Theories on migration and history of the North-Atlantic flora: a review

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Abstract — Two theories on migration and the history of the North Atlantic flora have been the subject of a popular debate for over a century. In late 19th century when signs of glaciations had been recognized in Scandinavia, it was concluded that the entire flora and fauna had been destroyed during glacial periods and that all plants immigrated after the last glacial period. This so called tabula rasa theory was soon opposed by the glacial survival theory which stated that plants survived the last or several of the Pleistocene glaciations in ice-free refugia within North Europe. The glacial survival theory was very popular, in the mid-20th century, notably because of three botanical arguments that were forwarded in its support: 1) it alone could explain the distribution of the so-called west arctic element e.g. species found in Scandinavia, Iceland and North America but missing in the Alps, Ural Mountains and Asia, 2) the alpine endemic element e.g. the relatively higher proportion of endemic species in the alpine flora of Scandinavia compared to the lowland, and 3) the special disjunction of the alpine flora. Later, those arguments were reconsidered for the Scandinavian flora and it was concluded that they could be explained without glacial survival. In the last decade, new techniques e.g. molecular methods, results from ice core projects and pollen analyses have offered fascinating possibilities to re-formulate the questions asked by research pioneers. The debate on the plant migration and origin of the flora in the North Atlantic region thus continues.

INTRODUCTION

It is generally believed that the present-day distribution of plants and animals in the North Atlantic regions is largely a product of Quaternary climate and environmental change (e.g. Bennike, 1999; Tremblay and Schoen, 1999; Tiffney and Manchester, 2001). Contrasting ideas on plant migration and the origin of the flora in the North Atlantic regions have been the subject of popular debate for over a century, with two contrasting theories emerging by the close of the 19th century: a) The tabula rasa (clean slate) theory, according to which all plants immigrated after the last glacial period (Nathorst, 1892; Nordal, 1987) and b) The glacial survival theory of plant survival during the last or several of the Pleistocene glaciations in ice-free refugia (e.g. Dahl, 1963; Löve and Löve, 1963).

The first ideas

The Tabula rasa Theory

It was not until the mid-19th century that scientists first began accepting the fact that major parts of northern Europe, North America and Siberia had once been covered with ice. Besides striated and polished rocks, European scientists found extensive unsorted sediments that could only be explained by the existence of a large ice sheet (Dahl, 1946; 1955).

Before the end of the 19th century, signs of glaciation were recognized on the outermost islands along the coast of Scandinavia. This led to the conclusion that the entire Scandinavian peninsula had been covered with ice during the “ice age” with the consequent destruction of the flora and fauna. This argument sub-