

## NEW PERSPECTIVES ON MEDICINAL PROPERTIES AND USES OF *IRIS* SP.

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**Abstract.** Rhizomes from various *Iris* species have been used in traditional medicine to treat a variety of ailments since ancient times and many constituents isolated from different *Iris* species demonstrated potent biological activities in recent studies. All research findings besides the increasing demand for natural ingredients in cosmetics and market demand from industries like alcoholic beverages, cuisine and perfumery indicate a promising future for cultivation of irises for rhizomes, various extracts but most importantly for high quality orris butter. Romania is situated in a transitional continental climate with suitable conditions for hardy iris species and thus with good prospects for successful cultivation of *Iris germanica*, *Iris florentina* and *Iris pallida* in conditions of economic efficiency.

**Key words:** *Iris*, medicinal plant, orris butter, rhizomes

### Introduction

The common word “iris” that gave the name of the genus, originates from Greek designating “rainbow” presumably due to the wide variety of colors that these flowers can have (Cumo, 2013). The genus reunites about 300 species (Wang *et al.*, 2010) with rhizomes or bulbs (Cantor, 2016). In Romanian wild flora can be met both naturalized and native species, some enjoying special protection, like *Iris aphylla* ssp. *hungarica* (Marinescu and Alexiu, 2013) that can be seen on the hills nearby Cluj-Napoca (Fig. 1), or the less known very elegant Romanian native Limniris species *Iris brandzae* described for the first time by Iuliu Prodan in 1935 ([www.floraofromania.transsilvania.net](http://www.floraofromania.transsilvania.net), <http://www.ipni.org>). General Romanian public is most familiar with *Iris germanica* (Toma, 2009) (Fig. 1), however, in last decades a few other garden *Iris* species have been introduced as well (Băla, 2002).

The peeled and dried rhizomes of *Iris germanica* Linne as well as its variety *florentina* Dykes and *Iris pallida* Lamarck are known as orris root (Troy and Beringer, 2006) or as rhizoma iridis and were used for centuries in medicinal treatments (Wollenweber *et al.*, 2003) while today they are most important particularly for production of orris butter. Some of the botanic characteristics of these three economic important taxa are given according to literature.



Fig. 1. *Iris aphylla* in the Fânațele Clujului area, and some tall bearded *Iris* sp. in UASVM Cluj Agrobotanical Garden (Source: Original)

*Iris pallida* subsp. *pallida* (syn. *Iris pallida* var. *dalmatica*) is a vigorous, semi-evergreen, rhizomatous perennial up to 120 cm in height, with narrow, grey-green leaves that are 20 to 60 cm long and 10 to 40 mm in width. Flowering occurs in late spring and early summer. The flowers have about 10 cm in width, are fragrant, and light violet-purple in color with light yellowish colored beard (<https://www.rhs.org.uk>). It is known also as Dalmatian iris or sweet iris, and it is native to Dalmatian coast (DeBaggio and Tucker, 2009).

*Iris germanica* is considered by the British Iris Society group: “a highly involved complex of more or less closely related irises who includes also what could be loosely called ‘near-species’ which were previously regarded as distinct”, and they might have derived by hybridization. It is probably native to eastern Mediterranean region. These perennial plants have 40 to 90 cm height upon flowering. Present-segmented stout rhizomes and leaves are 30 to 70 cm long and 2-3.5 cm wide, variably green, ensiform and glaucous. Flower stems are strong and branched with the lowest ones spreading. The

flowers present a very wide range of colors. The falls of the flower are 7.5 cm long and 3.8-5.5 wide, obovate and veined, presenting beards. Standards are obovate usually broader and more pale. Pollen grains are white and poorly produced, and capsule rarely formed, also seeds are few. Flowering occurs between mid-April and well into May (White *et al.*, 1997; DeBaggio and Tucker, 2009).

*Iris germanica* var. *florentina* (syn. *Iris florentina*) is a historic bearded iris and symbol for the city of Florence. It is a vigorous, spreading plant with slightly glaucous foliage, sometimes remaining semi-evergreen. Presents a membranous spathe by flowering that soon becomes wholly scarious. Flowers are semi-albino with standards and falls variably marked with faint blue while the hafts of the standards are always lightly bearded (White *et al.*, 1997; <http://www.botanical.com> <https://www.rhs.org.uk>);).

All these three taxa have a hardiness 7 which means they are hardy in severest European climates <-20°C (<https://www.rhs.org.uk>), and this makes them suitable for cultivation in Romania, that is situated in transitional temperate-continental climate (Philander, 2012) with the mention that local climate can vary however, for example the correlation between precipitations and solar activity gives Cluj County an oceanic character (Criveanu, 2001). Both the didactic collection and Agrobotanical Garden UASVM Cluj-Napoca present a selection of *Iris germanica* and *Iris pallida* that proved overall a very satisfactory development over the years.

### **Brief history on medicinal uses of irises from tradition to modernity**

The iris plant was well known and cultivated throughout ancient Greece and Roman Empire and appreciated for its value as a perfume (Cumò, 2013). Pliny the Elder gives us detailed written account on the iris plant values, effects and oil quality in his work “Natural History” (Plin. Nat. 21.19). However, it is speculated today that it might have been used medicinally as early as 1500 B.C. by ancient Egyptians (Lust, 2009) and to further support this hypothesis iris plant believed to be an *Oncocyclus* was found engraved on a marble panel in the Temple of Theban Ammon at Karnak (White *et al.*, 1997). In Asia, *Iris bungei* was long used in Mongolian traditional medicine, while *Iris* rhizomes believed to refer to *Iris tectorum* were mentioned in the first Chinese monograph on herbal medicine completed in about 200 A.D. (Wang *et al.*, 2010). The earliest records of irises in the New World date back to the 1600s. Many sources give credit to the idea that the Cherokee Indians used *Iris virginica* for various medicinal purposes (Garrett, 2003; <http://eol.org>), for example they

pounded the rhizome into a paste and used it as a salve for the skin (Cumó, 2013; USDA Plant Guide), while other Native American groups made a rhizome tea that was used for gastric problems, stomachaches as well as kidney and bladder disorders. As a poultice *Iris missouriensis* aided in the treatment of sores, aches, pains and lesions (Cumó, 2013; <http://montana.plant-life.org>). Some shamans added the rhizome to tobacco and smoked it as a way to ease nausea (Cumó, 2013). The use of underground parts of several species of *Iris* was well established in traditional European folk medicine for centuries (Wollenweber *et al.*, 2003). While the English botanist and herbalist John Gerard in 1597 described iris plants indicating hot and dry qualities and various deobstruent effects linked to diuretic, purgative, emmenagogue and attenuating actions, by 1719 John Quincy said that the juice was “hardly ever used” for purgative or errhine properties, but he further indicated that the “Florentine sort” was used in chest conditions, as a carminative or stomach ailments. In 1769 William Lewis was more comprehensive over the purgative properties and indicated differences between fresh and dried underground parts. Many authors expressed the difficulties in administering suitable doses (Crellin and Philpott, 1990). In 1821 Frederick G. S. in his Supplement to the Pharmacopoeia, indicates *Iris germanica* for external use in repelling eruptions, and *Iris florentina* and *Iris foetidissima* as known for treating dropsy. He also mentions that the special prepared juice containing *Iris pseudacorus* rhizome otherwise drastic purgative it was used by English country people and administered every hour or two in syrup of buckthorn to treat dropsy when other medicines failed (Frederick, 1821). Johnson cited by Crellin and Philpott said in 1884 that iris was used largely by eclectic physicians “as hydragogue cathartic, and alterative, sialagogue, vermifuge and diuretic”. In 1915 the work of Ellingwood “American Materia Medica”, presents irises in an enthusiastic fashion mentioning purgative, diuretic cholagogue properties and stimulant effects on the glandular system, but also with a general remark referring to their toxicity (Crellin and Philpott, 1990). In homeopathy, the tincture of *Iris versicolor* is attributed effect on the thyroid, pancreas, salivary and intestinal glands as well as gastrointestinal mucous membranes (Boericke, 2005). Romanians most likely also had knowledge of the medicinal properties of irises for a long time, and some recipes are still recommended today. For example, a spoon of iris rhizome tea taken from hour to hour is indicated for cough but with cautious for its toxicity (<http://www.terapii-naturiste.com>).

## Current importance and various uses of the genus *Iris*

Besides medicinal importance, irises have been given other uses throughout time. It is known and well documented that *Iris* plants (the flowers) were used for obtaining “iris green” and “iris blue” pigments used by Medieval painters and manuscript illuminators (Eastaugh *et al.*, 2004). The pigment from the petals is still extracted today and used to give the blue tint of some brands of gin, like Magellan blue gin (<http://www.magellanbluegin.com/about.html>).

Several species of *Iris* are known to currently have culinary uses. *Iris germanica* peeled rhizomes can be used as flavoring in ice cream, confectionary and baked goods. *Iris pallida* orris oil from rhizome is used to flavor soft drinks, candy and chewing gum. Orrisroot is often included as one of the many ingredients of *Ras el hanout*, a blend of herbs and spices primarily associated with Moroccan cuisine (Lim, 2016). Orris extracts are used in cosmetic industry for a large range of products in concentration not exceeding 10% (<http://www.makingcosmetics.com>) while orris absolute can be used safely in aromatherapy in concentrations up to 3% (Lis-Balchin, 2006).

Dried orris is currently used in potpourris as room fresheners, or in sachets (<http://www.superbherbs.net>). However, these practices are rooted in history also. For example, the practice to perfume linen with orris dates back to 1480 during the time of Edward IV of England (<http://www.botanical.com>) while in the early 1600's fine linen ruffs in storage were sprinkled with powdered orris root (Johansen, 2008). In addition, the French peasants had the habit of immersing their bed linen in boiled water that was poured over orrisroot pieces to confer pleasant smell (Stager, 1917). The larger and finer rhizomes are often turned into forms for ornamental purposes like rosary beads, while long pieces of Verona Orris are often shaped for infants to use when teething to this day (<http://www.botanical.com>).

Orris root is known as an ingredient in many brands of gin (Lim, 2016) like the well-known Bombay Sapphire (<https://www.bombaysapphire.com>), but also in perfumery as base note and for sillage, but most importantly as a natural fixative because orris has the power of strengthening the scent of other fragrant bodies (DeBaggio and Tucker, 2009) or flavors, that would otherwise be volatile and easily released from the solution that are suspended in. Thus, in alcoholic beverages orris is used similar with perfumery not necessary for the pleasant aroma but as a very potent natural fixative for the other components (Stewart, 2013). Most likely because of this characteristic it has been used in some wines as well (Eriksson *et al.*, 2013).

## Overview on some important technology and industry aspects

Although rhizomes of many *Iris* species are well known today as precious sources of isoflavones (Kukula-Koch et al., 2015), at the present time, *Iris pallida* is considered the best for extractive purposes followed by *Iris germanica* and *Iris florentina* for botanical sources of orris preparations either concrete, liquid, oil or extract (Lim, 2016).

Triterpenoids called iridals present in the fresh rhizomes were shown to be the precursors of irones from aged rhizomes. It is the irones extracted from aged rhizomes of *Iris* that have the aromatic principles used in the various industries and the most precious constituents responsible for the characteristic scent (Lim, 2016; Harborne and Baxter, 2001).

In the traditional method, storage of harvested rhizomes for 2 to 5 years are required for the formation of irones, which are, absent from the freshly harvested rhizomes, but are produced during the storage period. Since orrisroots are expensive, the storage period of 3 years is often neglected and thus orrisroot enters the market having a lower level of irones. Because of this, it is sometimes necessary to add irone enriched extracts to primary extracts to keep the irone content at the required levels, but this leads to increased price of the final product (Canhoto et al., 2009). For the temporal reduction of ageing time of the rhizomes, many technological alternatives have been researched with positive results obtained by using nitrite salts, ionized radiation or enzymatic processes to name a few (Surburg and Panten, 2006; Mogege, 2015).

As far as the production process is concerned, the crop is started with planting of rhizome fragments. After 2-3 years from planting, the rhizomes are unearthed in the summer during months of July and August. In the first stages, the rhizomes are cleaned of roots and washed. After this stage, the producer can follow two different paths depending on the final product it is interested to obtain. For obtaining black type orris, the washed rhizomes are sliced and dried outside for 5-6 days. After this they are collected usually by the cooperative of producers like in Italy, and it will undergo various processes for obtaining and extraction of irones after are sold further in the production chain (<https://www.sagrona.com>; Belletti et al., 2012). For obtaining the white type orris, rhizomes are peeled by hand and according to the classic method undergo a long process of 2-3 or up to 5 years of drying and ageing. The white type is considered the finest as it is more potent (Belletti et al., 2012; <http://www.alcademics.com>). Some sources from Italy state that the white type it is normally used by the food industry, while the black type is used by the fragrance industry (Belletti et al., 2012). Most of the cultivated orris today in Europe (Fig. 2) is *I. pallida*, grown in Italy and more recently also in France,

while *I. germanica* is grown more extensively in Morocco, China, and India (<http://www.biolandes.com>, <https://www.oldhousegardens.com>), but the finest quality comes from Italy (Belletti *et al.*, 2012).

The main buyers of raw dried orris material (either aged or not aged) are distilleries located in Grasse Provence of France, where the PASS (Pole de competitivité Parfums, Aromes, Saveurs, Senteurs) is located. In order to serve the French market, the consortium or cooperative of farmers, as it is the case of Italy, makes use of a broker, who acts as intermediary with the processing industries for quantities and prices and earns a commission out of the production sold, but individual cultivators with direct channels are also well established in the business (Belletti *et al.*, 2012).



Fig. 2. Fields with *Iris pallida* in Europe destined to processing  
(Source: <http://www.biolandes.com>)

To isolate the irone fraction, the dried raw orris product (either black or white orris and having a moisture content 8-13%) are milled to a powder state and steam distilled to yield an orris butter rich in irones and myristic acid. The butter may be sold and used as such or further concentrated (Canhoto *et al.*, 2009). This first product, constituting an orris essential oil is a cream colored solid and is more often referred to as orris butter due to its consistency, because the distillate contains a large proportion of myristic acid and other fatty acids that cause it to form a thick mass with melting point between 38-50°C. By further processing, orris absolute or orris oil 10-fold is obtained and is sold at a higher price (Lim, 2016; Surburg and Panten, 2006; Harborne and Baxter, 2001).

According to sources referring to crop yields from Tuscany Italy, from about 1000 tons of fresh *Iris* rhizomes, after peeling and drying the yielding is about 300 tons (<http://www.botanical.com>). One tone of *Iris* dried rhizome powder produces two kilos of essential oil or orris butter (Belletti *et*

*al.*, 2012) and in turn, two kg of orris butter (essential oil) gives 400 g orris absolute (<http://www.biolandes.com>).

As for the irone content, the traditionally processed rhizomes provide 530 mg irone/kg dry orris, while modern techniques using enzymatic processing managed to obtain yields around 696 mg irone/kg dry orris (Mogege, 2015).

### **New perspectives and researches regarding medicinal properties**

Today research regarding iris plant medicinal properties was partly triggered by the increasing resistance of microorganisms against available antimicrobial agents. This is a major concern and in these conditions, new antimicrobial drugs having a novel mode of action are permanently sought after. As such, recently there has been an increase in the number of studies on flavonoids as potential antimicrobial agents (Orhan *et al.*, 2010). Most isoflavonoids known today have been found in members of *Fabaceae* but abundant occurrence has been observed in *Iridaceae* as well with about 26 aglycones found in the genus *Iris* alone (Wollenweber *et al.*, 2003). Until 2008 over 90 flavonoid constituents have been discovered and characterized, including 38 new compounds, from 15 species of *Iris* (Wang *et al.*, 2010). Various studies conducted in recent times on bioactive principles of *Iris* extracts showed promising antioxidant activity, anticancer, atimutagenic as well as antimicrobial activity (Lim, 2016). Further, a few of these recent findings are summarized.

The methanolic extracts of rhizomes of *Iris pseudopumila* were tested for antibacterial activity and showed good inhibition against some bacterial strains tested with the exception of *Staphylococcus aureus*. It was shown that the Gram (+) bacteria were not very sensitive to the extracts while the Gram (-) bacteria were more sensitive and in particular *Enterobacter aerogenes* and *Escherichia coli* (Wang *et al.*, 2010).

In their study to determine *in vitro* biological activities including bactericidal, fungicidal and insecticidal activities of *Iris germanica* extracts, Orhan *et al.* (2003) found that chloroform and ethyl acetate extracts of *Iris germanica* rhizomes exhibited bactericidal activity. The chloroform extract of the rhizomes of *Iris germanica* exhibited bactericidal activity against *Staphylococcus aureus* and *Pseudomonas aeruginosa* in certain concentrations while the ethyl acetate extract was also found to be active against *Streptococcus pyogenes* and *S. aureus* (Orhan *et al.*, 2003). Other authors (Ibrahim *et al.*, 2012) also identified antimicrobial activity; this time against *S. aureus*, *S. marcescens*, *E. coli*, *C. albicans*, and *A. flavus* using methanolic extract from *Iris germanica* grown in Egypt. Same authors



observed potent anti-inflammatory effects of methanolic extract and the flavonoids isolated from the same *Iris* species (Ibrahim *et al.*, 2012). Another research conducted by Huwaitat *et al.* (2013) tested methanolic extracts from *Iris nigricans* for antibacterial activity against: *Staphylococcus aureus*, *Escherichia coli*, *Bacillus subtilis*, *Klebsiella pneumoniae*, and for antifungal activity against *Candida albicans*. Their results revealed that leaves extract of this species has better antibacterial activity against the tested microorganisms than the rhizome and flower extracts. Also methanolic extracts of *Iris nigricans* leaves shows stronger antifungal activity against *Candida albicans* than rhizomes and flowers extracts with some remarkable results, comparable to those of nystatin.

Wellenweber *et al.* (2003), used isolated isoflavones from dried rhizomes of *Iris germanica* in a series of *in vitro* bioassays with potential relevance for inhibition of carcinogenesis at the initiation and promotion stage. They found that isoflavones irigenin, irilone and iriflogenin were potent inhibitors of an enzyme, which is involved in the metabolic conversion of procarcinogens into carcinogens. It was concluded that inhibitory activities were comparable with that of the well-known cancer chemopreventive isoflavone named genistein found in soy products. In addition, it was observed that iriskashmirianin, irigenin and irilone displayed moderate activity as inducers of a carcinogen-detoxifying enzyme (Wollenweber *et al.*, 2003).

Researches from recent years showed antioxidant effects of some *Iris* extracts. Thus, flower extracts of *Iris nigricans* from Lebanon exhibited a noticeable antioxidant effect at low concentrations, which could be attributed to phenolic compounds, flavonoids and saponins (Huwaitat *et al.*, 2013). In the same sense, Chikhi *et al.* (2012) assessing the free radical scavenging assay of the essential oil and extracts of *Iris planifolia* from Algeria also identified some antioxidant effects.

These are just a few of the researches conducted in recent years in regards with possible medicinal applications of various *Iris* extracts today, that come to illustrate the importance that this genus can still have in responding to current challenges in medicine. However, perhaps above all in the end they somehow come to justify the empirical use of these plants to treat many ailments since ancient times. We can say that these plants are not only beautiful additions to our gardens but still hold a place in our lives through their many uses and fully deserving to maintain their special position assigned to them by our ancestors.

## Conclusions

A number of iris constituents and extracts have been found to possess useful medicinal properties. In this regards different authors obtained favorable results regarding antimicrobial activity, some using chloroform and ethyl acetate extracts from the rhizomes of *Iris germanica*, while others using methanolic leaves extracts of *Iris nigricans*. Notably, the methanolic extracts of *Iris nigricans* showed strong antifungal activity against *Candida albicans* with results comparable to those of nystatin. These results indicate that *Iris* plant extracts contain some antimicrobial components that might be developed as new bactericidal or fungicide agents. Anti-inflammatory and antioxidant properties of some iris extracts were also researched with positive results. Isolated isoflavones from dried rhizomes of *Iris germanica* were demonstrated by some authors to exhibit *in vitro* inhibitory activities comparable with those of the well-known cancer chemopreventive isoflavone named genistein found in soy.

Biosynthesis of irones, the most valuable component of interest for various industries occurs from precursors found in the fresh harvested *Iris* rhizomes via the degradative oxidation and so far, the most time consuming step in the extraction of irones from the orrisroot is the ageing period, which takes a few years. Thus, in last decades' new innovative technologies have been researched and developed in this regard in order to solve this issues of the production chain, researches that could continue in the future with the aim to optimize the processing.

Although other counties outside Europe entered very strong on the orris market, Italy remains in the top of quality due to specific and possibly unique characteristics the final product from plants grown there have. It might be possible after more analysis of the market to assess the feasibility of cultivation of some economic important irises in Romania, in the perspective to offer high quality orris produce at competitive price.

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