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STRUCTURE OF BUCKWHEAT KERNEL

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The structure of buckwheat kernels was studied. The orientation of cells and the shape and size of strach grains in endosperm were examined by scanning electron microscopy (SEM). The aleurone layer was confirmed by interference and flourescence microscopy and studied by SEM.

INTRODUCTION

The buckwheat kernel is a triangular dry fruit (achene). It consists of hulls, spermoderm, endosperm and embryo. Kernels are easily dehulled. The hulls represent 17-26 % (in tartary buckwheat 33 %) of kernels weight; diploid varieties have less hulls than the tetraploid. The embryo is spread through the endosperm and it has two large folded cotyledons. The terminal parts of cotyledons are often parallel under the kernel surface. Kernels in most buckwheat varieties are 4-9 mm long, larger kernels are in tetraploid varieties.

The detailed structures of buckwheat kernel have been studied by Pomeranz and Sachs (1972) and by Kreft and Javornik (1979) using a scanning electron microscope. Pomeranz and Sachs (1972) studied kernels of Pennquad, a tetraploid cultivar of buckwheat. They studied detailed structures of hulls (epicarp, fibor layers, parenchyma cells and endocarp) and the spermoderm (outer epiderm, spongy parenchyma and inner epiderm). Kreft and Javornik (1979) compared endosperm structures of diploid and tetraploid varieties.

MATERIAL AND METHODS

Kernels of diploid buckwheat populations Siva dolenjska, a population of buckwheat from PDR Korea and 4 samples from Nepal; tetraploid cultivars Bednja 4 n and Pennquad; and samples of tartary buckwheat (Fagopyrum tataricum Gaertn.) from Slovenia were studied.

Pictures were obtained by scanning electron microscopy (SEM), by interference microscopy and by fluorescence microscopy.

RESULTS AND DISCUSSION

Cross - section through the kernel of tetraploid Bednja 4 n is shown in Fig. 1. In endosperm the prismatic structure of the cells filled with round or polygonal starch grains can be seen. In the peripheral part of the endosperm, starch grains are strongly inbeded in matrix. The matrix is presumably rich in proteins and in other substances present in the cytoplasm before it dried. Polygonal and round starch grains (Fig. 2 bottom and Fig. 3 bottom) may differ due to different amount of matrix attached to starch grains. Cells containing polygonal structures are quite coherent, when the kernel is broken, the plain of breakage pass mainly at cell walls. In such cases the prysmatic structure of cells could be observed. When starch grains appeared round, they are less fixed to each other and there are air spaces between them. The plain of fracture of the kernel pass easily through the cells. When observed by magnifying glass this part of kernel is floury in contrary to the harder part with polygonal structure. Harder are usually peripheral parts and some parts near the embryo The orientation of cells in the first layer of cells under the aleurone layer is somewhat different than the orientation of most endosperm cells (Fig. 5). Starch grains are 3-8 um in diameter.

Pomeranz and Sachs (1972) examinated the aleurone layer and described the aleurone cells and grains. Only with SEM it is not easy to identify aleurone cells. So some examinations have been done on the structure of buckwheat kernel using fluorescence and interference microscopy (Fig. 5). On the interference light micrograph (Fig. 5 top) there is seen at the peripheral part of the kernel a layer of cells - presumably the aleurone layer. On the same micrograph the prismatic cells of the endosperm with starch grains can be observed. On the fluorescence micrograph (Fig. 5 bottom) at the peripheral part of the kernel a thin light blue structure parallel with the surface of the kernel is seen. In wheat (Fig. 5 bottom window), where the presence of aleurone layer is well known, a similar light blue structure is seen. From the comparison of wheat and buckwheat cross-sections and because the proteins give blue color in fluorescence microscopy, it could be concluded, that the studied structure in buckwheat kernel is the aleurone layer. Aleurone cell layer is in buckwheat sometimes discontinued (Fig. 5 top). Details of the aleurone layer could be observed in Fig. 4. Aleurone layer is 10-15 um thick, the size of aleurone grains is somewhat less than 1 um. The size of embryo is somewhat different in studied buckwheat samples.

Kernels of tartary buckwheat differ from kernels of common buckwheat mostly in the shape of kernels (Fig. 6 top) and in the higher content of hulls. The aleurone layer is about 10 um thick, the size of aleurone grains and starch grains is about the same as in common buckwheat. At tartary buckwheat it was only very few floury parts of the endosperm.

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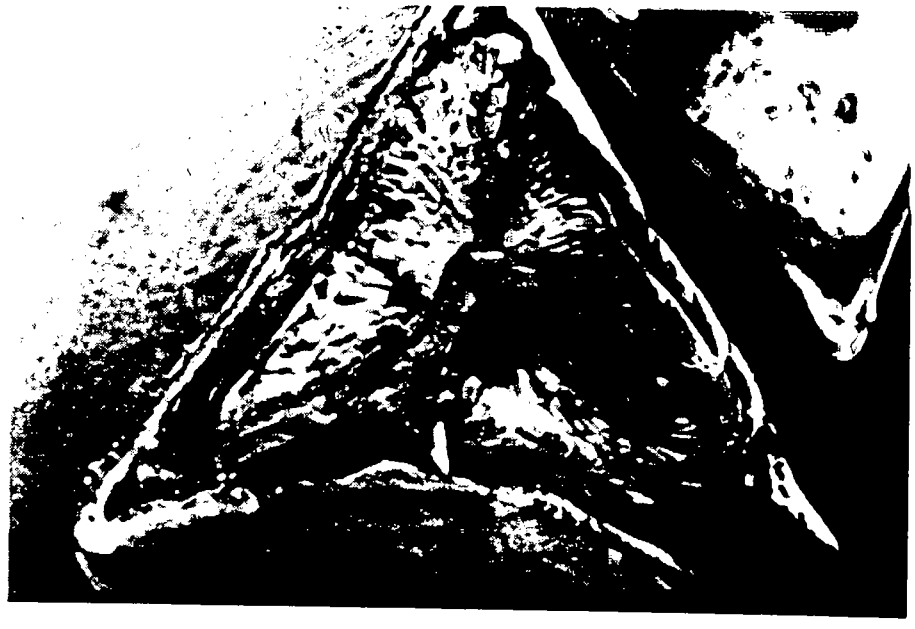
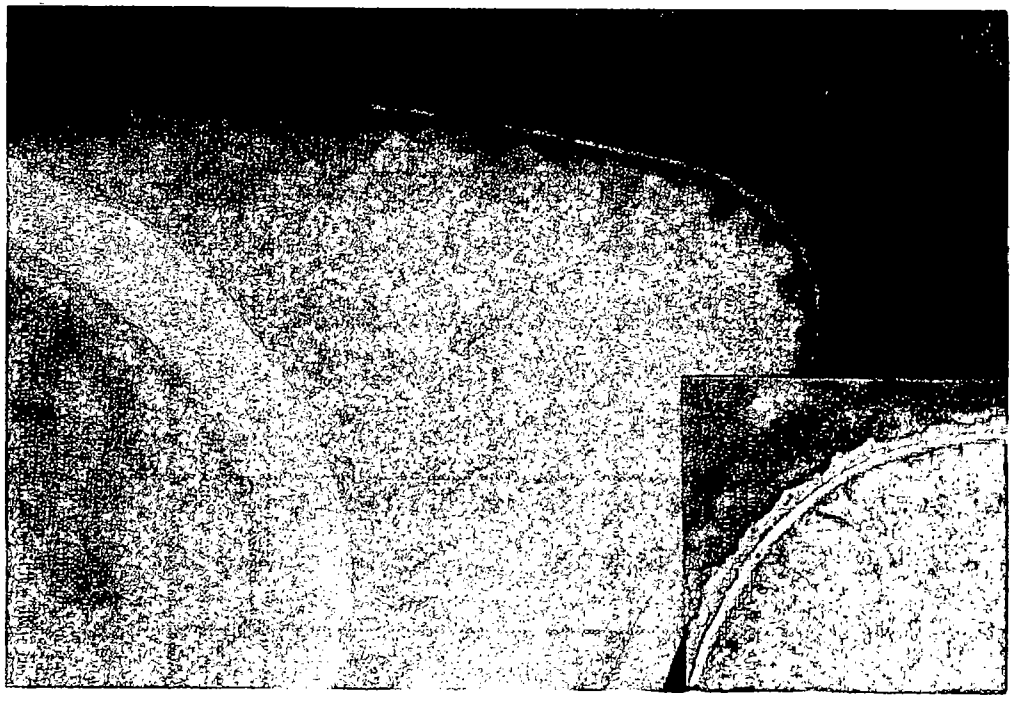
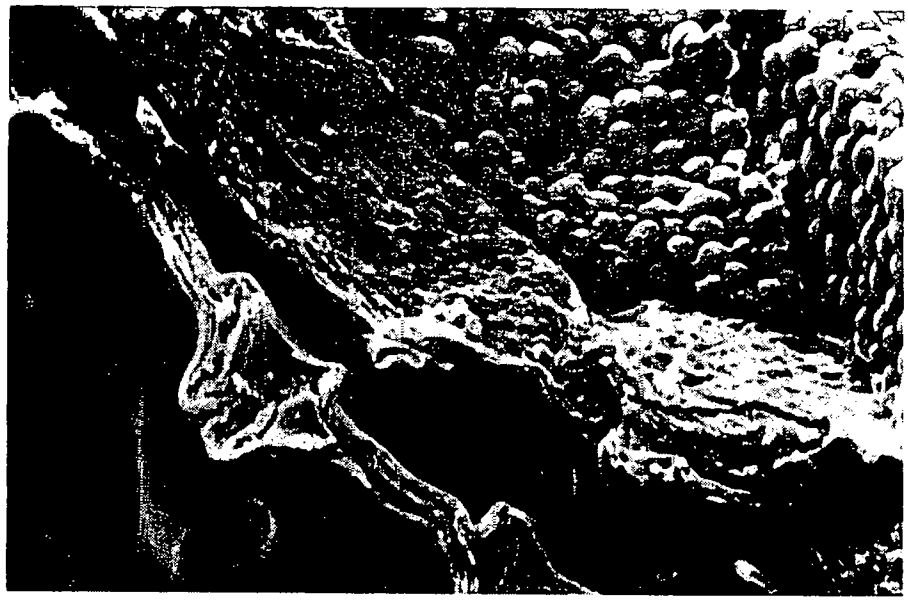


Fig. 1 Cross-section of the kernel of tetraploid buckwheat Bednja 4n (top x 20, bottom x 100)



The a eurone layer of buckwheat endosperm.
Top: Interference micrograph (x750). Bottom: Fluorescence micrograph (x75). Bottom window: Fluorescence micrograph of peripheral part of wheat kernel (x35).



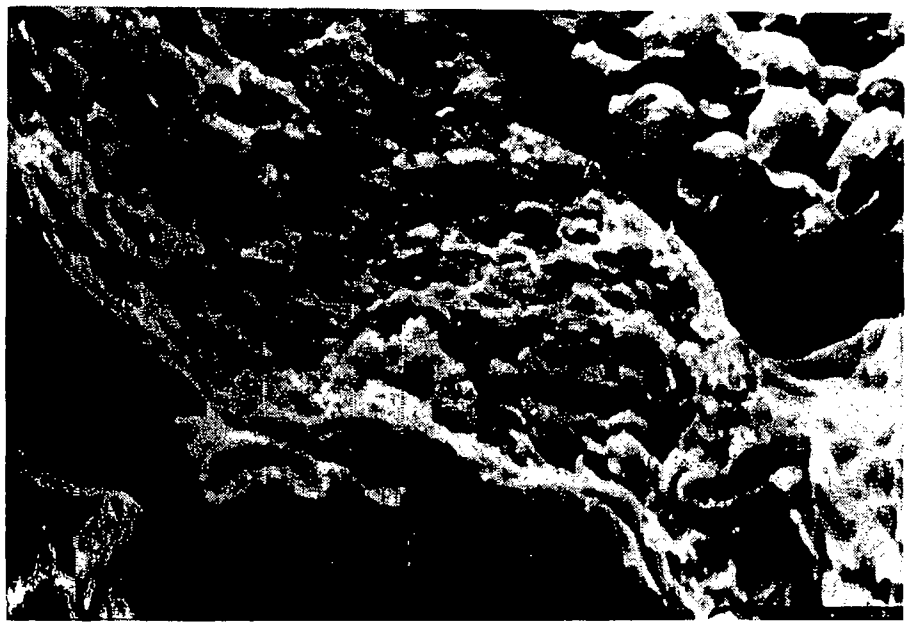


Fig. 4 The aleurone layer of Bednja 4 n (top x 2000, bottom x 5000)

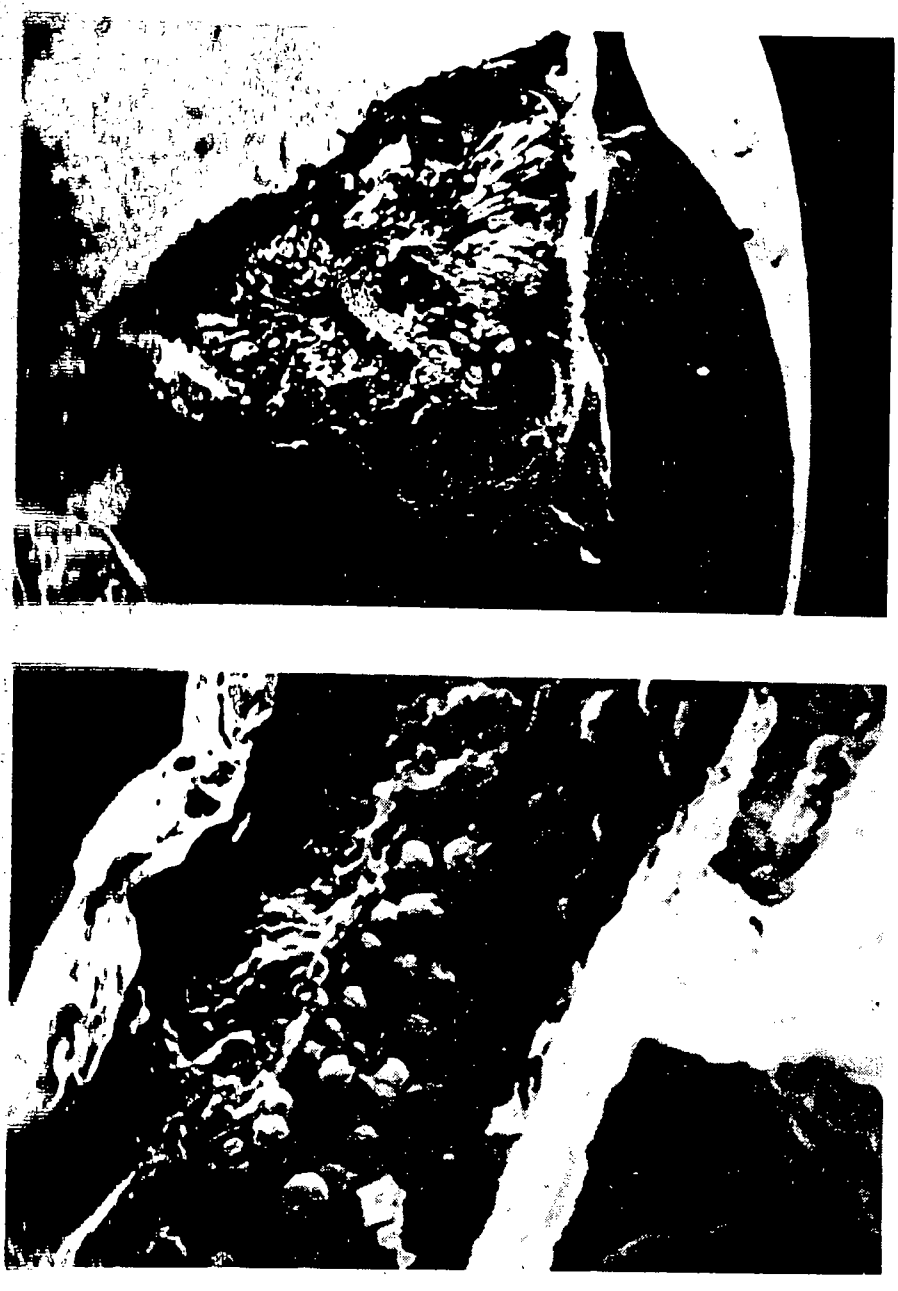


Fig. 6 Tartary buckwheat. Top: cross-section of the kernel (x 20). Bottom from left to right: spermoderm, aleurone layer, other cells of endosperm.

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STRUKTURA ZRNA PRI AJDI

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Opisana je struktura prereza zrna ajde, ki je bila proučena s pomočjo scanning elektronskega mikroskopa. Prizmatične celice endosperma so napolnjene z okroglimi ali poligonalnimi oblikami škrobnih zrn. Na perifernem delu prereza so škrobna zrna močneje povezana med seboj z matriksom kot v centralnem delu. Velikost škrobnih zrn je od 3 do 5 μm.

S pomočjo epi-mikroskopa in z uporabo flourescenčne ter interferenčne svetlobe je bila pri proučevanju prereza zrna ajde potrjena prisotnost alevronskega sloja (sloj celic zrna bogat z beljakovinami), ki doslej pri ajdi ni bil nedvoumno dokazan. Debelina alevronskega sloja je od 10 do 15 μm, velikost alevronskih zrn pa je nekoliko manjša kot 1 μm.

buckwheat

GENETICS, PLANT BREEDING, UTILIZATION

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