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CEREAL CULTIVATION WITH PARTICULAR REFERENCE TO RYE: SOME ASPECTS ON POLLEN-ANALYTICAL RECORDS FROM SW FINLAND

Abstract

Pollen evidence from six sites near the SW coast of Finland, and from three further inland, although limited in scope, show that the effects of man on the landscape began during the Bronze Age and continued thereafter. The value of pollen analyses in tracing changes in local vegetation by man diminishes with the increasing distance of the sampling site from the archaeological site. Sporadic short-term changes in the forest and non-arboreal pollen components throughout the late Neolithic can be attributed to temporary local clearances or to natural secondary successions and are not all associated with human activity. On the basis of pollen analysis it can be concluded that cultivation generally started during the Early Iron Age, A.D. 0–400. At some of the sites the first record of cereal cultivation could be traced to 3200 B.P.

Pollen and microscopic charcoal counts indicate widespread opening of the forests and increases in herb and grass pollen (incl. cereals and weeds) during the Late Iron Age, at about A.D. 800–1000, at a time when cultivation was practised at a scale sufficient to bring about permanent changes in both vegetation and soils.

Based on numerous pollen diagrams from the coastal areas, the first records of rye pollen are dated to the Early Iron Age, though showing great inconsistencies between different sites. Current knowledge on the introduction of rye cultivation into southern Finland is at present too limited to permit solid conclusions on the origin and status of rye. Its first appearance in the pollen diagrams is rare and sporadic, but can be regarded as evidence for its real introduction to the area. A pronounced increase in the frequency of rye pollen is generally dated to the Late Iron Age, although clear differences in time and distribution can be demonstrated most likely to be due to differences in local practices, such as the infield/outfield system. A comparison with pollen diagrams from the southwestern Lake District of Häme shows similar patterns of development.

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The number of palaeoecological studies of human influence on nature during prehistoric times in Finland, have increased markedly during the last decades primarily due to an increased awareness among archaeologists of the available methods and the value of multidisciplinary approaches. Some review papers, based on pollen-analytical records, have been published recently on the history of crop plants in this country (Vuorela 1982, Meinander 1984, Donner 1984, K. Tolonen 1984).

The present paper deals with further aspects

of the history of crop plants in Finland. Pollen data from six sites located in the southern cultivated area of Finland Proper (the Salo Hill Region; Atlas of Finland 1925) are compared with data from three sites in the Lake District of southwest Häme (Tavastia). The author does not attempt any thorough survey, but intends to trace the beginning of cultivation, especially that of rye, in these parts of Finland.

Generally, two major features are required of a pollen diagram in order to reconstruct accurately the history of man and the landscape,

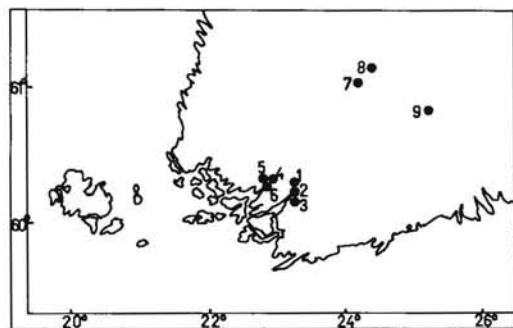


Fig. 1. Sites in southwestern Finland of pollen diagrams discussed in the present paper and listed in Table 1.

namely good chronological control with as exact dating as possible, and adequate sampling frequency, i.e. fine resolution analysis. When using pollen to reconstruct cultivation history, it seems necessary to consider, once again, dating methods, which cannot be regarded as absolute. Let us take one example. It has been demonstrated by several authors in dealing with cultural sequences that lake sediments may yield dates which may be contaminated to varying degrees by old carbon or sediment reworking because of inwashed soils (Pennington 1975, Huttunen & K. Tolonen 1977, M. Tolonen 1978a, K. Tolonen 1980). Thus, in making inferences from dates on gyttja with pollen indicators of human influence, i.e. cereals or apophytes, a chronolo-

gy based on annual laminations may be more reliable than one based on radiocarbon dates.

The present discussion (Figs 1-2 and Table 1) focuses on nine cases, 7 from ombrogenous *Sphagnum* peatland sites and two from annually laminated lakes. The chronology is based on ^{14}C dates and on inferred dates on the basis of peat growth for the peatland sites and for the two lake sequences the chronology is based on both radiocarbon and varve chronologies. A more detailed description of the sites is given in M. Tolonen (1978a, b, 1981, 1983, 1985a, b, c, d).

With respect to the introduction of rye, the use of "the empiric limit", i.e. the beginning of its continuous presence based on a pollen curve, as recently presented by Donner (1984), in fact may have obscured rye pollen in earlier periods. When evaluating pollen-analytical records for the introduction of *Secale*, however, the first occurrence of pollen grains are of great importance, as well as single occurrences of rye pollen which can verify the introduction of the species.

The origin of rye (*Secale cereale* L.) somewhere in central or southwestern Asia seems likely (Helbaek 1971, 1977, Sencer & Hawkes 1980). Helbaek (1971, 1977) came to the conclusion that rye spread by the latter half of 3rd millennium B.C., "as far as the Baltic Sea and the River Vistula" and the spread to the northeast covered "all of agricultural Russia". Since Vavilov's (1917, 1926) papers it has been generally suggested that rye was a weed or evolved as a secondary crop with wheat and barley (Jenssen

Table 1. List of sites used in Figure 1.

	location	alt.	site	information used for interpretation
1.	Santamäki, Salo (M. Tolonen 1985a)	60°25'N; 23°07'E	57.5 m bog	regional vegetation history
2.	Ketohaka, Salo (M. Tolonen 1985a)	60°23'N; 23°07'E	45 m forest soil	local vegetation history
3.	Pukkila, Salo (M. Tolonen 1983)	60°20'N; 23°10'E	29 m bog	regional vegetation history
4.	Preitilä, Paimio (M. Tolonen 1985c, in press)	60°26'N; 22°46'E	58 m bog	regional vegetation history
5.	Oinilanmäki, Paimio (M. Tolonen 1985c, d, in press)	60°28'N; 22°42'E	56 m forest soil	local vegetation history
6.	Palomäki, Paimio (M. Tolonen 1985b)	60°25'N; 22°43'E	72 m bog	local vegetation history
7.	Kantala, Sääksmäki (M. Tolonen 1978b)	61°10'N; 24°02'E	81 m bog	regional vegetation history
8.	Kissalammi, Pälkäne (M. Tolonen 1981)	61°17'N; 24°21'E	90.4 m lake	regional + local vegetation history
9.	Ahvenainen, Koski Hl. (M. Tolonen 1978a)	61°02'N; 25°07'E	122.2 m lake	regional + local vegetation history

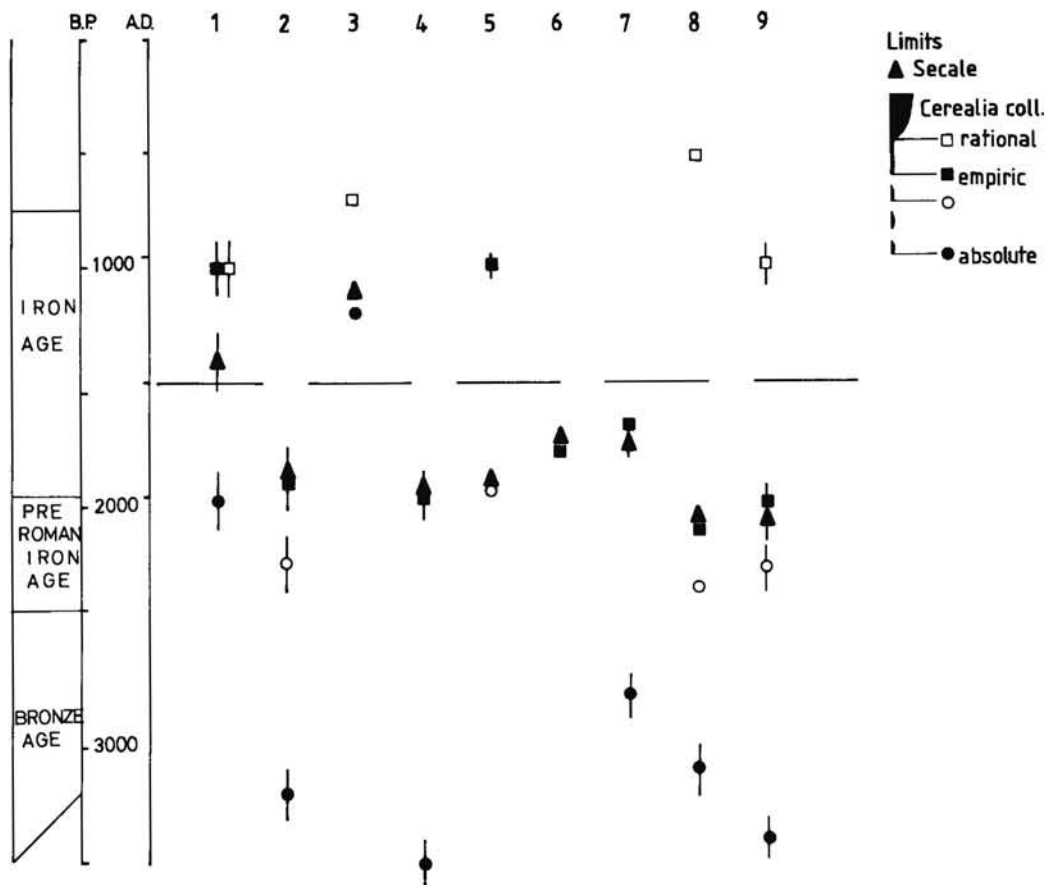


Fig. 2. Dates of the pollen record of *Cerealia coll.* and *Secale* from various sites in SW Finland (see Table 1) compared with the archaeological chronology. A typical pollen curve is given to show the various absolute, empirical and rational limits used for dating. The radiocarbon dates are illustrated with one standard error. For Pukkila, Salo (3), the radiocarbon dates cover the part of the profile only below cultural sequences and the dates for records of *Cerealia* are estimated from a growth-rate curve (M. Tolonen 1983). At Palomäki, Paimio the inferred dates are based on stratigraphical trends, on the known land uplift chronology and on the sediment accumulation curve (M. Tolonen 1985b). At sites 8 and 9 (Kissalammi, Pälkäne and Ahvenainen, Koski) the validity of varve counts supported by radiocarbon dating is stressed (M. Tolonen 1978, 1981). For details of the definition of the different limits see Donner (1984). Original conventional radiocarbon dates are used.

& Helbaek 1944, Godwin 1975, van Zeist 1976). Although, close connection between Celtic migrations (between 500 B.C. – A.D. 500) and the migration of rye in Central and Western Europe has been postulated (Sencer & Hawkes 1980), there is numerous considerably older evidence from e.g. the British Isles (Kilbride-Jones & Crichton Mitchell 1933, Hjelmqvist 1980, Chambers 1984, Chambers & Jones 1984).

In the light of available archaeological and palaeoethnobotanical evidence, it seems that the introduction of rye to different parts of Europe occurred independently. Therefore, it is also likely that the migration routes of rye to north-eastern Europe were numerous (Chambers &

Jones 1984). It can be assumed that the onset of rye cultivation took place relatively earlier in areas where conditions for wheat and barley were less favourable (e.g. Helbaek 1971).

Although rye is grown throughout most of Europe, it is a more important crop in northeast Europe. Traditionally rye is regarded as a crop suitable for dry sandy soils, associated with areas of marginal cereal agriculture (Jones 1981). Rye cultivation may well have been favoured because of deteriorating soils brought about by both climatic and human reasons (over-grazing etc.) during the last two thousand years in northern Europe, as described for instance by Iversen (1973).

Fig. 2 shows radiocarbon, varve and inferred dates on the basis of peat growth for *Cerealia* and *Secale* from nine pollen diagrams in SW Finland. The dates for *Secale* are based on the first appearance of the pollen in the diagrams. Three different limits *sensu* Donner (1984) for the occurrences of cereal type pollen are shown. The validity of these limits will be discussed below. On the basis of these records, it becomes apparent that the earliest presence of the *Cerealia* and *Secale* pollen (the "absolute" limit) at various horizons dates to various centuries B.C. and A.D. The scatter in ages is due to two main reasons. Firstly, the first sporadic occurrences of cereal pollen may actually reflect temporary clearances that can vary in age and location in relation to the sampling site. Secondly, the earliest cereal pollen at some sites may have been hidden due to specific pollen transport of sediment characteristics at the study site. These factors may lead to "inconsistencies" among *Cerealia* pollen records from different profiles. This problem is apparent at sites 1 and 3 (Santamäki and Pukkila), which represent regional pollen records from peat deposits, as opposed to that from site 2 (Ketohaka), which is a local pollen record. The accumulation rate of peat was too low to allow sufficiently high resolution for the first clearances to become registered in the pollen record. Thus the "absolute" limit for *Cerealia* in a regional pollen diagram may be synchronous with the "rational" limit in a local pollen diagram. In another study, site 5 (Oinilänmäki), it was clearly evident that local vegetation can filter out totally non-local pollen, often including cultural indicators and *Cerealia* pollen, which in most pollen profiles never registers great quantities of pollen anyway. Therefore, it is not necessarily so much a question of statistical uncertainties due to low or uneven pollen sums counted per sample, as suggested by Donner (1984), but perhaps related more to the complex processes of pollen production and dispersal and sedimentological phenomena characteristic of the study basin (=matrix effect).

The oldest evidence of rye cultivation indicated by pollen analysis lies at levels which, on the basis of radiocarbon dates and varve chronologies, have been dated to the Roman Iron Age near the coast of Finland Proper, and to the pre-Roman Iron Age and later in the lake District of southwest Häme further inland.

One can easily draw misleading conclusions about the history of agriculture on the basis of pollen stratigraphical correlations. The continuous presence of cereal pollen perhaps pro-

vides the best evidence for a general increase in farming, but does not necessarily relate to the first introduction of cultivation. With regard to the dates for the introduction and cultivation of rye, the results obtained in this paper correspond to that presented by K. Tolonen et al. (1979) for southwestern Finland. In their paper, they reviewed the available literature in the neighbouring areas (references in op.c., also Lange 1976). Records of rye seeds are relatively few in Finland and those available dated to the late Iron Age (Luoto et al. 1983, Seppä-Heikka 1981a, b, 1983, Matiskainen 1984).

Owing to the different rates of evolution and to variations in the accuracy of dating, only broad generalizations can be made, although the results do not exclude certain regional differences. Temporal comparisons with different parts of southern Finland are not possible, as there are no data available for e.g. the Coastal District of East Uusimaa or the Karelian coast. On the basis of the available knowledge it seems reasonable to conclude that the introduction of rye to southern Finland did not occur later than in areas further to the west or south-west (Lange 1976, cf. Donner 1984). The migration routes of rye into Finland are an open question. However, the author emphasizes migration influence from the south-east, south or west as equally possible.

Whatever the status of rye in the prehistoric period, it is not part of our native flora. Even if it was an accidental introduction with crops in the beginning, it must be regarded as a utility plant.

In summary, the pollen curves and limitations in the available pollen records for cereals cannot be used to infer either the quality or intensity of the successive vegetational events. The resolution apparent in pollen profiles is controlled by several complex factors, all of which are not necessarily adequate to trace cultivation. The pattern may reflect intense cereal cultivation (including *Secale*) or a change in local vegetation, which in turn causes inconsistent pollen rain, be it local or regional. Concerning earlier temporary clearings, it is questionable whether they have been inferred at all.

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