REFERENCES

KIWI FRUIT
*Actinidia chinensis*

1. In the Complete Book of Gardening (By Michael Upward) Octopus Books, we read that it is also known as the Chinese Gooseberry, and is becoming more widely available in fruit shops. The plants must be bought in pairs as a male and a female. The former is needed for pollination of the creamy-yellow female flowers. Plants can be grown in large pots.

2. Bianchini (B102) says that it is a plant of Chinese origin, *Actinidia sinensis*, usually called Actinidia or Chinese gooseberry. It has only recently, in Italy, aroused interest for its fruits. In other European countries such as England and france, it has been known for some time, while California and New Zealand have the largest cultivations. The climate in Italy is favourable for for the production of the Actinidia, whose fruits, according to recent studies, are thought to have considerable medicinal properties. The fruit contains protein, iron, calcium, and phosphorus salts and also a large amount of vitamin C, as much as is found in 10 lemons.

3. In a data sheet from Alban Muller ref 0192 Kiwi, we read that kiwi is a fruit with a brown epidermis covered with a silky pilosity. The sour fruit is green and has a pulpous flesh.

The kiwi fruit is a significant source of a wide variety of valuable vitamins and minerals.

The fruit (average weight 140g) shows a number of results, it contains 10% US RDA of vitamin E. It is rare to find a fruit with such significant amounts apart from the avocado. It has twice the amount of avocado, but with only 60% of the calories.

When extra potassium is needed, many physicians recommend a banana or an orange. A 140g serving of kiwi averages 450mg of potassium, more than both orange or banana.

Vitamin C in kiwi is surprising. Calorie for calorie it is hard to think of a more concentrated natural source. The average is about 230% of the US RDA, that is enough vitamin C for some 2-3 days in one serving. The nutrient density of vitamin C in kiwi is a high 57.5, almost twice that of a medium orange.

There are few foods truly rich in folic acid. Even in good sources, content per serving, with some 10% of the US RDA.

A lack of chromium is thought to play a role in the development of heart disease, in diabetes and possibly in obesity. Kiwi fruit supplies between 20 to 70% of the daily need.

The kiwi fruit is a powerful antioxidant because of its content of vitamin C and E. It can be used in anti-aging products and acts also as a moisturising ingredient. It is used as an emollient and also for moisturising.

4. Davidson and Knox (B104) say that the kiwi has an alternative name of Chinese Gooseberry. This suggests a double origin. In fact, although it was grown commercially on a large scale in New Zealand, it originated in eastern Asia, where several species of *Actnidia* grow wild.

Seeds of *Actnidia chinensis* from the Yangtze valley were taken to New Zealand early in the

20th century, and commercial cultivation began in the 1930s. The fruits ripen slowly after being picked, and keep well, so could be exported to Europe. The first shipment reached England in 1953. When nouvelle cuisine blossomed in France and elsewhere, the kiwi fruit quickly assumed as star role as as an exotic, decorative ingredient in fruit salads and many other dishes besides. Once the fruits became popular, growers in the south of France and California began to cultivate them in competition to New Zealand. It is a mystery why the Chinese have never perceived the culinary potential of this fruit, but have treated it in the main as a tonic for growing children.

The fruit, which is the size of a large egg, has a thin skin, brown and hairy on the outside (although there is a kind, indeed a separate species according to some botanists, with a smooth skin). Inside is a firm, green pulp containing tiny, black, edible seeds. The taste is sweet and slightly acid.

Kiwi fruits are rich in vitamin C, ten times more than the equal weights of lemons would be. They also contain an enzyme similar to that in papaya or pineapple, which has a tenderising effect on meat.

5. In a data sheet from Alban Muller (news sheet 3) we read that though kiwi fruits are of chinese Himalayan origin, the main centre of commercial cultivation of kiwi fruits is New Zealand. And the the second world producer is France.

The kiwi fruit seed oil is a pale yellow, light viscosity oil, which includes a wide range of fatty acids ideally suited to pharmaceutical, health products and cosmetic applications.

Research has shown that this oil is characteristic for its high content in linoleic and alpha-linolenic fatty acids. The fatty acid composition is as follows:-

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| Palmitic acid | 5.3% |
| Stearic acid | 2.8% |
| Oleic acid | 12.3% |
| Linoleic acid | 14.3% |
| Alpha-linolenic acid | 63.4% |

Oleic, linoleic and α-linolenic acids represent about 90% of the kiwi fruit seed oil.

These kinds of fatty acids are essential for the synthesis of prostaglandins, cell membranes, defence mechanisms, physiological and biochemical processes involved in cell regeneration. They are a significant source of valuable nutritional factors.

Thanks to its content in linoleic and α-linolenic acids, kiwi fruit seed oil is suitable for pharmaceutical applications to reduce the risk of coronary heart disease, hypertension and diabetes. This oil defends the organism, or at least helps, the fight against infection.

In the food industry, this oil is used in order to fortify and enhance the cell growth particularly nerve and eye tissues.

In the cosmetic field, kiwi fruit seed oil is used both in body oils and skin care formulations improving the condition of skin and furthering cell growth.

6. Alban Muller: "A new fruit of the forest" - a new fruit of the forest. SPC Feb. 1993. p.83.

Kiwi fruits are Chinese Himalayan by origin and knownin some quarters as Chinese gooseberry or *Actinidia chinensis* Planch. The name Kiwi is an epithet originally owned by a rather small, shy and wingless bird which inhabits its forests. Today, New Zealand is the fruit's main centre of commercial importance and cultivation. The second largest producer is France.

The kiwi plant is a climbing vine, which develops a woody stem, heart-shaped hairy leaves and eventually has creamy-white flowers. The species is unisexual having flowers which are either male or female. The fruits are capsule shaped, about 7 cm long and 4 cm in diameter, and have a thin fuzzy, leathery skin. The flesh is green and juicy, and spotted with numerous tiny black seeds.

Both offer a significant source of valuable ingredients. The flesh is a concentrate of vitamins E and C, potassium, folic acid and chromium, while the seeds provide an oil rich in alpha-linolenic acid.

Kiwi fruit seed oil is a pale yellow light viscosity oil which contains a wide range of fatty acids ideally suited to cosmetic, health and pharmaceutical applications. Oleic, linoleic and α-linolenic acids represent approx. 90% of kiwi fruit seed oil. They are C:18 acids and are precursors in a biochemical hierachy which, as a result of human metabolism, produces a number of important nutritional compounds, particularly prostaglandins.

*Oleic acid*. An important monounsaturated oil, oleic acid is the principal constituent of cooking oils. A diet high in oleic acid is known to reduce serum cholesterol levels and hence reduce the otential for coronary heart disease. The use of monounstaurated oils in a diet would also reduce the risk of a number of cancers (breast, colon, prostate).

*Linoleic acid*. In human metabolism, linoleic aicd is the precursor to the development of both α-linolenic and arachidonic acid. Arachidonic acid is itself a precursor to three eicosanoids (leukotrienes, prostaglandins and thromboxanes), hormone-like compounds which are important in the prevention and treatment of disease. Believed to be important in the treatment of hypertension, dietary intake of linoleic, or α-linolenic acids may significantly reduce blood pressure, serum lipids and lipoproteins.

*α-Linolenic acid (ALA)* By far the largest component in kiwi seed oil at around 63%, α-linolenic acid is described as an omega-3 fatty acid. Omega-3 defines the location of the first double bond in this fatty acid in relation to the terminal methyl group, and it determines the way in which it is metabolised. ALA is also a starter compound for a raneg of important biochemicals, including the eicosanoids, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). Once ingested, ALA is paretly converted into higher polyunsaturated fatty acids by a sequence of elongases and dehydrogenases. The resulting fatty acids arte converted into phospholipids and stored in the cell membranes until they are mobilised by a particular biochemical stimulus.

Using a cascade of oxidative reactions, these acids are then converted into highly reactive products with a variety of end uses. These include: reducing the risk of heart disease; the fight against cancer; the fight against general infection (anti-coagulases, reduce the clotting capacity of blood); cell growht, the building/repair of eye tissue; and in the nervous system, particularly in the development of brain cells in children.

Quantities of ALA exceeding the body's requirement are stored as fats until they are required as energy. This is a similar process to that which occurs with the more celebrated gamma-linolenic acid (GLA), an omega-6 fatty acid. With ALA however, the process appears to occur more slowly, requires more of the starter compound, and produces a number of different end products.

The characteristics of the predominant fatty acids in kiwi fruit seed oil appear to provide an attractive alternative to sources of gamma-linolenic acid, and suggests a number of end uses. In cosmetics, it is suitable for incorporation into body oils and skin care formulations, where it will improve the condition of the skin and support cell growth.

In pharmaceuticals, kiwi seed oil can be used in prophylactic formulations designed to help reduce the risk of coronary heart disease, hypertension, diabetes and some cancers. It can provide defences and support the fight against general infections and diseases. Kiwi seed oil can also be used in health products to fortify and enhance formulations, supporting cell growth and particularly nervous tissue and eye tissue.

There are of course limitations. ALA is relatively unstable to heat, making kiwi seed oil unsuitable as a cooking oil or in cooked products. Also, α-linolenic acid is a highly reactive fatty acid. The high levels of α-linolenic acid in kiwi fruit seed oil increases the likelihood of oxidation, requiring the inclusion of antioxidant in some aplications.

7. In a data sheet from Alban Muller we read that the flesh and seeds both present a significant source of valuable ingredients: the flesh is a concentrate of vitamins E and C, potassium, folic acid and chromium, while the seeds provide an oil rich in α-linolenic acid.
Oleic, linoleic and α-linolenic represent approximately 90% of kiwi fruit seed oil. They are C:18 acids and are precursors in a biochemical hierachy which, as a result of human metabolism, produces a number of important nutritional compounds, particularly prostaglandins.

Data sheet says the same as article above, word for word!

8. In a data sheet from Dragoco. The constituents of Kiwi exhibit moisturising and skin caring properties and thus offer excellent possibilities for use in cosmetic products. They are particularly suitablefor pre[arations for the care of normal and dry skin; in the hair care sector their use is recommended in products for normal and dry hair.

1Kg of extract corresponds to 500 g of fresh kiwi fruit.

It contains asparaginic acid, glutamic acid, asparagine, serine, glycine, threonine, alanine, arginine, gamma-aminobutyric acid, tyrosine, valine, methionine, isoleucine, phenylalanine, leucine and lysine amongst its amino acids.

The kiwi plant originally comes from China and grows there in the rain forests of the Yangtse valley. There it is known by the name "Yang-tao". The kiwi plant was introduced into Europe as a decorative plant towards the ned of the 18th century. Around the turn of the century it came to New Zealand, where in the year 1906 the first trials were made in the cultivation of the kiwi plant. The seeds, which were obtained from this climbing plant, first bore fruit in 1910.

These then created the basis for all the new cultivations in that country. The breakthrough in the cultivation of the kiwi plants was first achieved in the 1920s in the Bay of Planty. Export of

kiwi fruits began in 1953.

The plant is also cultivated in Australia, Japan, France, Spain, Italy, South Africa and the USA. The kiwi is even grown and harvested in the warmer regions of Germany as in Geisenheim in the Rheingau.

The kiwi plant belongs to the family of the Actinidiaceae, the berries of which are also called "ray-pistil fruits" (from the Greek "actinos" = ray) because they are formed from a large number of radiating, oalesced fruit leaves, as a cut through the fruit reveals.

As a climber, it is possible for the kiwi plant to reach heights of up to 8m. Similar to wine grapes, they are cultivated on rows of stretched wires.

The kiwi fruit contains the following materials: vitamin C, minerals, trace elements, protein, sugar, fruit acids, fibre. A kiwi contains around 8 times as much vitamin C, 4 times as much iron and twice as much phosphorus and protein as a lemon. Despite all of these values, a medium-sized fruit contains only 165 Joules.

9. The Lawrence Review of Natural Products (Sept 1993) refers to *Actinidia chinensis* Planchon. Family: Actinidiaceae.

Common names: Kiwi fruit, Chinese gooseberry, China gooseberry.

*Botany*: The kiwi is native to eastern Asia, but today is widely cultivated for its fruit. Major producers of the kiwi fruit include New Zealand and Italy, although a significant harvest is obtained from other temperate countries including France and Israel. The bisexual plant grows as a trained vine and is often cultivated as an ornamental.

*History:* The kiwi fruit has been used in China as the basis of a flavourful wine. It has a long tradition of use as a fruit beverage.

*Chemistry*: An enzyme inhibitor and a proteolytic enzyme have been isolated from the kiwi fruit. A glycoprotein inhibitor specific for pectin methylesterase has been isolated from the fruit. This enzyme inhibitor is ineffective against other polysaccharide-degrading enzymes such as polygalacturonase and amylase.

The proteolytic enzyme actinidin is derived from the kiwi fruit. The nucleotide sequence of this enzyme has been established. The proteolytic activity of actinidin is similar to, but not identical to, that of papain. Kiwi fruit juice has been used in some cultures as a traditional meat tenderiser.

Kiwi fruits have high concentrations of vitamin C, and the serotonin concentration of the fruit is approximately twice that of tomatoes and one-third that of bananas. Ingestion of kiwi fruits, therefore, can increase urinary 5-hydroxyindoleacetic acid excretion, and may interfere with laboratory analysis for this serotonin by-product.

*Pharmacology*: Kiwi fruit has no inherent pharmacologic activity. However, the action of the proteolytic enzymes can result in activity that may lead to toxic events.

One study reported the effects of a kiwi fruit-based drink supplement given to athletes training

in hot environments. In athletes riding a Maonark ergometer, the mean work time to exhaustion was longer (149 minutes) compared to placebo (120 minutes), and the work load was larger (947 KJoules vs 833 KJ)($p < 0.001$). The kiwi-based drink supplement resulted in an expansion of blood volume; haematocrit increased significantly after exercise in athletes taking placebo but did not change significantly in those consuming the supplement. Furthermore, based on the urinary excretion of vitamin C, it appeared that the vitamin C status of supplemented athletes improved compared to placebo. The drink was found to be "fragrant, tasty, refreshing and thirst quenching", and it did not appear to have any side effects.

*Toxicology*: The enzymatic components appear to be largely responsible for the toxicities associated with kiwi fruit. These events are typically manifested as food allergies. This hypersensitivity manifests as oral/buccal reactions that occur a few minutes after ingesting the fruit. More severe reactions, including dysphagia, vomiting and urticaria, have occurred immediately following ingestion of the fruit.

Contact urticaria has also been reported.

10. Marius Rademaker: Allergic contact dermatitis from kiwi fruit vine (*Actinidia chinensis*). Contact Dermatitis 1996: *34*, 221.

Kiwi fruit (Chinese gooseberry; *Actinidia chinensis*) is a major agricultural cash crop in New Zealand. Most of the harvesting is done by hand. There are reports of adverse reactions to kiwi fruit among casual workers, but their transient employment has made confirmation by patch testing difficult. Most reactions reported are consistent with an immediate contact urticaria type reaction. Other reports include cheilitis, pruritus, and burning tongue seen shortly after consumption of the fruit.

Anecdotal reports from patients include hives, following consumption of relatively large quantities of fruit (salicylate induced?), and diarrhoea (personal observation). Over the last few years, a number of full-time kiwi fruit orchardists have been seen in the patch test clinic with hand dermatitis attributed to kiwi fruit. In most cases, the hand dermatitis has either been either irritant in nature or allergic contact dermatitis from other allergens (rubber gloves, fungicide, etc.).

A case report of a 52-year old orchardist is described.

Urticaria and angioedema from ingested kiwi fruit is well recognised. The mechanism is thought to be IgE-mediated, but it may also be due to the salicylate content of the fruit. there are a handful of cases of cutaneous hypersensitivity reactions to the fruit itself.

The patient was sensitive to the vine itself (from among the various components tested).