kirksey, and U. Münster. 2016. Multispecies Studies: Cultivating Arts of Attentiveness. *Environmental Humanities* 8:1–23.

Wahlin, B., and S. Blixt. 1994. Nordiska Medicinalväxter. *Nordiska Genbanken* 24:15.

Wysocki, C. J., D. D. Pierce, Jr., and A. N. Gilbert. 1991. Geographical, Cross-Cultural, and Individual Variation in Human Olfaction. In *Smell and Taste in Health and Disease*, edited by T. V. Getchell, R. L. Doty, L. M. Bartoshuk, and J. B. Snow, pp. 287–314. Raven Press, New York.