

Orris: A Star of Inspiration

An evocative natural ingredient with roots in artistic and olfactive history

Pierre-Jean Hellivan, Charabot

Orris (or iris) root spurs the emotions of flavor and fragrance creative teams like no other natural. Handing a blotter of the material to any perfumer elicits raised eyebrows and slight grins—faint hints of a rush of emotion for a special material that is often pricier than gold. Famously, orris touched the heart of the legendary Gabrielle Chanel as she handpicked her last perfume in 1970, *Chanel N°19*, a green, floral and woody masterpiece that many perfumers still consider the most influential orris fragrance. Elsewhere, orris is intertwined in the fabric of creative and art history, fostering inspiration, romance, mystery and spikes of genius—notably in painter Vincent Van Gogh. That famously tormented soul found moments of peace in rendering the flower in works such as *Irises* (1889), a vibrant flower bed famous for its ground-breaking Japanese-style impressionism, and *View of Arles with Irises* (1888), which immortalizes the striking contrast of colors among orris, wheat and olive trees. In the same league as rose, orris is one of those rare fragrance materials to which consumers easily relate, visually and olfactively.

In the olfactive arts, the signature notes of orris have been painted into countless classics. In 1933, Jacques Guerlain's *Vol de Nuit* created a deliciously mysterious story. The fragrance borrows its name from a novel by Antoine de Saint-Exupéry, chief pilot of Aéropostale and close friend of Guerlain. Saint-Exupéry disappeared in a reconnaissance flight over the Mediterranean in a tragedy eerily similar to that of Fabien, the hero of *Vol de Nuit*. In the novel, the newlywed pilot perishes in bad weather, while his wife anxiously waits atop a control tower. The tragic story inspired Guerlain to create a timeless women's fragrance, masterfully formulating orris as its base note, and orchestrating an oriental powdery-sweet accord in perfect harmony with vanilla, oakmoss and sandalwood. Today, far from the romantic glamour of yesteryear, perfumers' and flavorists' love affair with orris is being tested. The industry is suffering seismic disruptions in the supply chain of orris. Shortages, coupled with major shifts in production from Europe to North Africa to Asia, have sent prices sky high, while eroding quality.

Orris Rhizomes

While consumers are familiar with the flower and stem of orris, it is actually the underground rootlike

stem—called a rhizome—that is collected and processed for extraction in the flavor and fragrance industry. These rhizomes contain the highest concentration of naturally occurring irones, a potent molecule responsible for much of orris' scent. Two species of orris are cultivated to serve the industry. *Iris pallida* Lam., which is a tall bearded iris with a pale blue to violet-colored flower, is widely cultivated for its rootstock in the province of Florence, Italy, in Tuscany, where it was introduced in 1842.¹ It is of interest to note that Florence has an iris flower in its coat of arms.² This first variety is ideal for fragrance applications. *Iris x germanica* L., the sword lily iris known as "German iris," "blue iris" or "orris of Verona," is taller than *I. pallida* and possesses beautiful, fleshy dark violet-blue flowers. It is primarily cultivated in Morocco both in small family plots and on large well-groomed parcels of land owned by large farming enterprises. Most of this cultivation takes place on terraces south of Marrakech.³ This second variety is better suited for flavor applications. *Iris pallida* is grown on calcareous soils in Italy; however, cultivation is also expanding into France and China. Iris is grown as an intercrop in Italy, where it complements acreage assigned to grapes for the wine industry and olives for the oil industry. Iris is segregated to the narrowest plots on the steepest slopes, making mechanization impossible. As planting, weeding and harvesting are all done by hand, iris cultivation is both labor-intensive and costly.

Planting is done by hand on soil that has been cleaned of weeds and other debris. The planting material is a section of the first swelling, or *struma*, of the harvested three-year-old rhizome that contains at least three rootlets. Iris rhizomes produce one struma per year of growth.¹ Each rhizome section is planted 30 cm apart in furrows 20 cm apart to a depth of not more than 7–8 cm on the slope of a hill starting in September. The planter ensures that the cut surface of the rhizome is facing upward for optimum growth of the roots down into the soil and thus ideal growth of the iris plant. Each spring, the iris plants are weeded by hand and sometimes again in the fall, if called for. To obtain optimum quality of the rhizome for harvesting, the whole plant is dug up in the summer of the third year. Once the plants are cleaned free of soil, the aerial parts are cut off and the rhizomes



are cut and divided into planting pieces and those that will be sold as orris root. The latter rhizome sections are freed of rootlets, washed, and in most cases peeled, washed again and sun-dried.

Rhizomes are sold to extraction companies in three forms: 1) Peeled rhizomes. In Italy the clean rhizomes are carefully peeled using a small traditional carved knife called a roncolino. This process is long and tedious; one person's daily yield is ~40 kg. 2) Sliced rhizomes. The rhizomes are cut into three or more pieces. This is done if (a) the rhizome skins are so tough it is too time-consuming to peel, which occurs with rhizomes older than three years, or (b) the price of rhizomes doesn't make it cost-effective to peel them. The latter scenario is rare. 3) Whole rhizomes. Generally, rhizomes of Moroccan origin are cleaned and sold as is, while rhizomes of Chinese origin are marketed either whole or sliced.

Global Production

Drawing a very accurate picture of global orris production is a challenge, considering the number of growing regions involved, compounded with the inconsistent size and nature of farming operations, and area of focus of key extraction players. Charabot's sourcing department currently keeps a pulse on five key regions. First, Italy produces *I. pallida*, the "gold standard," though in 2008 it marketed just < 30 metric tons, a far cry from the 200+ metric tons of just a few years ago. Meanwhile, in Morocco 120 metric tons of *I. germanica* are harvested in a very fragmented supply chain comprising everything from large efficient farms to small startups and collecting networks. China's 100 metric tons of *I. pallida* are grown in the country's semi-tropical regions, which are blessed with extremely fertile soils and advanced agricultural practices. France, on the other hand, is now up to 40 metric tons of *I. pallida*, which are produced by two cooperatives. This makes France a new reliable source of quality material. Finally, in Eastern Europe, new players are appearing in Bulgaria, Serbia and Poland—an emerging source not to be overlooked for the future.

Orris Root (Rhizome) Aging: A Slow Process

Fresh rhizomes of orris have no noticeable aroma. Even though they are not harvested until their third year in the ground, aroma production does not take place until the cleaned and peeled rhizomes have been stored for three years. During this desiccation period, an oxidative degradation of the C₃₁-triterpenoids takes place, yielding irones, the Holy Grail components of orris.⁴ Irones build up very slowly within the rhizomes, making orris one of the industry's longest crop cycles—six years from planting to harvest to extraction. Strict compliance with aging procedures ensures optimal irone buildup.

As stated, orris is the only natural source of irones that is being exploited by the flavor and fragrance industry. Irone precursors have been identified as triterpenoids named iridals, with iripallidal and iriflorental (**F-I**) being the best known.⁴ The natural aging process leading to the

Orris: a Multifaceted Note for F&F

"Chanel N°19 is by far the most superb illustration of the beauty of orris—a splendid fragrance that has been engraved in me since childhood," says Daniela Andrier, a perfumer with Givaudan and creator of Prada's *Infusion d'Iris*. "While I am always uncomfortable with preferences for any material," she says, "I confess my deep love for orris. Iris is the messenger of gods, whose scarf unfolds into a rainbow, thereby connecting the divine dimension to ours. In many ways, the raw material bears the same multiple subtle facets as the messenger's rainbow. Orris is woody yet floral, rooty yet powdery. I find orris so rich and multifaceted it is almost indescribable." Of formulating *Infusion d'Iris*, Andrier says, "This fragrance is an artful olfactive essay highlighting all the facets of orris. Orris is characterized by this indelible fingerprint of woody, floral and powdery notes that I complemented. The result is a subtle fragrance—not rooty, not buttery or powdery, but simply very refined, marvelous, stylish and noble. Creating this fragrance was a labor of love." Proving her point, Andrier has even named her daughter Iris.

Arnaud Winter, a perfumer with Cosmo International Fragrances, also admires orris, noting, "Orris is the reflection of luxury. Almost forgotten for its old fashioned image, orris has come back in the last decade. We admire orris for the beauty and purity of its multiple facets ... green, floral, rice, powder, woody and very seductive with a textural effect. Today, we like to use orris in combination with green watery fruity notes and in modern chypres. It brings sensuality, texture and a new 'skin feeling.'"

Jerome Epinette, a perfumer with Robertet, adds, "For me, orris is a powerful powdery woody note, with violet facets (cosmetic, clean linen), green, carrot and even hints of coffee grounds. Orris brings a texture to floral and woody accords. I love to formulate it with dry amber notes."

Surprisingly enough, large volumes of orris extracts are consumed by the flavor industry. The beverage field is riddled with flavors formulated with orris, from fruit juices to soda to vermouth to gin. Foremost, flavorists rely on orris' naturally occurring irones for natural fruity formulas. Irones give body to red natural berries (raspberry, strawberry, pomegranate), peach and apricot flavors. Philippe Gavini, flavorist at Charabot adds, "From a flavor standpoint, there are sharp differences between the *I. pallida* (Italy and China) and *I. germanica* (Morocco). *Iris pallida* is very floral, green and rooty. Its absolute has a very uniform note, which I find monochord. *Iris germanica*, however, has a much fruitier note, and is richer, with strong red fruit notes along with hints of mint. Its butter is my preferred ingredient because it offers a much more diversified and complete palette of tastes to the flavorist. Synthetic irones do perform in red berry formulations and deliver that typical note, but they come second to the rounding power of natural orris extracts."

development of irones is still not very well known. Researchers are striving to accelerate the process; patents have been registered to oxidize iridals and boost irone yields on young immature rhizomes, but regulatory specialists are still questioning their naturalness and thus debating their legal status. Today, the vast majority of orris ingredients are still extracted from naturally aged rhizomes.

Charabot quality control manager Alain Guenet is responsible for qualifying all starting material for extraction, and notes, "Irone content in orris root is carefully monitored. Because of shortages and high prices, farmers and traders increasingly violate proper aging procedures. It is now common to be offered lots [of orris] with historically low levels of irone. We aim to select lots by meeting irone content thresholds, and work hand in hand with the sourcing and purchasing group to deliver best overall value. Current targets are: Italy, 450 ppm; China, 200 ppm; and Morocco, 300 ppm."

Orris Ingredients

Because naturally occurring irones are the desired components in orris, the correct way to classify orris ingredients is by irone content. Purchasing staff would do well to closely monitor orris markets and determine the fair market value of "1% irone index." In recent years, the cost of 1% irone has more than doubled. Accordingly, quality control staff would do well to take a new look at their orris ingredient specifications, as unnecessarily wide irone spec ranges are rampant.



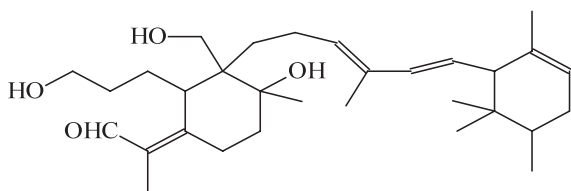
Iris is grown as an intercrop in Italy, among grapes and olives.

GC analysis of orris components reveals: myristic acid, various irone isomers, and many minor molecules such as (E)-2-nonenal, 2-undecenal, nerol, alkanes, ethyl myristate, ethyl caprate, and ethyl laurate. While irones are the keystone to the flavor and scent of an orris extract, these smaller components play a huge role in its depth and breadth. So perfumers and flavorists beware! A rich orris note cannot be recreated by simply formulating commercially available synthetic α -irones, methylionones and derivatives, topped off with a splash of synthetic myristic acid. As for natural flavors, there is still no natural orris substitute currently available.

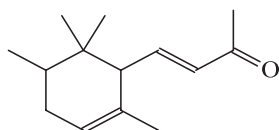
There are several types of orris ingredients. Infusions and tinctures are simple dilutions in alcohol. They may contain only a couple hundred ppm of irones. The extraction process involves submerging powdered orris in ethanol after filtration, yielding an amber to brown

Irone precursors iripallidal and iriflorental for α -irone and γ -irone, respectively

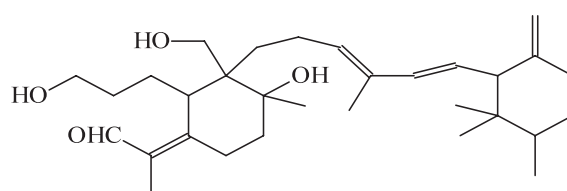
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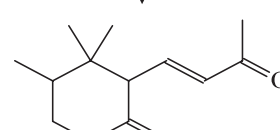
Iripallidal



Irone alpha



Iriflorental



Irone gamma

solution that is delicately perfumed. Infusions can be concentrated, giving a brown paste. Resinoids, meanwhile, usually contain 1–3% irones, with extraction yields of 3–5%. Resinoids are generally obtained by extraction with hexane or in combination with other solvents (benzene substitution). The powder is extracted through several warm washes, followed by filtration and concentration. Resinoids can be treated in alcohol. The alcoholic washes are chilled, filtered and concentrated. This process yields a more viscous material. Resinoids are pasty masses at ambient temperature and amber to dark brown in color. Next, butter, or concrete, is actually the essential oil obtained by steam distillation of powdered rhizomes, a semi-solid, ivory to yellow-beige wax resembling butter—hence the name. The term “concrete” is commonly used to describe this material; however, the word is misleading as the material is not the product of a hexane extraction process. Oil isolation yields are very low—just 0.15–0.25%. Orris butter is usually marketed in two grades: “8% irone” and “15% irone.” Considering that raw butter comes out of the still with 18–20% irone, irone calibration and standardization is achieved through the addition of natural myristic acid, a component of orris and by-product of absolute manufacturing. Absolute can be obtained by various processes, the aims of which are to eliminate waxes—mainly fatty acids, myristic acid—contained in the butter. Some processes consist of vacuum rectification, others of steam distillation in an alkaline environment. The fatty acids in the form of salts do not distill. The traditional transformation process from butter to absolute results in partial dewaxing. Absolutes are yellow to amber oily liquids that are highly odorous. The yield by vacuum rectification is on average 20% of the butter. They represent one of the most refined and expensive products in perfumery, priced today five times more than gold.

Fallout from Turmoil in the Heartland of Orris

Turmoil in Italy, the lost leader in orris root production, brewed in the late 1990s when Tuscan farmers walked away from orris agriculture, claiming unsustainable prices. The Italian orris output quickly shrank from more than



Sliced orris roots, Italy.

200 metric tons per annum to less than 30 metric tons. Jose-Luis Adrian, director of Charabot’s ingredient business unit explains, “Some of the most beautiful flavor and fragrance naturals lose farming acreage every day. I consider that naturals have two underestimated enemies: tourism and real estate. What has happened with orris in Italy is yet another example that farmers will quickly abandon unsustainable crops when land can be sold at a super-premium to real estate developers, or when service jobs created by a burgeoning tourism industry offer higher wages than back-breaking farm jobs.” The speed of Italy’s withdrawal from the orris markets sent most orris extraction companies scrambling, while those who saw it coming did not have six years to make a smooth transition to other growing regions. As the crisis deepened, Charabot’s business unit tackled a deluge of new challenges: 1) Unreliable supply. Supply contracts in alternate regions were in jeopardy, as some traders started auctioning reserved lots. 2) Low irone levels. Farmers and collectors chased quick dollars by rushing rhizomes to market, bypassing proper aging procedures. 3) Disastrous extraction yields. Manufacturing yields dropped significantly. 4) Quality gaps against the Italian gold standard. Olfactive and organoleptic profiles of Moroccan and Chinese extracts were very different from the Italian gold standard.

Sourcing Solutions

Securing an ample supply of quality roots starts by setting the strongest possible foothold at source. Yannick Lavenu, Charabot’s technical and sourcing manager, reported in the early moments of this turmoil, “I stress the importance of a vertical integration strategy in our management of orris. Our three-prong strategy must include: (1) Affirming our position as a long-term partner and not mere speculators by tying closer ties with select coops collectors and farms. (2) Rebuilding and supporting a network of organized and managed farming. Beyond mere savings generated by vertical integration, and beyond better controlling cost, being involved at the farm level will allow us to select the most productive plants and thereby improve irone productivity by 20%. (3) Researching and developing untapped/emerging areas.” In Morocco, vertical integration took the form of a technical and commercial collaboration that bloomed in a small farm that planted 10,000 orris



Orris rhizomes drying in the China sun.

Snapshots from the Tuscan Fields

The bucolic road winds through the hills of the Tuscan countryside, dotted with olive trees, green vineyards and yellow wheat fields. Yannick Lavenu, Charabot's technical and sourcing manager, is in the midst of yet another sourcing trip—this time within driving distance of Grasse, France. Dodging trucks rushing olives to the presses during the short three-week harvest season, Lavenu combs through the two key areas that produce orris in Tuscany: the first lays near the towns of Valdarno and Casentino (Castelfranco, Loro Ciuffenna), the other around the village of Greve in the heart of Chianti country. The orris rhizome business is managed by coops here. Associazione Toscana Giaggiolo, located halfway between core growing areas in the village of Montevarchi, gathers and markets the crops of 150 farmers. The patriarch of the coop explains how costly growing orris has become: under pressure from lucrative wine and olive oil business, farmers have reassigned available premium acreage to these other crops, moving orris to the steepest plots on small plateaus and narrow plots under olive trees. Tractor access is futile. Considering the cost of labor in Western Europe, one can easily understand how a material that contains ppm levels of its most desirable compound yields astronomical prices. Today, orris in Italy remains a fragmented crop, making it impossible to provide an accurate acreage estimate. Lavenu ventures to guess a dozen acres for this one coop in 2007. Meanwhile, a visit to a competing coop, Giaggiolo—Italian for iris—is also on the agenda. There, Lavenu is quickly whisked to a scene of another time. The doors of a fragrant warehouse swing open to uncover canvas bags piled up to the ceiling: two to three metric tons of aging 2006 and 2007 crop rhizomes. There are two qualities slowly building up irones here. "Black" rhizomes are simply dried, sliced, unpeeled roots. This quality is expected to yield 420 mg of irones per kg at maturity. "White" rhizomes are peeled by hand. This is a premium grade whose yield of irones should reach 470 mg per kg. At the negotiation table, discussions quickly move to business. Prices that are almost five times higher than in 2002 remain justified by supply and demand. But what can be done to stop further erosion in supply? Mutual commitment, trust, long term relationships and financial support will be the pillars to Italy's strong return to the orris scene. Doubling output of Italian roots to 50 metric tons is not a far-fetched idea anymore—it is a done deal.

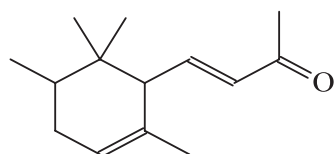
plants on a 12-acre orchard. Commitment of prefinancing and agronomical support was met with guaranteed volumes and locked prices. The second project in Morocco involved a much larger operation, with access to large tracts of fertile land, agricultural expertise, proper farming equipment and an advanced irrigation system. Agronomic research on Moroccan orris is bound to explore *I. pallida* (the Italian variety) in a region where before only *I. germanica* has been grown. In China, the company relied on its local team of sourcing professionals. Laurent Gallet and Luke Meng took over the management of sourcing *I. pallida* in three key provinces. In Yunnan, for instance, they strengthened a collecting network for orris grown there amidst eucalyptus, banana, rice, corn and potatoes. A key factor was to identify sustainability thresholds in the price of orris versus competing crops. In Italy, emphasis was placed on convincing key coops that our organization was not a raw material trader-speculator, but rather sought long-term commitments with steady partners to assure a more reliable supply while bringing prices to mutually beneficial levels. (See **Snapshots from the Tuscan Fields**.) In Eastern Europe, a detailed combing of emerging farming operations yielded a new long-term partnership. Charabot committed to finance the purchase of farming and processing equipment, to support agronomical projects and guarantee purchase volumes. The partnership boosted productivity, improved aging techniques, supported new research programs on alternate orris varieties and opened the opportunity to process organic roots.

Technical Solutions

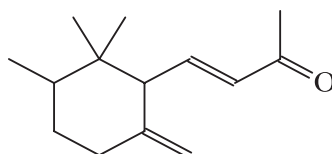
The operations team worked on implementing new extraction tools to optimize efficiencies and somewhat compensate for low irone levels. Distillation took place in a turbo still that accelerated the process from several days to mere hours, generating significant savings. Patrick Rogier, Charabot's director of operations, explains, "We used to grind orris rhizomes by hand before loading six traditional stills with 80 kg batches. This

α -Irone, γ -irone and β -irone, respectively

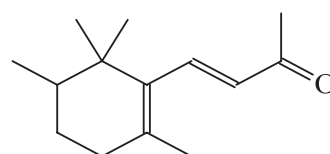
F-2



α -irone



γ -irone



β -irone

	(-)- <i>trans</i> - α -Irone	(+)- <i>trans</i> - α -Irone	(+)- <i>cis</i> - α -Irone	(-)- <i>cis</i> - α -Irone	(+)- <i>cis</i> - γ -Irone	(-)- <i>cis</i> - γ -Irone
<i>I. pallida</i>	<5	>95	#80	#20	>98	<2
<i>I. germanica</i>	<5	>95	#10	#90	35	65

process was hazardous, inefficient and costly. A reengineering program addressed all these issues; we now load 500 kg batches in a converted 5000-l aroma chemical reactor, where rhizomes are ground automatically. The enclosed grinding process now shields our workers from this very hazardous step, the extraction is much faster and yields are higher. The extraction procedures are fully automated: the still can work day and night, without full-time human supervision. All parameters are recorded in our control system.” The R&D team focused on identifying the key components that created such difference in olfactive and organoleptic profiles between the rare Italian *I. padilla* and the more readily available Moroccan *I. germanica* and Chinese *I. padilla*. Research zeroed in on irone isomers: α -irone, γ -irone and β -irone (**F-2**). Irones are chiral compounds with many isomers, whose ratio vary depending upon orris origin and species. Differences in isomer ratios and their odors have been identified and reported.⁵ The lab measured irones on GC by internal standardization either on an apolar column with anethole, or on a polar column with ionone (AFNOR NF T 75-424, id. ISO 18054: 2004). The enantiomeric repartition, which can also be measured with chiral GC, is summarized (average values) in **T-1**.

The formulation team then worked on reengineering the company's portfolio of orris ingredients and designing blends of various species/origins. Blends were developed to shield clients from drastic swings in quality and price and to achieve an irone isomer ratio and flavor profile closest to that of the Italian gold standard. Laure Jacquet notes, “As an ingredient perfumer, my role is to assure our orris portfolio remains coherent in spite of shortages, lower irone yields and overall quality shifts. For instance,

I developed substitution blends (especially for the Italian quality) to maintain the nobility of the note and shield demanding customers from drastic swings in quality. It is quite a complex game of art and process. Beyond mere blending, I am particularly fond of developing and evaluating qualities for new untapped sources. When the sourcing team brought back the fruit of their work in the Balkans, and I was shocked to find how the quality of its extract resembles the Italian gold standard. This Balkan quality is an *I. pallida*, but bears much lower levels of γ -irone compared to Chinese *I. pallida*. This new Balkan orris absolute is soft, floral, creamy, clean and very remanent. It stays on the blotter for two weeks with a very cosmetic texture.”

Conclusion

The landscape in orris has indeed changed dramatically in recent decades, forcing the industry to tackle unexpected issues and provide creative sourcing agronomic operational and technical solutions. What has not changed, apparently, is perfumers' and flavorists' fascination for the flower, its root and unique rainbow scent.

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Loading of an extractor, Grasse, France.