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STARTING-POINTS FOR BUCKWHEAT BREEDING IN YUGOSLAVIA

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Samples of buckwheat (*Fagopyrum esculentum*) and of tartary buckwheat (*F. tataricum*) populations grown in Yugoslavia were collected. Some of their main characteristics are described. Purposes of buckwheat breeding and possible methods are discussed in the paper.

INTRODUCTION

In Yugoslavia buckwheat is grown at least from the beginning of the 13th century, first written report is from the year 1426 (Kuhar 1976). It became widely spread later, especially in the 16 and 17 centuries, when it became one of most important crops. Reasons for spreading of buckwheat growing were that it is an undemanding crop, with short vegetation period, which makes it possible to grow it as a catch crop, on the same field after harvest of barley or wheat. (Valvasor 1689). Among reasons for the spreading of buckwheat was, that as a new crop, it was not mentioned in old feudal books for duties of subjected farmers (Kuhar 1976). Buckwheat was mostly considered to be a food of poor people.

In Yugoslavia acreage of buckwheat strongly decreased from 1950 to 1970, but somewhat increased again after 1970, when buckwheat became more wanted again. It is mostly due to the revived interest for traditional "old days" foods, a reaction to too uniform, industrial and half-prepared meals. Buckwheat is grown in North-West of Yugoslavia, mostly in Slovenia. Acreage in Slovenia is over 3,000 ha and total yield about 400 tons. Consumption of buckwheat in Slovenia is greater than its own production, some buckwheat is imported from other countries (f. ex. Brazil, USSR etc.).

This paper is a report on available buckwheat populations and a discussion on possible materials, methods and ideotypes in buckwheat breeding.

BUCKWHEAT SAMPLES COLLECTED IN YUGOSLAVIA

Several hundred samples of buckwheat were collected in western parts of Yugoslavia. No buckwheat was found or been recently growing reported in SR Serbia (including Vojvodina and Kosovo), SR Macedonia or SR Montenegro.

Collected samples of buckwheat could be grouped as follows: - "Siva ajda" (grey buckwheat). Hulls are grey or light grey with dark-brown mottles. It is mostly sown about July 20 and harvested in the beginning of October. Yields are up to 1.5 t/ha. It has small seeds (1000 grains weight is about 20 g) and about 21 % of hulls. Flowers are white. It gives less nectar than črna ajda or Bednja 4 n. Samples of grey buckwheat were in Slovenia collected around Višnja gorā, Trebnje, Novo mesto, Šentjernej, Metlika, Ig, Škofljica, Sežana, Nova Gorica, Tolmin, Ptuj, Gornja Radgona and Murska Sobota. A form growing south-east from Ljubljana is known as "Siva doljenjska".

- Črna ajda ("black buckwheat") has hulls black when ripening and dark brown when dry. Flowers are white with reddish shade on the outer side of corolla leaves. Vegetation period is some days shorter than that of grey buckwheat, so it is appropriate for cold, alpine part of Slovenia; in other parts gives less yield than the grey buckwheat. Kernels are somewhat larger than those of the grey buckwheat. Samples were collected in Ljubljana-Kleče, Tolmin, Trebnje, Radovljica, Slovenj Gradec and Ptuj. In some places samples were mixed with the kernels of grey buckwheat.

- Tartary buckwheat (*Fagopyrum tataricum* Gaertn.) is very frost resistant. Flour and foods are slightly green colored and somewhat bitter. It is used mainly as feed or as admixture to wheat or buckwheat flour. Yields may be over 10 q/ha. It has long vegetation period and is still grown as main crop in two locations in Slovenia (Radohova vas and Krma valley). In Cirkovce-Ptuj it was found a mixed crop with about half of tartary buckwheat and half of grey buckwheat. In several other locations it appears up to 1 % as a weed on fields of the grey buckwheat.

There were collected also some other buckwheat samples: North-East from Murska Sobota grey buckwheat with small grains (1000 grains weight 19 g) with the name "French" (francoska) was found. Buckwheat at one of fields near Cirkovce-Ptuj has brown grains and white corolla leaves with a large green spot on the basal part. In Šenčur-Celje and at Murska Sobota was found buckwheat called "Russian" (ruska), it has sharp lanceolate leaves and very long vegetation period, but very different from Bednja 4 n (known in some villages also as "Russian"). In SR Bosnia and Hercegovina farmers grow buckwheat near Prijedor. Farmers are Ukrainians, they brought buckwheat seeds with them from Ukraine in the beginning of this century. This is very similar to grey buckwheat from Slovenia. About 30 years ago an admixture of grey buckwheat from Slovenia was introduced "to improve their own buckwheat" according to the farmers.

Of registered cultivars, it is only Bednja 4 n grown in Yugoslavia. It is a tetraploid variety, selected from the material grown for decades in Yugoslavia, but originating in the USSR. It is morphologically very similar to Pennquad. Bednja 4 n has long vegetation period and is hardly able to be a second crop in the year after barley or wheat. It has sometimes high, but unstable yields, large kernels and relative high percentage of hulls. It is a good source of nectar for bees. Similar unselected material is maintained by farmers around Lendava.

Buckwheat was introduced in Slovenia very early. First written report is from 1426 (Kuhar 1976). According to Valvasor (1689) buckwheat was in Slovenia very important crop sown in July after the harvest of barley or wheat. In the beginning of 19th century tartary buckwheat was introduced. As sources of

buckwheat seeds in previous centuries are in literature mentioned Bretagne and other parts of France ("sarrasin seigle"), Westphalia (black), Karinthia (black), Slovakia (black), Russia (tartary buckwheat), Siberia (light brown), Japan (grey), Mongolia (grey), Sweden, Scotland and Canada (Adamič 1976, Rihar 1976). Fifty years ago black hulled buckwheat from Germany was introduced (Berlin). This buckwheat is growing in Kleče near Ljubljana.

Slovenia is very rich in buckwheat germplasm, it is possible that here exist some forms which disappeared in their previous locations. We try to collect and maintain at least a part of this material, and also to use it in buckwheat breeding.

Several buckwheat samples from other countries were also studied to find out their value for buckwheat breeding in Slovenia:

- 15 buckwheat samples from Japan. They have in our climatic conditions too long vegetation period and poor yield. Kernels are relatively large, plants were high and leaves large, branching was not intense.
- 4 samples collected in Nepal (Table 1). Branching was very good, yields were moderate, but vegetation period was too long. Flowers and plants in some samples were more intensely red than flowers of črna ajda.
- Buckwheat from PDR Korea has very good yields, intense branching and a low percentage of hulls (Table 1). In comparison with Siva dolenjska buckwheat it has much longer vegetation period. Flowers are white, seeds light brown. This buckwheat is used in crossing experiments with Siva dolenjska buckwheat.

Experiments with buckwheat populations or cultivars from Hungary, Austria, Poland, USSR, Northern India and Brazil are in progress. According to informations, in small extent buckwheat is grown also in England (Kent, inf. in: Alive Nov./Dec. 1979, p. 14), in Switzerland (Lustenberger et al. 1977) and in Sweden (A. Hagberg, pers. comm.), but we have not yet obtained seed samples from these countries.

Table 1 Nitrogen content, 100 grains weight and percentage of hulls in buckwheat samples

Buckwheat sample	nitrogen (%)	1000 grains weight (g)	hulls (%)
Siva dolenjska	1.90	20.8	20.7
Črna ajda	1.79	22.6	23.1
Pennquad	1.84	37.7	22.4
Bednja 4n	1.87	37.5	25.5
Korea	1.93	26.5	17.5
Hungary 1	1.77	23.1	20.5
Hungary 2	1.75	26.1	20.8
Brazil	1.96	23.8	20.8
Pisang (Nepal)	1.72	25.7	25.1
Manang (Nepal)	1.94	28.3	24.1
Came (Nepal)	1.94	25.8	22.7
Tokucha (Nepal)	1.67	25.6	21.7
F. tataricum	1.78	17.4	33.0

IDEOTYPE OF BUCKWHEAT

For more successful buckwheat growing in North-West Yugoslavia there should be following purposes of buckwheat breeding:

- Larger assimilation surface
- Good fertilization of flowers
- Short vegetation period (suitable to be as after crop sown in end of July and harvested in the end of September)
- Photoperiodic intensity
- Resistance to freezing in autumn before the harvest (or in spring if spring sowing)
- Determinant growth (Fesenko 1968)
- Good utilization value (Buckwheat proteins have very good biological value, but the content of hulls, the content of tannin and the content of substances causing fagopyrism could be lowered).

POSSIBLE METHODS OF BUCKWHEAT BREEDING

Improvement of buckwheat yields could be obtained by following ways:

- Selection within populations or within progenies of crossing different populations or cultivars.
- The use of heterosis based on the genetic heterogeneity within populations (but the population should be not too heterogeneous in regard to morphological and some important physiological characters). Frequent introductions of seeds from distant countries in the past had probably also this function.
- Heterosis obtained by crossing different populations or cultivars. Parents may be sown in alternative rows. Elimination of pin respective thrum plants in alternative rows to obtain complete heterosis.
- Heterosis obtained by crossing of inbred lines. Existing inbred lines have too low seed set.
- Breeding of homomorphic varieties (Ruszkowski 1980)
- Introduction of tartary buckwheat into breeding. Tartary buckwheat is homomorphic self-compatible species. It has high yields, is freezing resistant and has as good amino acid composition as buckwheat. Breeding for shedding resistance and for lower content of hulls should be needed. The substances causing greenish colour and somewhat bitter taste are not yet investigated.

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IZHODIŠČA ZA ŽLAHTNENJE AJDE V JUGOSLAVIJI

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Ajda (*Fagopyrum esculentum* Moench) je dvokaličnica iz družine Polygonaceae. V Jugoslaviji jo sejemo v Sloveniji (okoli 3000 ha) in v Hrvatski. Sejemo jo predvsem kot strno žito. Povpraševanje po ajdi se veča, kot se veča zanimanje tudi za druge tradicionalne jedi, ki prispevajo k bolj raznovrstni prehrani. Posebno pomembna je ajda zaradi izredno visoke biološke vrednosti beljakovin. Problem pa so razmeroma nizki pridelki, ker smo doslej pri nas zanemarjali raziskovalno in žlahtnjiteljsko delo z ajdo.

Eno pomembnih izhodišč za žlahtnjenje ajde je avtohton material. V različnih krajih Slovenije in Jugoslavije smo zbirali vzorce ajde, proučevali pa smo tudi vzorce iz tujine.

Cilji žlahtnjenja ajde so predvsem:

- povečanje asimilacijske površine,
- izboljšanje fertilnosti oziroma oplodnje,
- skrajšanje vegetacijske dobe,
- ohranitev dobre uporabne vrednosti ter nižanje odstotka lusk, vsebnosti tanina in fotoaktivne snovi,
- izboljšanje odpornosti proti mrazu,
- približevanje k fotoperiodični nevtralnosti.

V prispevku so prikazane možne metode žlahtnjenja ajde.

buckwheat

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