

Citation:

Reiner H., Holzner W., Ebermann R.: The development of turnip-type and oilseed-type *Brassica rapa* crops from the wild type in Europe. - An overview of botanical, historical and linguistic facts. - **Rapeseed today and tomorrow, Vol 4, pp 1066-1069 (1995), 9th International Rapeseed Congress, Cambridge, UK 4 - 7 July 1995**

THE DEVELOPMENT OF TURNIP-TYPE AND OILSEED-TYPE *BRASSICA RAPA* CROPS FROM THE WILD-TYPE IN EUROPE - AN OVERVIEW OF BOTANICAL, HISTORICAL AND LINGUISTIC FACTS

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ABSTRACT

There is a lot of botanical, historical and linguistic evidence that the use of turnip-type *Brassica rapa* is very old in Europe. It was probably domesticated directly from its wild progenitor, the wild-type *B. rapa*. The use of European oilseed-type *Brassica* crops is relatively new. This paper gives a short overview on the history of *B. rapa* and presents botanical, historical and linguistic facts for a better understanding wild-, turnip- and oilseed-type *B. rapa* which will be useful for the interpretation of systematic and genetic work and future breeding.

INTRODUCTION

In one of our research projects we want to characterize the varieties of turnip-type *Brassica rapa* which are autochthonous in the Alps and to make out the morphological, physiological, genetical and phytochemical differences between the varieties (in continuation of Ebermann *et al.*, 1991). A main area in the work of the Institute of Botany is the biology of weeds and thus wild-type *B. rapa* occurring in Austria is also of great interest to our work. Incrosses from *B. napus* can easily occur and there is the question, if wild-type *B. rapa*, the progenitor of the oilseed-type *Brassica* crops, is still found in natural habitats and if in situ conservation is still possible. In doing our literature research we were very surprised at finding interesting remarks on the development of turnip-type and oilseed-type *B. rapa* out of their wild progenitor especially from the early botanists (Linné, DeCandolle, Metzger).

THE WILD-TYPE *BRASSICA RAPA* STILL IN NATURAL HABITATS ?

The name *Brassica campestris* was given to an annual weed growing in "non loamy fields of Europe" by Linné in his "Species Plantarum" (1753). DeCandolle (1824) calls *B. campestris* "Chou des champs" (Field kale) and points out, "that it has rough, stiff hairs as a young plant just like *Brassica rapa*". It seems to be native to Europe and the botanists say it is wildgrowing in the fields of England and Scotland, in Sweden, in southern Lapland, in Spain near Madrid, in Transsylvania and on the Krim". When it was realized that *B. campestris* and the turnip-type *B. rapa* have to be classified as the same species, a confusion in nomenclature began and the wild type was often subordinated under *B. rapa*. In the Flora Europaea (1964) the plant is named *B. rapa* ssp. *sylvestris* (L.)Janchen. A very simple and often used name is also *B. rapa* L. ssp. *campestris* (L.)Claph.. Prakash and Hinata (1980) give a comprehensive treatise on the genus *Brassica* using the name *B. campestris* ssp. *eu-campestris*

(L.)Olsson. All these names have been given to this taxon. For this paper it is sufficient to call it the wild-type *Brassica rapa*.

In Austria the annual wild-type *Brassica rapa* is only found ruderal and as a weed in rye- and potato-crops situated in relatively cool and high areas with an altitude of about 1000 m (Holzner 1981). In inner alpine valleys soil was tilled up to the middle of this century. The identification of specimens from former times, when rapeseed (*B. napus*) was not yet intensively grown, is quite easy. In the 70s farmers began to grow rapeseed in many parts of Austria. Since then information on the distribution of *B. rapa* in Austria has been very uncertain, because rapeseed can very easily escape from culture and incrosses can occur. In situ conservation of wild-type *B. rapa* is no longer possible. In our project we want to collect wild-type *B. rapa* in Austria and check the chromosome numbers ($n = 10$), in order to avoid any confusion with *B. napus*. Wild-type *B. rapa* accessions from several germplasm collections have been used in systematic work for example by Song *et al.* (1990).

HISTORY OF THE TURNIP-TYPE CROP PLANT

Willerding (1986) lists all the prehistoric finds of *B. rapa* seeds in Europe. The oldest were found at neolithic sites in Switzerland. There is always the problem of distinguishing the seeds of wild-type and turnip-type *B. rapa*, especially, if all the details of the excavation are not fully documented. The domestication of the turnip must be very old. There is a word in the ancient Assyrian Language "laptu", that dates back to about 1800 BC. The turnip is a very well known vegetable in the entire Near East (arab: "lift", persian: "salgham"). In the Greek and Roman period the turnip was a well domesticated and important crop plant. The Greek Theophrast (371-285 BC) calls it "gongylis" and the Roman Columella (35 - 65 A.D.) distinguishes the cultivation and conservation by lactic acid fermentation of "napus" und "rapa," saying that napus only forms a tender root, whereas rapa has a "thick stomach." One of the best witnesses for the importance of the turnip as a crop plant is the beautiful picture in the Dioscurides, a Byzantine book from 512 A.D. The oldest excavated turnip is from ancient Sparta in Greece and shows the importance of this food plant for the Byzantine culture. (Hather *et.al.*, 1992)

In the Middle Ages the turnip was a staple food plant. In the "Capitulare de Villis" emperor Charles the Great (around 800 A.D.) gives instructions as to which crops had to be planted and had to be given to his court; among those there are "napi." In the herbal books of the 16th century one can realize how turnip forms vary. In his "Herball" of 1597 Gerarde differentiates very clearly between turnips and navews (*B. napus*), adding very good illustrations. Linné gave the description of the turnip-type *B. rapa* in his Species plantarum (1753). Many specialists worked on the botany of this important crop plant. Phillip Miller in England, DeCandolle in Switzerland, Metzger in Germany and Vilmorin in France described all the garden varieties which were so important for the food supply of the big cities showing that Europe has been an important centre of diversity for *Brassica rapa*. Sinskaja included all the varieties from Asia. *Brassica rapa* L. *ssp. rapifera* (Metzg.)Sinsk. is a widely used scientific name for the turnip.

Special mention must be made of J. Metzger, who was a gardener in the German duchy of Baden. He did field experiments for several years with nearly all the varieties he could collect in the early 19th century. He gives us a complete and perfect systematic overview of the cultigens of the *Brassica* family in Europe. Working on the basis of morphological data alone he placed all the different cultigen varieties into the right species without any mistake, realizing that *B. napus* is a cross of *B. oleracea* and *B. rapa* (Metzger 1833).

Especially in areas with long, cold winters the turnip must have been an important food. Thus in the mountain chains of Europe the selection of the wild *B. rapa* for bulbing is probably older than the selection for seed (McNaughton 1986). Plinius tells us that "the best varieties in Italy come from Amiternum and Nursia, two towns northeast of Rome in the mountains of Abruzzi. The turnip grows in misty, frosty and cool regions, which make the turnips even sweeter, whereas heat makes them leafy. On the other side of the River Po it is the third crop after grain and wine". In the Alps the turnip

became a very important food plant. It was very well suitable for lactic acid fermentation ("Sauerrüben"). Thus a centre of diversity for the turnip developed. This is shown by many medieval works of art, e.g. the frescos in the Torre Aquila in Trento and frescos in Castello d'Issogne in Valle d'Aosta, both in northern Italy. The autochthonous turnip-type *B. rapa* varieties of the Alps are not very well documented and very little germplasm material is available.

THE FIRST USE OF THE OILSEED-TYPE CROP PLANT

In Latin "rapa" and "napus" are both crop plants, exclusively used for their tubers in Roman times. There were other oil plants available in Southern Europe, especially the olive tree. So *B. rapa* was spread mainly as the turnip-type crop within Europe. North of the Alps there was a lack of vegetable oil which was only taken from flax (*Linum usitatissimum*), hemp (*Cannabis sativa*) and poppy (*Papaver somniferum*). In centres of agricultural and economic prosperity like the Netherlands people tried to produce more vegetable oil. Almost all *Brassica* seeds were used to press oil. An old Dutch source from the 14th century says that oil was made from "raepsaet, koolsaet and mostaert saet", which means the seeds of *B. rapa*, *B. oleracea* and *B. nigra* (or *Sinapis alba*). As *B. rapa* turnips were most intensively grown it is quite evident that this crop was first used to produce large quantities of oil. A German herbal book from the 16th century says there are "ruoben" used to produce oil.

The history of the words gives us a very good explanation for the origin of the oilseed-type *Brassica* crops in Europe. The old German word "ruobesamen" changed into "Rübsen", the old Dutch word "raapzaad" entered the German language as "Raps" (Schröder-Lembke 1976). As many other *Brassica* seeds were used to produce oil, the old Dutch word "kohlzaad" (seed of *B. oleracea*) changed into "colza" in Southern Europe (Italian and French). In all European languages you find the same words.

There are some further interesting details in old German books from the 16th century supporting this thesis on the origin of oilseed-type *Brassica* crops in Europe: "Raps" and "Rübsen" have obviously not been selected for the character "late opening of the silique" to prevent shedding seed before harvest. The chronicist Konrad Heresbach tells us about the difficulties in harvesting these oilseed crops (Schröder-Lembke 1976).

DeCandolle (1824) gives an example which may show how the the turnip developed into an oilseed crop. In the Dauphiné in France DeCandolle finds that farmers grow "rave sauvage" or "ravette". This "ravette" is grown for oil in places where the other cruciferous oil-crops do no longer grow because it is too cold. It is sown in summer after harvest, and in June of the following year its seed is ripe.

Further evidence for this theory is that Metzger (1833) in his experiments could easily make a turnip out of his *Brassica rapa oleifera biennis*: "If you sow the seed on very good soil in spring, loosen the earth frequently and remove it from the roots in autumn, then the root acquires a thick long turnip-form, which has the taste of the common turnip. I repeated these experiments several times and could find out that this plant, which was so long unknown to us, is nothing else than the wild turnip, from which through constant care all the different varieties came into existence."

Sun *et al.* (1991) presented a poster at the last Rapeseed Conference on oilseed-*Brassicac*s in the province of Gansu in China. Lintao Caizi, which is very well known to the world as *B. chinensis* (leafy-type *B. rapa* vegetable with n=10), is used in China as an oilseed crop. This can be interpreted as a parallel to the evolution of the oilseed-type out of turnip-type *B. rapa* in Europe.

CONCLUSIONS

This paper shows that from many facts you can conclude, that in Europe the use of the turnip-type *Brassica rapa* is very old and that it was probably directly domesticated from the wild progenitor. We have one of the rare cases where the wild plant is still found as a weed in the same area where its descendant, the turnip is an important vegetable crop. Further there is a lot of evidence that European oilseed-type *B. rapa* must be very close to the turnip-type *B. rapa* genetically, because it was selected or raised out of it only some hundred years ago. Europe is a centre of diversity and a centre of the use of *B. rapa*. Thus it should be a very important aim of agricultural policy to preserve wild-type and turnip-type *B. rapa* in germplasm-collections or through in situ conservation as a valuable gene pool for all *Brassica* oilseed-crops.

REFERENCES

- DeCandolle, A.P., translated into German by Berg, C.F.W. (1824). *Die verschiedenen Arten, Unterarten und Spielarten des Kohls und der Rettige, welche in Europa gebauet werden*. Leipzig
- Ebermann, R., Werteker, M., Reiner, H. (1991). Studies about peroxidase patterns in high- and low-glucosinolate rapeseed. In *Proceedings GCIRC, 8 th International Rapeseed Congress*. Ed. D.I. McGregor. vol 3, pp 917-921. Saskatoon.
- Flora Europaea (1964). Vol 1 Eds. Tutin *et al.*. Cambridge
- Linnaeus, Carl (1753). *Species Plantarum*. Holmiae (Stockholm) (Reprint London, 1957)
- Hather, J.G., Pena-Chocarro, L., Sidell, E.J. (1992). Turnip remains from Byzantine Sparta. *Economic Botany* 46(4) 359-400
- Holzner, W. (1981). *Acker-Unkräuter - Bestimmung, Verbreitung, Biologie und Ökologie*. Graz, Stuttgart
- McNaughton, I.H. (1986). Turnip and relatives. In *Evolution of Crop Plants*. Ed. N.W. Simmonds. pp 45-48. Essex
- Metzger, J. (1833). *Systematische Beschreibung der Kultivirten Kohlarten*. Heidelberg
- Prakash, S., Hinata, K. (1980). Taxonomy, cytogenetics and origin of crop Brassicas, a review. *Opera Botanica* 55, 1-57
- Schröder-Lembke, G. (1976). Die Entwicklung des Raps- und Rübsenanbaus in der deutschen Landwirtschaft. *Z. für Agrargeschichte und Agrarsoziologie* 24, 145-160
- Song, K., Osborn, T.C., Williams, P.H. (1990). *Brassica* taxonomy based on nuclear restriction fragment length polymorphisms (RFLPs) 3. Genome relationship in *Brassica* and related genera and the origin of *B. oleracea* and *B. rapa* (syn. *campestris*). *Theor. Appl. Genet.* 79, 497-506
- Sun, W.C., Pan, Q.Y., An, X.H., Yang, Y.P. (1991). *Brassica* and *Brassica*-related oilseed crops in Gansu, China. In *Proceedings GCIRC, 8 th International Rapeseed Congress*. Ed. D.I. McGregor. vol 4, pp 1130-1135. Saskatoon
- Willerding, U. (1986). *Zur Geschichte der Unkräuter Mitteleuropas*. - Neumünster