

Hops: Medicinal plant of the year 2007

VERSATILE PLANT | Hops, the “Medicinal Plant of the Year 2007”, is the only ingredient, other than water, yeast and malt, permitted in brewing of beer in compliance with the German ‘Reinheitsgebot’ (Purity Law). The annual prize was awarded by ‘Studienkreis Entwicklungsgeschichte der Arzneipflanzenheilkunde’ (Study Group History of the Development of Medicinal Plant Botany) at Würzburg University.

THE STUDY GROUP explained its decision to select hops stating that hops are a crop whose usefulness is not limited to brewing. Meantime, hops are becoming increasingly common as a botanical.

Medicinal uses of hops

Oldest evidence on medicinal uses of hops originates from the Arab cultural region i.e. a tractate from the 10th century. Hops have an established position in the herbal books of the Middle Ages. These books ascribe a multiplicity of different effects such as blood purification, effectiveness against gallbladder complaints, ear infections and toothache, as a diuretic and digestion-promoting agent or in gynaecology.

Hildegard of Bingen had an especially interesting view about hops. In her opus „Physica“ dating from 1158, she writes “der Hopffe ist dem menschen nit gar güt zü essen ...” (meaning that hops do not taste particularly well) “...aber er ist güt etlichem trang: den behalt er, das er lenger wert und nit fül wurt” (but hops are good for all beverages which they preserve and protect from putrefaction). She thus describes hops as a suitable preservative for beverages. At that time, such a substance was extremely important in view of hygiene conditions in the Middle Ages.

Author: Dr. Martin Biendl, Hopsteiner, Mainburg, a lecture delivered at the 36th International Malting Barley Seminar at the VLB Symposium in October 2007

With her view about hops, Hildegard of Bingen had also paved the way for the Bavarian ‘Reinheitsgebot’ in 1516, specifying hops as sole beer seasoning due to the preserving properties of hops. This presupposed comprehensive knowledge about the healing power of hops in folk medicine, already known at that time. By 1516 at the latest, hops became well established as a beer ingredient. Particularly in terms of volume, use of hops as a botanical increasingly faded into the background. But it never disappeared completely.

Otto Eifler in “Schriftentum über die physiologischen Wirkungen des Hopfens” (Writings on the physiological effects of hops), published in 1940, gave an overview of medicinal uses of hops common up to that period. These included uses against diseases of the gastro-intestinal and urinary tract, fighting listlessness and sleeping disorders as well as counteracting scurvy, the seafarers’ disease, in the form of strongly hopped beer.

INGREDIENTS

Physiologically beneficial ingredients in conventional beer originating from hops

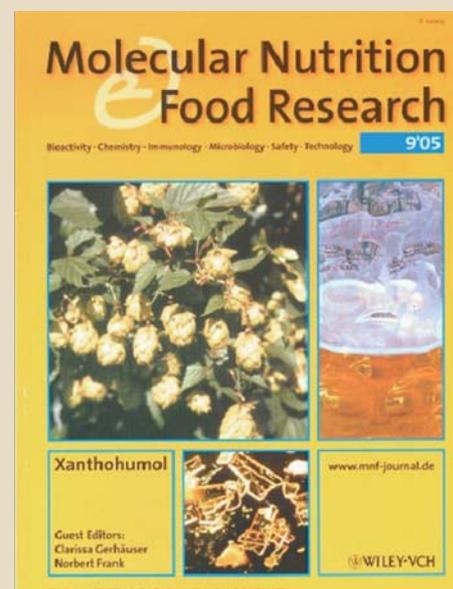
Rutin (quercetin):	up to about 1 mg/l
Xanthohumol:	up to about 1 mg/l (dark beers)
Isoxanthohumol	up to about 3 mg/l
Iso-alpha-acids	up to about 40 mg/l

Table 1



Otto Eifler's tractate about hops dating from 1940

Nowadays, medicinal applications as a sedative and as a sleep promoting agent represent the most common therapeutic usages still practised. For these indications, hops are practically always combined with valerian. This combination of hops and valerian cur-



Special edition “Xanthohumol” (2005)



Hops had an established position in the herbal books of the Middle Ages



Physica (1158)

"Hops do not taste particularly well ... but they are good for beverages which they preserve and protect from putrefaction."

Hildegard of Bingen and her view about hops

rently represents by far the most frequent form of administration of plant-based sleeping agents and sedatives. Compared to drugs containing synthetic materials, they are better tolerated and have no side effects. In addition, there is no danger of addiction or leaden tiredness the next morning. The efficacy of the hops/valerian combination has recently been scientifically confirmed in a clinical study. The unequivocal outcome of this study was another reason for selecting hops as "Medicinal Plant of the Year".

Combined with other plants, hops are sometimes used as a component in preparations for improving bladder function or for strengthening the cardiovascular system.

Valuable ingredients

Three groups of substances are mainly responsible for the beneficial influences of hops on health: essential oils, polyphenols and bitter substances.

Essential oils

Up to recently, it seemed certain that essential oils played a major part in sedation and promoting onset of sleep. Meantime, it

is accepted that their role is less important than had been assumed for a long time. In a recently published scientific study, a methanolic aqueous hop extract without essential oils proved to be especially effective. The active ingredients of this extract have not yet been identified.

Polyphenols

Hop polyphenols are regarded as having definite beneficial effects. Many of these polyphenolic compounds, such as e.g. phenolic carboxylic acids and catechin tannins, also occur in barley and many other plants. Flavonols e.g. quercetin (or rutin, the quercetin form bonded to the sugar rutinose) are also commonly found in the plant world. In contrast, prenylflavonoids are contained in very few plants apart from hops. Xanthohumol is the best known representative of this substance group, also in terms of quantity. Up to one percent xanthohumol is found in dried hop cones. A multitude of beneficial effects on health is ascribed to plant polyphenols, such as e.g. antioxidative activity. This means that they can scavenge free radicals that trigger harmful reactions in the human body. Quercetin is regarded as the most active natural antioxidant. Beneficial properties of many polyphenols have been known since the beginning of the 1980's. Xanthohumol, however, is still a very young polyphenol from the point of view of medical science.

The first studies on xanthohumol were published exactly ten years ago. The international journal "Molecular Nutrition and Food Research" has meantime published a special edition dedicated exclusively to the subject of 'xanthohumol' [5]. The editorial discusses the question "Xanthohumol – A New All-Rounder?" as a surprisingly large multiplicity of pharmacological activities has been discovered to-date (e.g. antiviral, antibacterial, against malaria, anti-inflammatory, antioxidative, antiatherogenic, antidiabetic and cancer preventative).

Most of these properties have initially been proven 'in vitro' i.e. in tests with isolated enzymes or cells. Whether xanthohumol can also give rise to such effects in a living organism has been confirmed only in isolated cases so far. 'In vivo' investigations with xanthohumol are currently ongoing worldwide, mainly in Japan, the United States and in some Central European countries, among others in Germany at the Cancer Research Centre in Heidelberg. The

state of knowledge about xanthohumol and other prenylflavonoids is repeatedly summarised in review articles published in various scientific journals, e.g. in the German magazine "Ernährungs-Umschau" in 2006 [2]. They address the question of how humans can take up hop prenylflavonoids, i.e. in the form of beer, the only food produced from hops to-date. The article in question in "Ernährungs-Umschau" was entitled: "Prenylflavonoids in hops and beer – their biochemical and biological effects".

The question as to what happens to hop ingredients during beer brewing automatically arises in this context. As hops are generally added during wort boiling, chemical reactions take place in the hot wort. They convert hop xanthohumol largely into isoxanthohumol. Isoxanthohumol could be identified as a mild beer bitter substance and is contained in practically all beers. Compared to the 'all-rounder' xanthohumol, the pharmacological potential of the isomerised form is lower, though still clearly measurable.

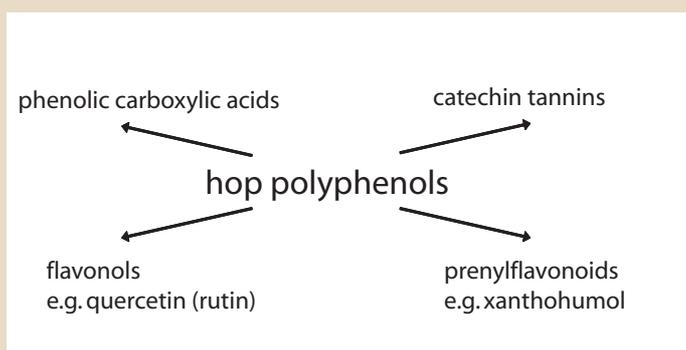
Two patent applications specifically favouring certain activities of isoxanthohumol over those of xanthohumol are of interest. These relate, on the one hand, to anti-inflammatory and 'anti-aging' properties and, on the other hand, to prevention and treatment of osteoporosis. The pertinent patent specifications explicitly state that even conventional beers may contain sufficient effective amounts of isoxanthohumol (e.g.: "In general, hop-derived food and drink, such as beer, alcohol-free beer, and low-malt beer sometimes already contain a given or larger amount of the active ingredient according to the present invention.").

Bitter substances

It has been proven that bitter substances, in addition to polyphenols, are among the hop ingredients beneficial to health. Numerous publications, some dating back quite some time, some very recent ones, report on the positive effects.

Beta-acids (lupulones) are mainly known for their antibacterial properties (among other things against the tuberculosis pathogen or against "*Helicobacter pylori*", involving infections of the gastrointestinal tract).

A broad spectrum covering a whole range of effects has been identified in association with alpha-acids (humulones), inter alia antioxidative, anti-inflammatory, cancer preventative and for prevention of



Classification of hop polyphenols

osteoporosis. It is known that alpha-acids are also converted during wort boiling.

In this process, iso-alpha-acids (isohumulones) are formed, the main bitter substances in beer. In various animal tests, they proved to be cancer preventative (intestinal cancer in male rats) or could prevent obesity, arteriosclerosis and diabetes. It was possible to confirm the physiological effectiveness of iso-alpha-acids in a clinical pilot study. Men and women suffering from diabetes mellitus who had iso-alpha-acids orally administered were found to experience significant reductions of glucose levels and blood pressure.

Beer and health

Many of these beneficial compounds are contained in appreciable concentrations in conventional beer (table 1). Thus, hops as a raw material contribute more to beer than just shelf life, bitterness, aroma and head retention. Hops are also a valuable source of physiologically beneficial ingredients.

Something quite similar applies to the barley/malt raw materials, also supplying beer with polyphenols (significantly more in terms of quantity than hops), important vitamins of the B group and minerals.

A large number of scientific studies have shown that moderate consumption of beer, like moderate consumption of red wine, can prevent numerous

life-style diseases. Medical and dietary experts meantime classify both of these alcoholic beverages as being at least equal in terms of health benefits. This assessment is of great importance in view of the political 'anti-alcohol' campaign which is becoming increasingly louder. Brewers are provided with solid data and very convincing arguments to prove the worth of their products. These arguments are, strictly speaking, underpinned by the ingredients of beer that have a beneficial dietary physiological effect. And these very ingredients originate from hops and malt raw materials, valuable for human health. ■

References

1. Arzneipflanze Hopfen – Anwendungen, Wirkungen, Geschichte, Dr. Biendl/Dr. Pinzl, 2007 (Fachverlag Hans Carl, Order No. 1373)
2. Ernährungs-Umschau, 53, issue 6, pp 225-229, Prof. Dr. Schmandke, 2006
3. European Patent Application EP 1618875 A1, Kirin Beer Kabushiki Kaisha, Tokyo (JP), 2006
4. International Patent Application WO 03/090555 A1, Unilever PLC (GB), 2003
5. Molecular Nutrition and Food Research, Vol. 49, No. 9, 2005
6. The Benefits of Moderate Beer Consumption, Third Edition, The Brewers of Europe, 2004