Resistance in spelt wheat to yellow rust

III. Phylogenetical considerations

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Summary

Theories on the origin and dissemination of spelt wheat (Triticum aestivum ssp. spelta) are evaluated. Recent information on resistance to yellow rust (Puccinia striiformis Westend. f. sp. tritici) and variation for gliadin patterns in spelt wheat accessions originating from Iran and Europe is superimposed on literature reports concerning the origin, status and dissemination of spelt wheat. The data support the theory on the origin of spelt wheat in the Near East. An alternative European site of origin, albeit improbable, cannot be excluded.

Introduction

Spelt wheat, Triticum aestivum (L.) Thell. ssp. spelta (L.) Thell. (Kimber & Sears, 1983) or T. spelta L. (Kimber & Sears, 1987), is a primitive hexaploid wheat with a brittle rachis and adherent glumes, long spike internodes and non-spherical seeds, which are controlled by the pleiotropic spelt factor (Q/q), and factors for ear compactness (C/c) and seed form (S/s), respectively. Therefore, its genotype has been designated as qqccSs (McIntosh, 1983). During evolutionary processes mutations materialized, eventually resulting in bread wheat (T. aestivum L., QQCCSS). The question where these processes took place has been a scientific issue since the early thirties.

A natural site of origin of spelt wheat was discovered in Iran (Kuckuck & Schiemann, 1957). There is not much archaeological evidence, however, for its agronomical importance in the Middle-East where emmer (T. turgidum ssp. dicoccum, domesticated form of T. turgidum ssp. dicoccoides) was most popular (a.o. Harlan, 1981). The area of cultivation of the crop has been confined to Europe. According to Gradmann (1909; cited by Harlan, 1981) the acreage of spelt wheat exceeded bread wheat in the first decade of this century. In 1930 it was still a major constituent (40%) of the Middle-European wheat growing area, ranging from the North-West Alps, where its former importance is recognized in village names like ‘Dinkelbühl’ (‘Dinkel’ is the German word for spelt wheat), and parts of Austria up to the Black Forest in Germany and North-East France, where its cultivation is already known for some 900 years (Flaksberger, 1930). According to Zeven & de Wet (1982) the area might have been much larger, reaching from Sweden to Spain or North Africa. Linguistic evidence includes the old Spanish word ‘Escandia’ (spelt wheat) for a Swedish region considered to be the ancestral home of the ‘Escandians’ or Norsemen (McFadden & Sears, 1946). According to excavations in Denmark, Sweden and the United Kingdom, the first occurrence of spelt wheat in
Europe is dated in the late Bronze Age (ca. 1000 BC; Bell, 1987). An inventory on its prehistoric distribution, compiled by Schultz-Motel & Kruse (1965), provides evidence for Iron Age (600 BC) and even Neolithic (5000–4000 BC) presence of spelt wheat. The first reference in literature as ‘spelta’ or ‘scandula’ was in the Edict of the Roman emperor Diocletian (301 A.D.) (a.o. Flaksberger, 1930).

The interest in spelt wheat has been recently revived due to its reputation as a species with a natural defence against several fungal pathogens. The competitive properties of the species under marginal cultural conditions initiated a breeding programme in Switzerland (Riesen et al., 1986; Schmid & Winzeler, 1990). Moreover its flour is considered to be of an excellent quality for pastry production and the grains are the major constituent in the traditional German ‘Grünkern’ dish (Baumann, 1984; Hitschfeld, 1985; Züllig, 1985). These trends are not yet reflected in an increasing agricultural importance, however. Currently the crop gains most attention from ecological farmers and its total acreage in Europe is still negligible (e.g. 5% of the total Swiss wheat acreage in 1985).

Several spelt wheat accessions have been studied with respect to resistance to the fungal yellow rust pathogen of wheat (Puccinia striiformis Westend. f. sp. tritici) and variation for gliadin patterns (Kema, 1992; Kema & Lange, 1992). In addition to having similar gliadin patterns, European and Iranian accessions were found to carry an identical...