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# ORIGIN AND DISTRIBUTION OF THE WESTERN CULTIVATED CARROT

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## Introduction

From the viewpoint of root colour, four types of cultivated carrot can be distinguished. They are purple, yellow, white, or orange.

Purple varieties were known in Europe until the beginning of the 20th century. They are still popular in Egypt, Asia Minor, India, Japan, China, and other Asiatic countries today. As purple colour is caused by anthocyanin, the type is called the anthocyanin carrot.

Yellow varieties used to be very popular in Europe as a winter food, but they have lost most of this importance now. Yellow varieties are also known in Eastern countries.

White varieties were sometimes used for human food in European countries in the 18th and 19th centuries, but more for the feeding of cattle. In eastern countries some varieties are white.

Orange varieties now predominate in the western world. In the east they are found together with purple, yellow and white varieties. The orange colour is caused by carotene, hence this type is also called the carotene carrot.

I shall now formulate four theses on the origin of these four colour types of the cultivated carrot, and give the supporting evidence I have found.

## Thesis 1

*The anthocyanin carrot originated in Afghanistan; from Afghanistan, as its primary centre of dissemination, it spread to Iran, Asia Minor, North Africa, and Spain in the 10th, 11th, and 12th centuries; it spread in Western Europe in the 14th and 15th centuries; it reached China during the Yuan dynasty (1280-1376 A.D.), and Japan in the 17th century.*

That Afghanistan is the primary centre of dissemination of the anthocyanin carrot is a conclusion drawn by V. I. Mackevic (1929, 1932). Russian expeditions had provided a large collection of carrot seeds from the east and the west. Plants grown from them were studied on experimental fields, and the greatest diversity of the anthocyanin type was found in the material from Afghanistan. According to Vavilov's thesis that the primary centre of greatest diversity is at the same time the primary centre of dissemination of a plant, Mackevic concluded that Afghanistan must be the birthplace of the anthocyanin carrot.

According to Edward Atiyah (1955), the Arab empire of the 9th and 10th centuries united Pakistan, Afghanistan, Turkestan, Iran, Armenia, Iraq, Arabia, and the countries along the east, south and west coast of the Mediterranean from Syria to the southern part of Spain. It is very probable that the communication system created by this empire favoured the distribution of the Afghanistan carrot material towards the Mediterranean areas. Evidence for this assumption is found in some old writings, which are mentioned in Table 1. From this table it can be concluded that carrots were known in the 10th century in Iran, Babylonia, and Nabatea, in the 11th century in Syria and in the 12th century in Spain. In the 13th or in the beginning of the 14th century, carrots were known in Italy, in the 14th century in France, Germany and the Netherlands, and in the 15th century in England.

It will be seen in Table 1 that in most writings « red » carrots are mentioned. This is somewhat confusing. We are used to indicating our orange carrots as red carrots nowadays, but once the term red in connection with carrots meant purple. Up to the 17th and 18th centuries red carrots were purple or violet coloured, as red cabbage and red beet are to-day.

This is confirmed by the statement of Pier de Crescenzi (new edition, 1548) that the « red » carrot, when cooked together with turnips, made a beautifully red compote. And it can also be concluded from the colour indications used in the European herbals of the 16th, 17th and 18th centuries, which include terms like red, brown-red, blackish red, atrorubens, rubra, or «even redder than the root of a red beet».

TABLE 1

**Distribution of the anthocyanin carrot from Asia Minor to Western Europe.**

| Century A.D. | Locality | Source | Indications of characters of carrots |
|---|---|---|---|
| 10th | Iran | Laufer (1919) | — |
| 10th | Babylonia, Nabatea | Ibn-al-Awam (Clement-Mullet, 1866) | A «red» and a yellow type; the red was finer, more juicy and more tasty than the yellow. |
| 11th | Syria | Simeon Seth (new edition 1868) | A «red» and a yellow type; the red was better than the yellow. |
| 12th | Spain | Ibn-al-Awam (Clement-Mullet, 1866) | — |
| 13th or beg. 14th | Italy | Pier de Crescenzi (new edition 1548) | A «red» type, which when cooked with turnips made a beautifully red compote. |
| 14th | France | Gibault (1912) | «Carrots are red roots which are bought in the market in bunches, and in every bunch a white one». |
| 14th | Germany | Hofmann (1913) | — |
| 14th | Netherlands | Sangers (1952) | In 14th century documents, it was only said that carrots were grown around most towns. In a 15th century document, mention is made of «white carrots» (according to Sangers probably parsnips and «red» carrots. |
| 15th | England | Alicia Amherst (1895) | — |
| 16th-18th | W. Europe | Fuchs (1543)<br>Dodoens (1554)<br>Gerarde (1597)<br>Parkinson (1640)<br>Munting (1672)<br>de Ville (1680)<br>Nylandt (1682)<br>Zwinger (1744) | A long «red» type, also indicated as brown-red, blackish red, atro-rubens, rubra, or «even redder than the root of a red beet».<br>A long yellow type, also indicated as yellow, fair yellow, or lutea. |

Paintings by Pieter Aertsen (1509-1575) and Nicolaes Maes (1634-1693) show that long purple and yellow carrots were common in Holland in the 16th and 17th centuries. In the south-eastern part of the Netherlands in 1949 we found a cultivator who still grew an anthocyanin carrot from seed which he regularly produced for his personal use. But in most countries of Western Europe the importance of the anthocyanin carrot had certainly ended in the 18th century. Its popularity had suffered too much from the fact that its anthocyanin pigment colours the soups or ragouts to which it is added, and also from the fact that after cooking the root turns a dirty yellow colour.

**Thesis 2**

*The yellow carrot is a colour mutant of the anthocyanin carrot; it spread together with the anthocyanin type from Afghanistan; it had become an individual variety by the 10th century or before.*

Mackevic (1932) stated that in all eastern areas where the anthocyanin carrot occurs the yellow carrot is found at the same time. According to her, a yellow carrot that is found with an anthocyanin carrot in the same area has the same morphological characters as that anthocyanin carrot. From this observation it seems safe to conclude that the yellow carrot is a colour mutant of the anthocyanin carrot.

In Table 1 it can be seen that, in the writings of Ibn-al-Awam on plants in Babylonia and Nabatea, of Simeon Seth on plants in Syria, and of the old European herbalists on plants in Western Europe, a yellow type was mentioned together with the «red» anthocyanin carrot. As it was distinguished not as an off-type but as a separate type, it was an individual variety as early as the 10th century or possibly earlier.

The yellow carrot migrated simultaneously with the anthocyanin carrot to the Mediterranean areas and afterwards to Western Europe. Its quality was improved in Europe and gradually it became the leading type there, probably as early as the 16th century.

In the first part of the 19th century the yellow carrot was still widely grown for winter use, but gradually it declined to the position of cattle-food. In the country, however, it was used for human consumption during the winter until the beginning of the 20th century. Many appreciated its mild flavour, but eventually it was replaced by the orange carrot.

### Thesis 3

*The white carrot is a colour mutant of the yellow carrot; it was not mentioned as an individual variety before the end of the 17th century.*

There are indications that white carrots occasionally appeared in a yellow variety, but it was not until 1697 that an author, de la Quintinye (1697), mentioned an individual white variety of the carrot. It was also discussed by du Vivie (1721), de la Court van der Voort (1763) and J. H. Knoop (1769). De la Court van der Voort described it as a long yellow carrot which was nearly white, and Knoop as a type like the yellow but with a white or yellowish white colour.

This is all the evidence I can produce to support my thesis that the white carrot is a colour mutant of the yellow.

Only in France have white carrots been more or less popular for human consumption. In most countries they were mainly grown for cattle, and used only occasionally as a human food.

There is no indication that a white carrot has played any essential role in the building up of the European cultivated carrot.

### Thesis 4

*The orange or carotene carrot is a colour mutant of the yellow; the first individual carotene varieties were selected in Holland in the 17th century.*

I have not found any indication of the existence of an orange coloured carotene variety before the 17th century. The first indications have the form of carrot pictures in 17th cen-

tury Dutch paintings and of written descriptions by 18th century authors. They have been summarized in Table 2.

These pictures show two types of carrot:

a) Big long carrots, which are only pale orange-yellow (P.C. van Rijck, 1621, Gerard Dou between 1613 and 1675).

b) Somewhat smaller or thinner or finer long carrots, which are more explicitly orange-yellow or even red-orange (the other four paintings mentioned in Table 2).

As regards the authors, J. du Vivie, H. Hessen, Philip Miller and M.L.B. only described a reddish yellow or orange variety as distinguished from the ordinary yellow variety of carrots. P. de la Court van der Voort also mentioned the long orange but added three shorter and more intensively orange coloured so-called *Horn* carrots. J. H. Knoop did the same, but he included the three *Horn* varieties in one term, i.e. «the small orange-yellow, also called *Horn*-carrot».

There are three arguments which support the opinion that the orange varieties must have been selected from the yellow ones. In the first place, no other possible origin has been encountered; secondly, the 18th century authors always classified the orange as a sub-variety of the yellow variety; and thirdly, the 17th century paintings show intermediate types.

We can see the development of two types now:

(a) The ordinary big long winter carrot which was developed from the ordinary big long yellow into the long pale orange carrot of the 17th century, which was gradually selected into the orange so-called *Long Orange* variety, which still exists to-day.

(b) A finer strain of the long yellow which had in 1618 already been selected as orange-yellow, and from which the so-called *Horn* varieties must subsequently have been selected. The first well-coloured type may have originated near Utrecht. It was painted there in 1618, and for a later period it is known with certainty that breeding work in the direction of finer well-coloured varieties was very progressive there.

TABLE 2

Paintings and writings indicating the existence of orange carrots.

| Time | Source | Character of carrots |
|---|---|---|
| 1618 | J. WTTEWAEL (1566-1638). Painting of a woman selling vegetables, painted at Utrecht. Centraal Museum, Utrecht, Neth. | Three violet and four yellow big long carrots. Below these, and partly hidden by them, four or five somewhat thinner and finer orange-yellow carrots. |
| 1621 | P. C. VAN RIJCK (1568-1633). Painting of a kitchen scene. Frans Hals Museum, Haarlem, Neth. | A homogeneous bunch of pale orange -yellow big long carrots. |
| Between 1604 and 1633 | P. C. VAN RIJCK (1568-1633) Painting of a kitchen scene. Rijksmuseum, Amsterdam, Neth. | A group of rather fine, slender carrots, of a somewhat varying orange -yellow colour; some roots are nicely orange-yellow, some more pale orange-yellow or yellow and one root is whitish. |
| Between 1613 and 1075 | GERARD DOU (1613-1675) Painting of «Woman scraping carrots», painted at Leyden. Staatliches Museum, Schwerin, Germ. | A bunch of big long carrots, coloured yellow with a tinge of orange. |
| 1650 1652 | GERARD DOU (1613-1675) Two paintings « Old woman with boy» and «The Quacksalver». Museum Boymans-van Beuningen, Rotterdam, Neth. | In both paintings, a bunch of nicely orange-yellow coloured carrots of a somewhat smaller size than the ordinary long carrots. |
| Between 1636 and 1684 | GERRIT VAN BATTEM (1636-1684) Painting of a store-room and kitchen, painted probably at Utrecht. Museum Boymans-van Beuningen, Rotterdam, Neth. | A bunch of red-orange coloured half long carrots. |

(TABLE 2 con.)

| Time | Source | Character of carrots |
|---|---|---|
| 1721 | J. DU VIVIE (1721), Netherlands | This author distinguished a pale-yellow and a reddish-yellow variety of carrots, both extensively used in the kitchen. |
| 1740 | H. HESSEN (1740), Germany | The long, red-yellow Brunswick variety was described; it was qualified as dry, hard and coarse. |
| 1763 | P. DE LA COURT VAN DER VOORT (1763), Netherlands | This author described four pale-orange or orange varieties, among which were three Horn varieties. The quality of the three Horn varieties was good, the «redder long yellow» was not quite as good. |
| 1768 | PHILIP MILLER (1768), England | Miller said that in London the orange carrot was preferred to all others. |
| 1769 | J. H. KNOOP (1769), Netherlands | In addition to the ordinary yellow, the whitish, and the «red» carrots, two orange-yellow varieties were mentioned: one just indicated as «the orange-yellow carrot» and the other as «the small orange -yellow, also called Horn carrot». |
| 1770 | G. GIBAULT (1912), France | Le Père d'Ardenne wrote in 1770 that he had imported a Horn carrot from Holland. |
| 1775 | M. L. B. (1775), France | This author said that the Long Red (=Long Orange) had come into fashion, but its strong taste did not please everybody. |

Nearly all modern varieties of the carotene carrot can be traced back to the *Long Orange* and the *Horn* carrots. The origin of the English variety *Altringham* is not exactly known, and it may be possible that *Long Red Coreless* is a descendant of *Altringham*. But the other varieties belong either to the offspring of *Long Orange* or to that of the *Horn* carrots. All high-quality varieties are derived from the *Horn* carrots.

The *Horn* varieties certainly originated in the Netherlands. As for the country of origin of the *Long Orange*, this is not so easy to decide.

France undoubtedly imported its first orange carrots from abroad. Towards the end of the 18th century it favoured only yellow and white carrots; about 1775 the *Long Orange* (*Long Red*) was just coming into fashion (B., M.L., 1775).

In England in 1768, the yellow carrot was commonly cultivated in gardens for the kitchen, though in London the orange carrot was preferred to all the others (Miller, 1768). As this preference evidently was restricted to London, it probably had not spread over the country at that time. If it had originated in the English country-side, it would have been used first there and would probably have a name related to some country locality, like the *Altringham* variety, which was first mentioned by George Don (1834).

The most likely country of origin of the *Long Orange* is Germany or the Netherlands. The first Dutch writing which mentions what was later called the *Long Orange* is dated 1721, whereas the first German writing mentioning the *Brunswick* is of 1740. This does not make much difference, because more or less orange selections from the long yellow carrot had already existed in the Netherlands for a century, as is proved by the painting of Van Rijck of 1621. That there are no 17th century pictures of orange carrots in Germany may be traced back to an absence of orange carrots in Germany in the 17th century, but it can also indicate, of course, an absence of carrot painters. So this does not prove the non-existence of orange carrots in Germany in the 17th century. The fact, however, that Joan. Sigism. Elssholtz (1684) wrote that carrots are either yellow, white, or red, and among the latter many even blackred, and did not mention any orange variety, makes it very unlikely that the *Brunswick* existed at that time.

My conclusion, therefore, is that the *Long Orange* type was also produced in the Netherlands in the 17th century.

It is an interesting problem how an orange carrot variety could be produced from a yellow one. There are no records of how it actually happened, and we can only speculate. There is, however, evidence that individual orange carrots, containing some carotenoid, had already appeared in the Asiatic material. According to Mackevic (1929) some roots of the yellow Afghan varieties may be coloured more or less orange-yellow. Lubimenko *et al.* (1936), who established the chemical basis for Mackevic's classification by investigating material, stressed the point that their chemical characterization applied to the groups as wholes, not to individual plants. They wrote that within the groups individual plants with sub- or supernormal carotenoid contents were found.

It is probable, therefore, that individual carotene carrots may occasionally have appeared among the yellow ones from the beginning. The production of an orange carotene variety from a yellow variety must be understood then as the selection of one or more orange roots which happened to occur in a yellow population and the breeding from their progeny of a purely orange type.

## Hybridization theories

It is rather generally assumed that the cultivated carrot is the result of a hybridization process which took place in the Mediterranean area.

A. Thellung (1926) suggested that the cultivated carrot has resulted from a cross between the wild carrots *Daucus carota* subspecies *carota* and *Dacus carota* subspecies *maximus*. He did so on the evidence of his observations that most of the morphological characters of the cultivated carrot are intermediate between those of the two subspecies mentioned. Neither subspecies has a succulent root like the cultivated type, but this was attributed to the unknown possibilities of hybridization. As the distribution areas of the two subspecies overlap on the coast of the Mediterranean, the cultivated carrot was thought to have originated there.

V.I. Mackevic (1932) adopted Thellung's theory of hybridization in the Mediterranean area and suggested the southwestern part of Anatolia as the place of meeting and hybridization of the subspecies *carota* and *maximus* of *Daucus carota*, and that the anthocyanin carrot of Afghanistan was a third partner in this hybridization process. She characterized Anatolia as the secondary centre of diversity of all kinds of cultivated carrot, and as a primary centre of dissemination of the European carrots.

Seven years later, P. Zagorodskikh (1939) proceeded on the idea of V. I. Mackevic, and projected a scheme of presumed movements of the anthocyanin carrot and a complicated series of hypothetical hybridizations, without any data to justify his opinions. He wrote:

«The birth-place of the red, yellow and white carrot, widely spread in Europe, is the Mediterranean. Here flourished in times widely remote from ours the Greek and Roman culture with their highly developed agriculture, and undoubtedly the Afghan carrot which migrated thither from Middle Asia was at that time already under cultivation».

According to Zagorodskikh, of this Mediterranean group of carrots the one with the white coloured surface was created first. It developed as a direct improvement of wild European forms, with centuries of assistance from man. This white carrot crossed with wild and cultivated Afghan forms, which resulted in the birth of the yellow carrot. As soon as the yellow carrot appeared, it entered the general cycle of crosses with wild and cultivated white, and perhaps with the Afghan carrot as well, with the result that the carotene carrot appeared. All this according to the opinion of Zagorodskikh.

The thesis of Mackevic that Afghanistan is the primary centre of dissemination of the cultivated carrot is based on observations and seems quite plausible. There is, however, no conclusive evidence that hybridization has been an essential factor in the genesis of the cultivated carrot. The hybridization theories had better be dropped, and replaced by a mutation theory.

As has been discussed, the cultivated anthocyanin carrot probably originated in Afghanistan, and spread as such to other countries. By way of mutation, yellow, white and orange

roots occasionally appeared. By selecting for homogeneity in the progenies of these off-types, individual yellow, white and orange types were produced. Especially from the orange type, mutations of different size and shape as well as further colour improvements were selected, which gave rise to many new varieties. It is only recently that some of these varieties have been crossed in order to combine different favourable characters.

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## *Summary*

So far it has been generally assumed that the cultivated carrot is the result of a hybridization process, which took place in the Mediterranean area. Evidence is produced, however, that hybridization did not play an essential part in the genesis of the cultivated carrot, and that there is more reason to believe that mutation followed by selection has been the main factor.

The purple anthocyanin carrot probably spread from Afghanistan to part of the Mediterranean area in the tenth, eleventh and twelfth centuries, and to Western Europe in the fourteenth and fifteenth centuries. It reached China at the end of the thirteenth or in the fourteenth century, and Japan in the seventeenth century. A yellow colour variant of the anthocyanin carrot spread together with the anthocyanin carrot. The white and the orange carrot are probably mutations of the yellow carrot. The first orange types of cultivated carrot were selected in the Netherlands in the seventeenth century.

*Résumé*

Il était jusqu'ici généralement admis que la carotte cultivée résulte d'un phénomène d'hybridation qui a eu lieu dans la région méditerranéenne. Mais aujourd'hui on a la preuve que l'hybridation n'a pas joué un rôle essentiel dans l'apparition de la carotte cultivée et il y a plus de raisons de croire que le facteur principal a été une mutation suivie de sélection.

La carotte à anthocyane violette s'est probablement propagée de l'Afghanistan dans une partie du bassin méditerranéen au cours des dixième, onzième et douzième siècles; elle a gagné l'Europe occidentale au cours des quatorze et quinzième siècles. Elle a atteint la Chine a la fin du treizième ou du quatorzième siècles et le Japon au dix-septième. Une variante jaune de la carotte à anthocyane s'est propagée en même temps que cette dernière. La carotte blanche et la carotte orange sont probablement des mutations de la carotte jaune. Les premiers types oranges de carotte cultivées ont été sélectionnés aux Pays-Bas au dix-septième siècle.

*Resumen*

Hasta ahora se ha supuesto generalmente que la zanahoria cultivada es el resultado de un proceso de hibridación que se produjo en la zona del Mediterráneo. Sin embargo, se presentan pruebas de que la hibridación no desempeñó un papel fundamental en la génesis de la zanahoria cultivada y que hay más razones para creer que el factor primordial fue una mutación seguida de selección.

La zanahoria antocianínica purpúrea probablemente se propagó desde el Afganistán a parte de la zona mediterránea en los siglos X, XI y XII y a Europa Occidental en los XIV y XV. Llegó a China a fines del siglo XIII o en el XIV y al Japón en el XVII. Una variante de color amarillo de la zanahoria antocianínica se propago juntamente con la zanahoria antocianínica. Las zanahorias blanca y anaranjada son probablemente mutaciones de la amarilla. Los primeros tipos anaranjados de la zanahoria cultivada se seleccionaron en Holanda en el siglo XVII.