



Introduction

Humans and hemp (*Cannabis sativa*) have an ancient relationship, dating back to the beginning of recorded history. Today hemp is perhaps most famous for the psycho-active properties of its flowers, but historically hemp has primarily been cultivated for fibres. The fibres were traditionally extracted from the stems through “water-retting” and are extraordinarily strong and durable which makes them suitable for production of various textiles and ropes. This study examines the European history of hemp cultivation, based on already published data from the European Pollen Database and other relevant studies.

Research questions

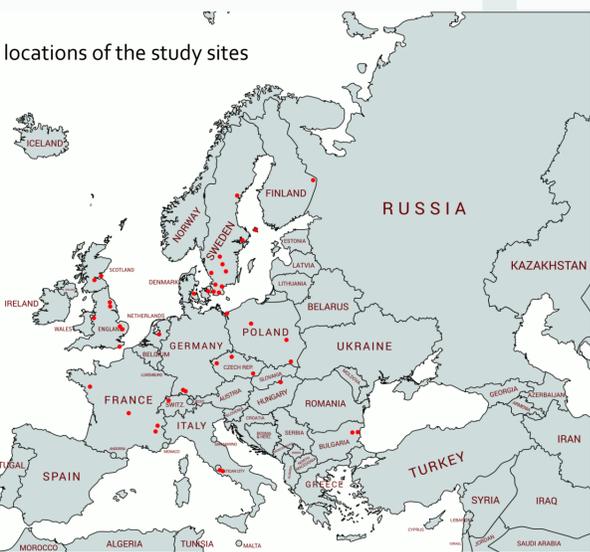
The purpose of this project is to further analyze the European cultivation history based on already published pollen data and literature.

- ✦ **When was hemp introduced to Europe and where was it introduced first?**
- ✦ **To what extent was hemp cultivated in Europe during different times?**
- ✦ **How did hemp cultivation and water-retting impact local environments?**
- ✦ **When did cultivation begin in Sweden?**

Conclusions

- ✦ **Hemp has likely been domesticated multiple times and the expansion to Europe might have been spontaneous.**
- ✦ **The earliest indicators of cultivation are from southeast Europe, where cultivation possibly begun already c. 4200 BCE and definitely by 577 BCE.**
- ✦ **Cultivation had begun in western Europe by 130 BCE.**
- ✦ **The earliest evidence of hemp cultivation from Sweden are dated to 20-220 CE and comes from a study site in Malmö.**
- ✦ **The most intensive period of European hemp cultivation took place between 800-1400 CE.**
- ✦ **Retting of hemp in lakes caused eutrophication and oxygen deficiency.**

Fig 1. Geographical locations of the study sites



Methods

This study is based on already published data from the European Pollen Database (EPD) and literature. The taxa included in my study are: *Cannabis sativa*, Cannabaceae/Urticaceae and *Humulus/Cannabis*.

Interpretation of cannabis-type pollen:

- 1% = wild growing native hops (*Humulus lupulus*)
- >5% = strong indication of hemp cultivation
- 10% + macrofossils = strong indication of hemp retting.

I searched the EPD in April and May 2019. I only include dated and calibrated data sets with ages displayed in BCE/CE (Before the Common Era/Common Era), which had recorded levels of cannabis-type pollen >2% of the total pollen sum (total pollen sum = all determinable pollen grains and fern spores). My study was delimited to a total of 13 data sets from the EPD and 22 additional pollen studies (not published to the EPD). I also included unpublished data from two study sites in Sweden: Lyngsjön and Skärpingsgölen. The geographical locations of the data are displayed in figure 1. The datasets retrieved from the EPD were compiled in Microsoft excel and the program C2 was used for plotting the data and visually presenting the results in figure 2.

Results

- Study sites from the Varna-region in Bulgaria display both a substantial increase in cannabis-type pollen to values >2%, as well as hemp fibres from c. 4200 BCE, representing some of the earliest finds from Europe indicative of cultivation. However, trustworthy evidence from this time period are rare.
- Clear signs of European cultivation appear in the pollen record from 577 BCE in Czech Republic.
- A prominent increase begun around 700 CE, at this time cultivation had spread to northern and western Europe.
- The earliest evidence of hemp cultivation from Sweden are from 20-220 CE.
- The most intensive period of cultivation took place between 800-1400 CE. During this time hemp retting was common all over Europe, which is indicated by high abundance (sometimes >80%) of *C. sativa* pollen.
- The unnaturally large accumulation of plant material in the lakes used for retting often caused eutrophication, which could lead to oxygen deficiency and pollution and often caused a foul smell.
- In the late 1800s the cultivation of hemp experienced a strong decline as cotton production expanded in Europe.

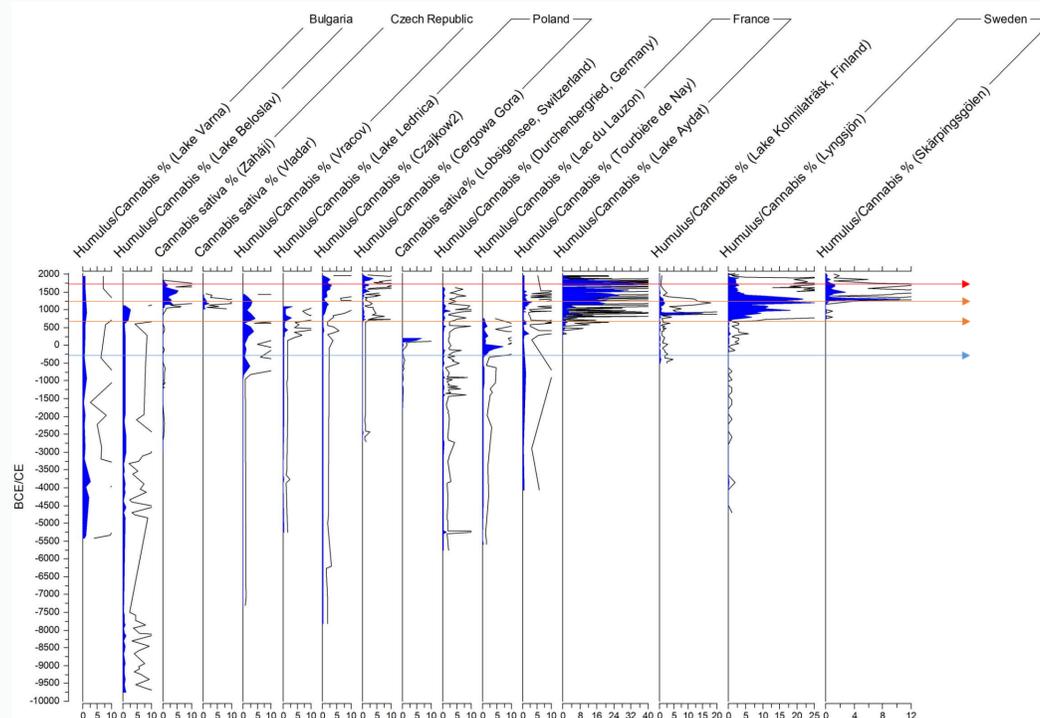
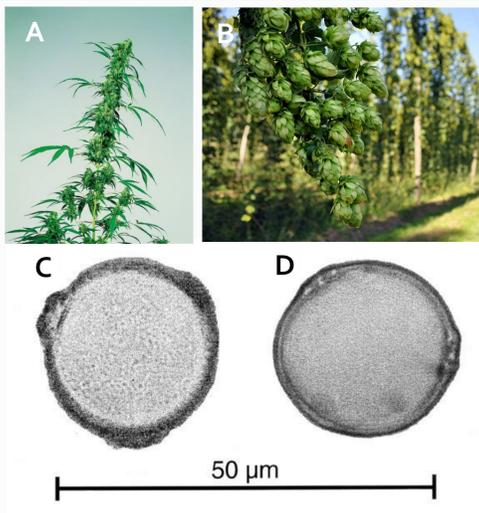


Fig 2. This figure illustrates the results of the pollen data study, based on data from the European Pollen Database and unpublished data from study sites Lyngsjön and Skärpingsgölen. The x-axis display the percentage (%) of cannabis-type pollen (or *C. sativa*) from the different study sites. The ages of the samples are displayed on the y-axis in BCE/CE. The blue arrow marks the beginning of cultivation in western Europe. The period of most intense hemp cultivation (800-1400 CE) is marked with two orange arrows. The red arrow marks the decline of cultivation (ca. 1850-1880 CE).

Hemp or Hops?

Hemp (A) and hops (B) are closely related, belonging to the same taxonomic family. The various classifications (i.e. *Cannabis/Humulus*, *C. sativa*, Cannabaceae) on the European Pollen Database reflect the difficulties to accurately separate hemp (*C. sativa*) pollen (C) from pollen of hops (*H. lupulus*) (D), as they are very similar.



Retting



Hemp was primarily cultivated for fibre production (G & H) in Europe. Retting is a traditional practice of fibre extraction where mature plants were submerged in water for several weeks at a time (E). Microbial processes would then break down the cellular tissues so the residual fibres could easily be extracted from the rest of the plant material (F). Retting is known to have had a negative impact on the ecology of the lakes that were used, causing eutrophication, oxygen deficiency and pollution.

