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THE FIRST TRULY INDEPENDENT WATCHDOG FOR THOSE WORKING WITH NATURAL AROMATIC MATERIALS

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ROSEWOOD OIL – CROPWATCH FEATURES 2004-2009.

Modified from Cropwatch's *Threatened Aromatic Spp. v1.11*
& other Cropwatch articles & sources.

§1. Rosewood Trading & Fragrance Industry Usage.

Rosewood essential oils from S. American *Aniba* spp. have become widely known examples of unethically traded commodities from threatened species in recent years, but the commodity continues to be employed in the formulations by many leading fragrance houses. In past years, the US has been the traditional major importer of Rosewood oil, which was resold as 'US Quality' Rosewood oil, which was essentially the original oil stretched with up to 40% synthetic linalol. The use of rosewood oil in fragrances (and formerly in luxury soaps) has been the target of some criticism [e.g. French opposition to the alleged use of Rosewood oil by **Chanel** in *Chanel 5* as reported by Osava 1997 & Osava1998. Major purchasers of Rosewood oil are believed to be the local representatives of fragrance sector multinationals, who have taken up to 100 tons per annum of the oil since the 1980's. These companies seem un-phased by criticisms of unethical behaviour, & fragrance launches have continued to feature Brazilian Rosewood [e.g. *Presence d'une Femme* by **Mountblanc** (2002); *Trussadi Skin* by **Trussadi** (2002); *Lagerfield Jako* by **Lagerfield** (1999) etc.], although availability of rosewood oil 'spot' in more recent years (2006-2009) is becoming more difficult as IBAMA manages to close down illegal stills, leaving just four licensed operative stills in Manaus. Successful Brazilian companies, however, such as O **Boticario** and **Natura** have featured traditional Brazilian ingredients (such as Rosewood oil) as part of their policy for developing home-market cosmetic product ranges, seemingly without adverse comment.

In more detail, Coppen (1996) indicated the chief importer of Rosewood oil was the US, followed by Switzerland (presumably by **Givaudan**), France & other EC countries. Barata (2007) maintained that Brazilian rosewood oil production is presently 38 t/y, worth $2.8 million, which represents the unsustainable loss of 4,000 rosewood trees per year. This annual production figure is well down on the 1992 annual production figure of 66 tones (Coppen 1995) or with the Brazilian situation of the nineteen sixties, where fifty or so Brazilian distilleries provided 500 tons per year of oil (Ohashi 1997). Lupe *et al*. give rosewood oil exports at 38.5t for Aug 2005 to Aug 2006 (down from a quoted 360t/y from 1945 to 1974).

All these authors fail to say if these are official figures from licensed still production, or if they include illegal production, of which Osava (1998) says "illegal export of the oil occurs via "a variety of yet unknown routes."

§2. Rosewood Leaf Oil

Barata (2007) maintained that rosewood leaf oil production was currently 1000L/y from a 30 ha experimental plot, chiral analysis showing the produced oil to be 90% *dextro*- and 20% *laevo*- (linalol?) quoted figures which seems to be missing some ancillary scientific explanation – like for example, why don't the percentage figures quoted add up to 100%? (Cropwatch wrote to the authors 10/2007 for an explanation – so far, no reply). If it is deemed that a high proportion of *dextro*-linalol is necessary in a rosewood-like essential oil commodity suitable for high-class perfumery, then a far cheaper cheaper and less ecologically damaging recourse would be to isolate *dextro*-linalol from coriander oil, and develop this route instead. In spite of what Barata appears to be saying, it would seem to Cropwatch that the perfumery value of rosewood oil is much more to do with the minor character compounds & modifying components to the odour profile, rather than the enantiomeric purity (of linalol), which is much less important.

The May & Barata (2004) paper on sustainable Rosewood production prospects has been widely quoted, but has been critiqued by Cropwatch for its many scientific errors at http://www.cropwatch.org/cropwatch6.htm. This is reproduced below for convenience.

§3. Rosewood Sustainability: Review of May P.H. & Barata E.S. "Rosewood Exploitation in the Brazilian Amazon: Options for Sustainable Production" *Economic Botany* 58(2) pp257-265 (2004) [from Cropwatch 6 (2004)].

Abstract: The authors report on ongoing work in the Brazilian Amazon to assess the current and prospective management of rosewood (*Aniba rosaedora* Ducke) populations threatened by a half-century of predatory extraction for the valuable essential oil linalool (sic) used widely in perfumery. The report synthesizes (sic) prior research on rosewood exploitation and markets and recent research to develop new essential oil products derived from rosewood leaves and stems. The study suggests alternative rosewood production systems, to guide investment in management and certification of sustainable rosewood oil supplies. (N.B. linalool is more correctly called an isolate, *not* an essential oil – TB).

Critical Assessment of the May & Barata Paper

This is an undoubtedly much needed and informative paper and adds to such data on the subject previously contributed by workers such as Ohashi *et al* (1997) and Coppen (1996). The authors are Peter May who works for the Dept. of Development, Agriculture & Society, Federal Rural University of Rio de Janeiro and Lauro Barata who works for the Natural Products Laboratory, State University of Campinas, São Paulo. Over 9-pages, the authors explore the topics of Species Distribution & Distribution, Production Industry in the Amazonas, the

trade in Rosewood oil, Rosewood Extraction and the Threat of Species Extinction and Rosewood Plantation Experience & Conclusions. Unfortunately, as we will see below, the paper contains several factual inconsistencies, which were not picked up under peer-review. Barata reveals an involvement in analysis of rosewood plantation leaf oils and fine stems, and has published two papers on this subject (Barata 2001; Barata & Discola 2002).

Species Description and Distribution Section.

The authors state that the only source of rosewood oil (aka Bois-de-Rose oil) is Brazil, but relate little of its former history. The Dutch botanist Kostermans ascribed the name of the French Guiana tree *Aniba duckei,* after the botanist Alfred Ducke had previously named the same unidentified French Guiana tree "bois de rose" *Aniba rosaedora*, and named the Brazilian variety *A. rosaedora* var. *amazonica*. The oil from the French Guiana tree was introduced into European perfumery around 1866, but in recent times it has been described as very scarce. I (TB) am familiar with Cayenne Rosewood oil as a light yellow to yellow oil, with a sweet linalolic and spicy character. It is sweeter and finer in odour than the Brazilian oil. It can contain up to 90-97% *laevo*-linalol, but the range is more usually 85-95%; correspondingly the optical rotation is in the range -10° and 17° - more negative than Brazilian rosewood oil which is typically between -2° and + 5° (Burfield 2004). The Essential oil Association in 1959 & 1963 had previously defined Bois-de-Rose oil Brazilian as including both Cayenne Rosewood oil and Peruvian Bois-de-Rose oil, and as possibly deriving from a number of species including *Aniba rosaedora* var. *amazonica* Ducke, *Aniba parviflora* Mez, *Ocotea caudata* Mez. etc. To this author's certain knowledge (TB) small lots of Rosewood oil from *Ocotea caudata* has been sold into aromatherapy during 2003-4.

Returning to the paper on Brazilian Rosewood oil, May & Barata say that the only port of export for Brazilian Rosewood oil is that of Manaus, in contrast to statements in a press article (Osava 1998) which maintain that illegal export of the oil occurs via "a variety of yet unknown routes". Previously Ohashi *et al*. (1997) had maintained that only 65% of oil production is exported from Manaus, the rest being sold in São Paulo and Rio to local branches of fragrance houses; May & Barata maintain that Firmenich is the principle Brazilian buyer. May & Barata fail to mention the work of environmentalists in Brazil who are actually against the extraction of Rosewood oil (Osava 1997). The fragrance house Chanel has been accused of contributing to the extinction of rosewood by use of rosewood oil in the well-known perfume Chanel No 5, according to an NGO called "Robin Hood" which had called for a worldwide boycott of the company (Osava 1997, Osava 1998).

The paper contains several typographical errors, and errors of fact. For example the sentence on p258 "…there may have been some tendency to substitute other *Aniba* species, leading to a change in the refractive indices of the oil, which can contain 0.7% to 1.2% pure linalool." This is nonsense as Rosewood oil typically contains 84-93% racemic linalool (Tony Burfield unpublished figures). It is likely

that the "0.7% to 1.2%" wording actually refers to the *yield of oil* from the tree as previously quoted by Ohashi *et al.* (1997) a fact correctly established by the authors on p259.

The authors maintain (p258) that producers recognise two plant sources and make little attempt to keep them separate, although confusingly on p260 it is maintained that three types of aromatic wood are noted by producers (the third type possessing little oil). They further maintain that producers agree that the aroma of rosewood oil can vary from batch to batch, hardly surprising considering the findings of tree to tree analytical quality variations in the resultant distilled oil according to Ohashi *et al.* (1997).

Rosewood Oil Production in Amazonas

Interestingly, and in contrast to the Ohashi paper, the topic of Brazilian deforestation does not appear per se in the text of the paper, nor do other examples of the over-exploitation of rainforest commodity-bearing species, putting them into a category of increased threat (see Margolis 2004 for actual examples of this). Again, no history of concern contexting Rosewood sustainability is presented – and, for example, Campbell de Araujo *et al,* as long ago as 1972, expressed an opinion that propagation difficulties and slow-growth of *Aniba duckei* meant that continuing supplies of Brazilian Rosewood could not be assured ref: Cambell de Araujo et al. (1972). The authors do, however, report on the status of rosewood as being included on the endangered species list (IBAMA 1992) and, following discussions with producers, new regulations were drawn up by the same organisation in 1998, requiring the preparation and approval of sustainable management plans. Little is revealed in the paper on any progress or success of these measures, although it is reported on page 263 that "industrialists" "…plant 9 trees for each barrel of essential oil produced, [and] have established other plantations." The authors subsequently admit, "this parameter is not generally adhered to by industry…" but go on to refer to plantations established in Maués Amazonica. Without a properly constructed fully independent audit of the bio-resources here, and without spelling out who owns these exactly, it is impossible to make a realistic opinion on the likely relevance, if any, of these initiatives.

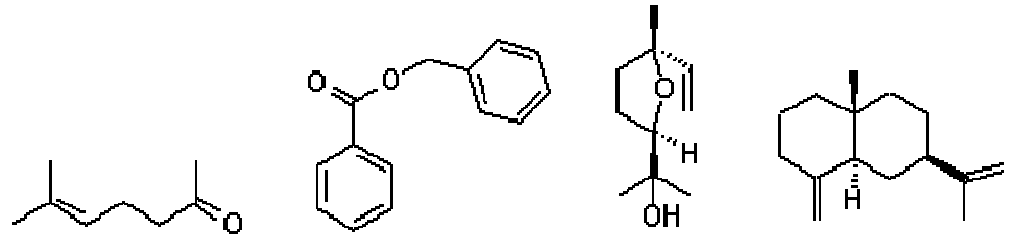
May & Barata maintain that six licensed distilleries only, now operate somewhat precariously within Manaus producing 50 tons of oil per annum, but acknowledge that mobile distilleries exist, confirming the comments made elsewhere (Osava M. 1998). Ohashi *et al*. (1997) commented that these mobile stills are capable of producing 10 tons of oil per year. Conversely the website of D. Cookson http://www.cooksonco.com/ROSEWOOD.HTM who maintain they obtained information via Brazilian exporters, reveal that 4 licensed distilleries operated in Manaus in 1999, producing 100 tons of oil (of which 65 tons are exported). The figure of only 4 licensed distilleries around Manaus, with a number of others operating illegally, has been confirmed by a conservationist working in the region (personal communication, Chrissie Wildwood 2004).

Trade in Rosewood Oil

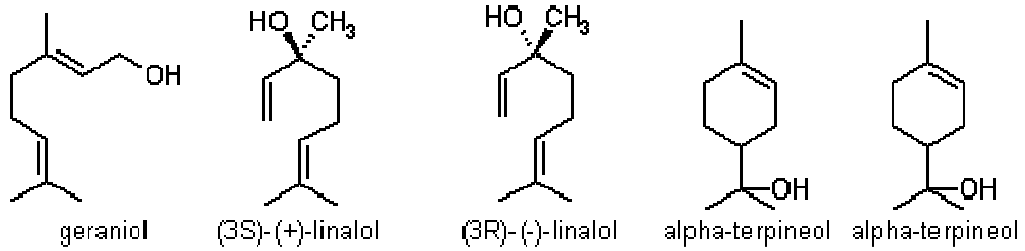
The demand for Rosewood oil fell due to the introduction of cheap synthetic linalool (which the authors incorrectly state on page 259 occurred in the 1980's, although further down the same page they suggest it was the 1960's - it was, in fact, the early 1960's), and also due to the availability of cheap Ho wood & leaf oils (from *Cinnamomum camphora* L. var. *linaloolifera* and *Cinnamomum camphora* Sieb var. *glavescens* Hayata etc). To put this into context, Lawrence (1995) states that the production of Ho oil from China in 1995 was 800 tons/year. May & Barata do not present an effective overview on end-usage applications of Rosewood oil in contrast to synthetic linalool and Ho oils, as explained by their individual characteristic odour qualities, and the differences in end-application performance.

In reality, Rosewood oil is still used in fine fragrances (male and female) but its price precludes its widespread use in cheaper products. Synthetic linalol with its clear bell-like quality does not have the spicy more complex piquancy that Rosewood oil possesses. Further the effects of the two materials in use are quite different. For example Rosewood oil can transform a lily-of-the-valley type perfume and bring it to life, whereas synthetic linalool cannot, since its particular effects on the composition are flatter and more one-dimensional.

Some of the following trace compounds are present in rosewood oil as well as the major components, the linalool enantiomers (TB)



and trace components such as *para*-methyl acetophenone and tetrahydro *para*-methyl acetophenone seem to be important as modifiers (TB 2000):



In contrast fractionated or double/triple rectified Ho oils are nowadays available containing high purity *laevo*-linalool (99.6% +) of high enantiomeric purity (to 99.7% *laevo* linalol). Demand for Ho oil containing linalool of even higher enantiomeric purity (towards 100%) is high, in order to adulterate lavender oil

undetectably. The demand for high purity acetylated Ho oil (to produce “natural” *laevo*-linalyl acetate) is also similarly high for the same purposes.

Further, the authors do not take the following factors into account:

1. Because of legislative requirements affecting fragrances, the demand for *natural status* linalool is often the current driving factor, rather than a demand for linalool *per se*. Thus the cheaper, but quite differently odoured, Ho oil has substituted for rosewood oil because both are of natural status. The fact that Ho oils are cheaper in bulk than some grades of linalol may also be a mitigating factor.

2. That the availability of natural materials is unreliable because of climatic, political and other factors, and consequently prices can be volatile. Although reliable information is scarce, Zhu (1994) has already warned that supply of essential oils from various oil-bearing *Cinnamomum* species in China is precarious due to over-exploitation. In apparent support of this situation is the fact that Ho oil became in short supply in early 2003, and continues to be scarce at the time of writing.

May & Barata present a breakdown of destination information for Rosewood oil exports, the US being the principle importer (47.5% of production for 2000-2003); other destinations include France, Belgium and the UK. Ironically, at the time of writing, officials at IBAMA - the Brazilian export control authority – are on strike resulting in difficulties in obtaining Rosewood oil from source.

Rosewood Extraction and the Threat of Species Extinction.

Earlier, May & Barat stated that Rosewood harvesting & distillation occur in the municipalities of Paratins, Rio Madeira, Presidente Figueiredo, Manicoré and Maué. The authors produce a detailed account of the amount of rosewood exploited (1700 trees per year – the IBAMA have accepted a figure of 1000-2000) using the figure of 10Kg oil/ ton wood – 50 tons production needing 5000 tons of wood/annum (i.e. yield is 1.0%). This is slightly at odds with the statements on David Cookson’s website which state that 15 tons of wood produce 180 Kg of oil (i.e. yield 1.2%). May & Barata conclude the occurrence of rosewood trees in the wild is low (0.33 to 1.0 tree per hectare) and the frequency of occurrence close to rivers (used to transport the sawn wood downstream to distilleries) is negligible up to a distance of two kilometres away. They repeat the opinions of the Agricultural & Forestry Sciences Faculty (FCAP) that there are considerable populations of rosewood in deep forest areas distant from streams.
The authors cite three divided opinions about the status of rosewood: “at one extreme” are those of environmentalists and IBAMA who think that over-exploitation has caused a demise; those of the distillers who maintain the threat is exaggerated; and “in the middle ground” are the scientists of FCAP, the National Industry for Amazonian Research – INAPA, and the Centre for Agroforestry Research (EMBRAPA-CPAA). May & Barata refer to evidence of trees still standing a four-hour walk from accessible streams, and evidence of natural regeneration from field studies conducted by these bodies.

Slightly working against predicting outcomes from these computations is the fact that the annual production figures for Rosewood oil does not seem to be agreed with any degree of certainty – Mitja & Lescure (1996) quoted Coppen's 1995 figure saying production may be closer to 100-130 tons/year rather than 50 tons/year quoted by the authors. With the reported problem of illegal distillation units referred to above, this latter figure may well be nearer the truth.

Rosewood Plantation Experience.

The authors concede that Rosewood oil is still 100% obtained from native stands, but describe a plantation of 300 trees planted in 1973 at Curacá Una in the Tapajós river valley in the state of Pará which was studied by Ohashi *et al.* (1997). Importantly, the authors conclude on a chemotaxological basis that part of this plantation consists of *Aniba fragrans* trees (this tree was previously identified as the fragrant wooded tree Macacaporanga by Mors Walter & Rizzini (1966) – TB). They also report on other experimental plots established by the FCAP at Belém & in Benfica. It is concluded that due to the natural variability of the species in terms of yield and aroma, the appropriate factors for a viable commercial plantation operation could take decades to establish.

A small batch of oil, allegedly derived from the distillation of the leaves of plantation rosewood, gave the following analysis (TB 2004, unpublished data):

Odour/appearance: Colourless oil with a strong, almost fruity rosy-citrus aspect dominating the usual woody-floral rosewood tonality, becoming more pleasant on airing. Not that reminiscent of normal rosewood oil, on first opening the container.

S.G. at 25°/25° C: 0.8795

Optical rotation at 20°C: + 0.57°;

Refractive index at 20° C: 1.4630

GC analysis: α-pinene 0.18%, β-pinene 0.83%, limonene ND,1,8-cineole 0.40%, *tr*-ocimene 0.17%, methyl heptenone ND, 3-octanol ND, methyl heptenol ND, linalol oxide A 0.17%, linalol oxide B 0.18%, citronellal 0.06%, α-p-dimethylstyrene ND, camphor ND, α-copaene 0.06%, linalol 84.74%, β-caryophyllene ND, terpinen-4-ol 0.20%, benzaldehyde ND, a-terpineol 6.95%, nerol 0.12%, geraniol 1.93%, hotrienols ? 0.18%, β-caryophyllene oxide 0.13%, spathulenol ND, benzyl benzoate 0.32%.

It is unlikely that perfumers used to the characteristic character of rosewood oil would be impressed by this oil, and the relatively high a-terpineol content is perceived as a decidedly negative quality factor (the transformation of linalool to a-terpineol during distillation is known to occur, and may be able to be controlled by more appropriate distillation conditions).

Potential for Extraction of Essential Oil from Rosewood leaves.

This is an area of involvement for one of the authors as previously noted, and the authors further concede that leaf oils are "somewhat different" from wood oils

[two of the three samples of rosewood leaf oil seen by this author were judged to have no commercial value, being both crude and oxidised]. The effect of shading on propagation of young trees is described in some detail. Leaves are ready for coppicing in five years (seemingly a fall-back from Ohashi *et al*. who had previously estimated 3 years). It remains to be seen whether the oil will be attractive to essential oil buyers.

Conclusion.

In conclusion May & Barat present a case for a technological search to solve the production of acceptable quality rosewood oil from plantation grown and gathered leaves and stems, listing a series of suggested steps. The omission of presenting an overall ecological impact assessment of this monoculture project is quite glaring – "sustainable production" does not just mean guaranteeing the continuance of an exportable commodity, rather it means presenting a scheme which does not harm the environment. Failure to do this in other plantation schemes has been previously reported by TB & CW in the Cropwatch series (http://www.tonyburfield.co.uk/).

Low (2004) presented some wise words: "Many problems in managing and protecting endangered species arise not from our ignorance of the species' ecology, but from human conflicts of interest". Whilst the authors of the paper noticeably distance themselves from entering into the sustainability debate (calling the antagonists and protagonists "local actors"), their very involvement in aspects of rosewood leaf oil production schemes biases their paper in my opinion (TB), and I recommend that readers should seek opinions from other sources on this subject, in the interests of balance.

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§4. Rosewood Update July 2008.

For some reason which completely escapes us, the trade magazine *Perfumer & Flavourist* have seen fit to publish a paper from Lupe, Souza & Barata entitled “Seeking a sustainable alternative to Brazilian Rosewood” (Lupe *et al*. 2008). In the paper the authors examine the possibility of directly substituting the linalol-containing essential oils of *Lippia alba*, *Ocimum basilicum* & rosewood leaf oil, for rosewood oil itself - the sort of exercise you might set for a perfumery beginner on their very first day in the industry. From the information given, the authors seem to have made their judgments merely by comparative analysis of the components of the individual oils. The entirely predictable conclusion of the investigation was that of the oils chosen, rosewood leaf oil had the closest composition profile to rosewood oil; at variance with the previous finding of one of the authors who had co-written a paper previously where it was found that rosewood leaf oil was differently odoured to rosewood oil (May & Barat 2004 – Cropwatch extensively criticised the paper at http://www.cropwatch.org/cropwatch6.htm). It should also be mentioned that the authors did not even attempt to concentrate up the 40% linalol content of *O. basilicum* to the linalol concentration level typically found in Rosewood oil (approx 85-90%) for a slightly more realistic comparison, because “…it would be necessary to conduct a fractional distillation of *O. basilicum* oil, which is a relatively complex and expensive process…” As you can see, the technical level of this paper puts us firmly back in the 1870’s.

As we noted above, the authors fail to understand the underlying factors contributing to the perfumery value of rosewood oil, and continue with this wrong-headed obsession about the chiral purity of linalol.

§5. Ecological View: Rosewood oil (aka Bois de Rose oil) from *Aniba* spp.

According to a botanical status review (Maia *et al*. 2007), the Brazilian essential oil produced mainly from morphological types of *A. rosaeodora* Ducke and *A. duckei* Koster. (syn. *A. rosaeodora* Ducke var. *amazonica*). Other *Aniba* spp, have been (probably erroneously) linked with rosewood oil include:

Aniba fragrans Ducke;
Aniba canelilla (HBK) Mez.
Aniba.parviflora Ducke.

A. rosaeodora Ducke and *A. duckei* Koster. Are distributed through Brazil (Amapá, Amazonas, Pará), Colombia, Ecuador, French Guiana, Guyana, Peru, Suriname, Venezuela. The following status listings were collected by Cropwatch for *Aniba rosaedora*:

Endangered EN A 1d+2d Varty N. (1998). *Aniba rosaedora* In: 2008 IUCN Red List of Threatened Species. Loss of germ plasm diversity and narrowing of the genetic base is already believed to have occurred, although a germ plasm collection is believed to be in operation via the efforts of the Faculdade de Ciensias Agrarias do Para at Belem, Brazil.

Threatened in Brazil: IBAMA (1992)

Threatened in Columbia (Calderton 1997)

Threatened in Surinam (Werkhoven 1997).

Endangered: FAO Panel of Experts 5th Report on Forest Gene Resources 7th Appendix.

Largely eliminated in French Giuana by 1930; a few trees still exploited for essential oil up until the 1980's (Cropwatch 2007).

Refs & further reading

– see also Cropwatch's extensive *Rosewood Bibliography* in the Cropwatch Files section.

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Mitja D. & Lescure J.-P. (1996) “Du bois pour da parfum : le bois de rose doit-il disparaître?” In L. Emperaire ed. Le forêt en jeu l’extrativisme en Amazonie Centrale UNESCO)-ORSTOM, Paris pp93-102. through May & Barata (2004) above.

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§6. Ecological View (2) ‘Rosewoods’ from *Ocotea* spp.

Ocotea caudata (Nees) Mez.
& other *Ocotea* oils

Distribution: Brazil, French Guinea

Status: Many *Ocotea* oils endangered Cropwatch (2004).

Notes: Other ‘rosewood oils’ - e.g. from *Ocotea* spp., especially *Ocotea caudata* Koeller which has been previouskly linked with Cayenne rosewood oil, are sometimes also sold as Rosewood oil, but have often been of very low odour value (probably due to the presence of isovaleraldehyde & furfuraldehyde).