Cape Chamomile Oil – the Origin of its Blue Colour

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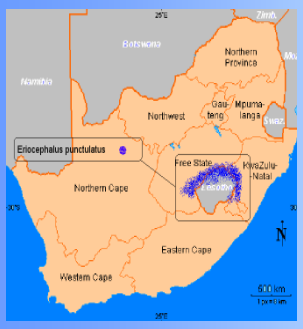

Introduction:

Commercial Cape chamomile oil is produced from cultivated plants of Eriocephalus punctulatus DC (Asteraceae) in the Cape Province. E. punctulatus is an endemic plant growing on the north-east slopes of the ‚Drakensberge' in the Province Freestate (South Africa). It is a white flowering small shrub similar to the better known E. africanus. In folk medicine several species of Eriocephalus are traditionally used as diaphoretics and diuretics [1]. No special use is published concerning E. punctulatus; local people reported its benefit in the treatment of stomach diseases using different administration forms. Due to its pleasant odour the essential oil is added to cosmetics and nowadays applicated in aromatherapy.

The blue colour of the commercial oil is striking and one associates it automatically with the European chamomile oil won from Matricaria recutita. When several samples of dried plant material cultivated in the Cape Province were distillated in the laboratory it could be observed that the blue colour appeared about half an hour after starting the procedure. This observation led us to assume that the blue colouring compounds are formed during distillation from precursors as it is known from the European chamomile where chamazulene is formed from the proazulene matricine.

Results:

The leaves of E. punctulatus were extracted with ethyl acetate at room temperature in order to avoid any decomposition or conversion reactions due to heat or water (a). The gas chromatogram of this extract was compared with a chromatogram of an oil sample won by steam distillation (b). To locate the peaks of the constituents responsible for the blue colour the blue fraction was isolated from the distillated oil by column chromatography and TLC at low temperature (c). Previous experiments had proved the blue colour to turn up in the hydrocarbon fraction of the oil.

The gas chromatograms of (a), (b), and (c) are presented in *figure 1.* Evaluating the gas chromatograms as well as the results of GC-MS analyses the main peaks in the chromatogram of the ‚blue fraction' (c) were proved to be 1,4-dimethyl azulene and chamazulene which had already been described by Roard et al. [2]. Both components could be detected in the oil sample (b). The mass spectra of these compounds are shown in figure 2. The chromatogram of the ethyl acetate extract (a) was only partially similar to that of (b). Nevertheless at Rt 39.85 min and 47.25 min two peaks appeared which had to be identified.
In the mass spectra of both peaks the typical base peaks of the azulenes, mz 156 and mz 184, were missing.

Therefore we start out from the fact that the azulenes are not genuine compounds of the plant but are produced during distillation. Investigations on the precursors which we assume to belong to the group of proazulenes are in progress.

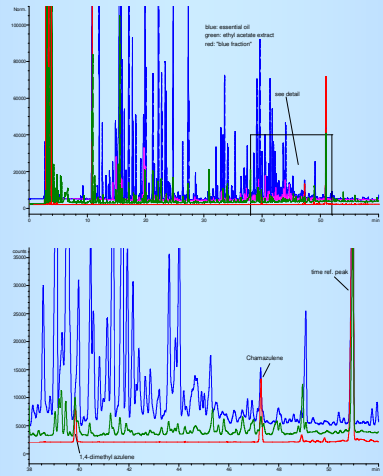

Figure 1: Chromatograms

In addition to this results we present the composition of a commercial Cape Chamomile oil as hitherto identified *(Figure 3, Table 1).*

Material and Methods:

(a) 10g of leave
(b) Steam distilled essential oil solved 1% in n-pentane. The oil sample was provided by Grasroots Natural Products, ZA (November 1999)
(c) 1 ml of pure essential oil was applicated on a silica gel column (25cm x 1cm) and eluated with n-hexane. The blue fraction was collected and concentrated followed by TLC at -20°C. Stationary phase: silica gel 60 F_{254} Merck, mobile phase: n-hexane. The blue zone was removed and extracted with n-pentane. After concentration this solution was used for GLC and GLC-MS.

GLC: HP 5890, Column: Phenomenex ZB-1, 30m x 0.25 i.d., 0.25µm film thickness, carrier gas N_2, flow 1ml/min., temperatur program: 3°C/min from 45°C to 230°C, split injector (ratio 1:10): 250°C, FID 250°C

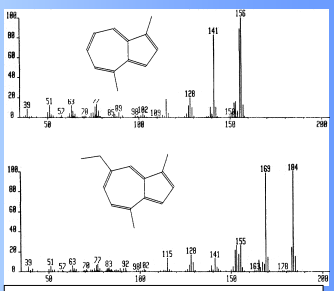

Figure 2: Mass spectra of 1,4-dimethyl azulene (↑) and Chamazulene (↓)

GLC-MS : HP 5890, Column: Chrompack CP-Sil 5 60m x 0.25 i.d., 0.25µm film thickness, carrier gas He_2, flow 0.9ml/min., temperatur program: 5°C/min from 45°C to 220°C, injector: 220°C, detector: HP MSD 5970 B, electron impact mode 70 eV

References:

[1] B.-E. van Wyk, B. van Oudtshoorn, N. Gericke, *Medical Plants of South Africa*, Briza Publications, Pretoria, ZA 1997
[2] D.Roard et al., *Contribution to the study of Eriocephalus punctulatus essential oil: II. Azulenic compounds*, Perfumer & Flavorist, Vol.3, April/May 1978, 32-36

component	*peak*
2-methylpropyl propanoate	140
2-methylbutyl acetat	144
nonane (time ref.)	152
2-methylpropyl-2-methyl propanoat	154
alpha-thujene	168
alpha-pinene	170
camphene	174
3-methylbutyl propanoat	178
2-methylbutyl propanoat	180
sabinene	182
ß-pinene	184
unk 67B,68,82,96,110,137,152	188
ß-myrcene	189
2-methylpropyl-2-methyl butenoate	190
2-methylpropyl-3-methyl butanoate	192
3-methylbutyl-2-methyl propanoate	194
2-Methylbutyl-2-methyl propanoate	196
alpha-terpinene	198
p-cymole	200
1,8-cineole	202
isobutyl angelate	212
gamma-terpinene	218
2-nonanol	220
butyl (Z)-2-methyl-2-butenoate	222
terpinolene	230
linaloole	232
3-methylbutyl-2-methyl butanoate	234
2-methylbutyl-2-methyl butanoate	236
camphor	252
2-octanol acetate	256
3-methylbutyl (Z)-2-methyl-2-butenoate	260
2-methylbutyl (Z)-2-methyl-2-butenoate	262
borneole	268
terpinen-4-ol	274
pentyl-(Z)-2-methyl-2-butenoate	276
alpha-terpineol	280
linalyl acetate	314
bornyl acetate	324
eugenole	354
neryl acetate	358
geranyl acetate	368
alpha-copaene	376
ß-caryophyllene	390
unk 68,81,96b,191,206	400
unk 43,71,97,115,159,201	412
gamma-elemene	424
delta-cadinene	433
davanone	446
spathulenole	454
caryophyllene oxide	456
chamazulene	504
octadecane (time ref.)	534

Table 1:Main components of commercial essential oil of *eriocephalus punctulatus DC*

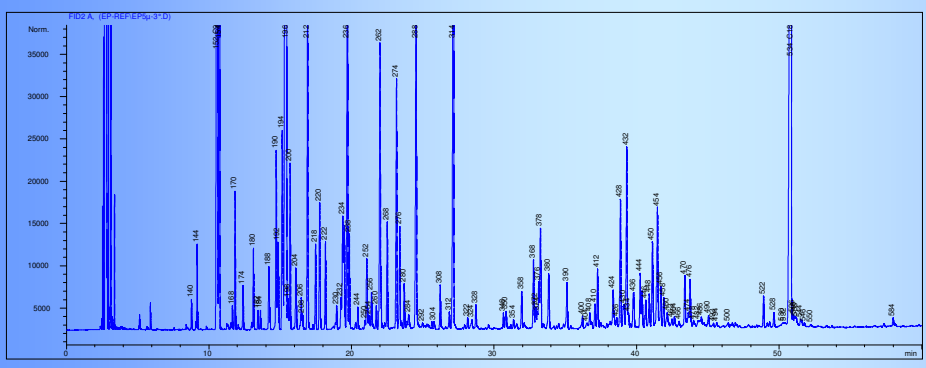

Figure 3: Chromatogram of commercial essential oil of *eriocephalus punctulatus*