

Effects of metabolic changes in rapeseed during moist storage on the sensory quality of rapeseed oil and its profile of volatile compounds

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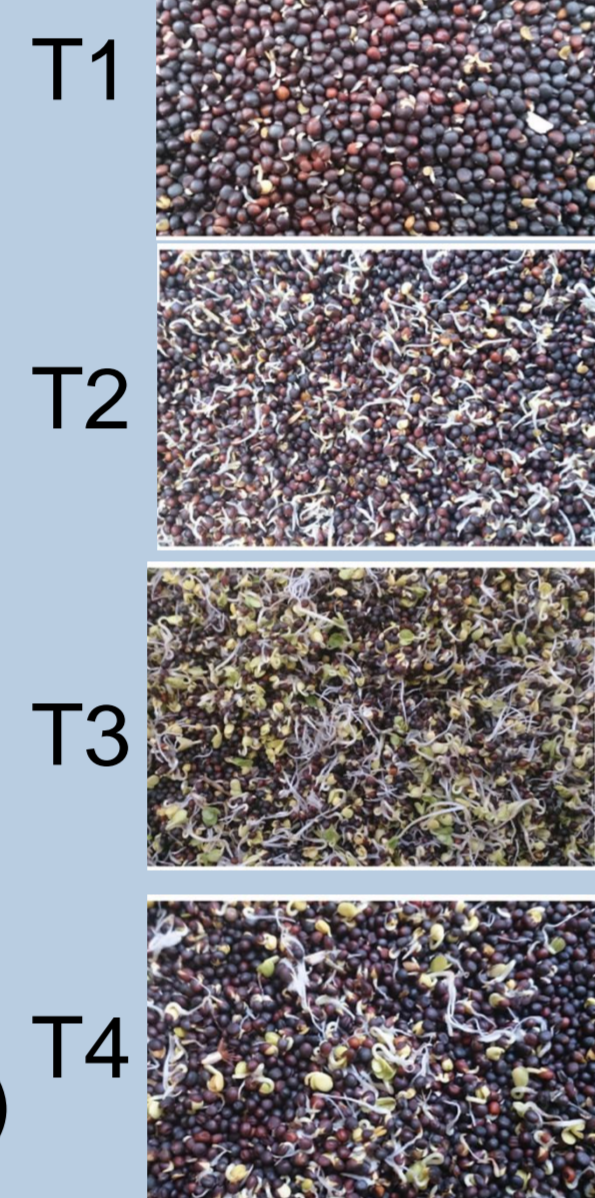
Introduction

The storage conditions of rapeseed (*Brassica napus*) are decisive for the sensory quality of virgin rapeseed oil. The high oil content of the seeds acts as sensory memory and collects the volatile compounds formed during storage. This can impair the sensory oil quality resulting in a fusty and musty smell and taste. Therefore the knowledge of the metabolic changes in rapeseed during moist storage may help to understand how short-chain volatile aroma-active compounds affect the quality of virgin rapeseed oil.

Aim

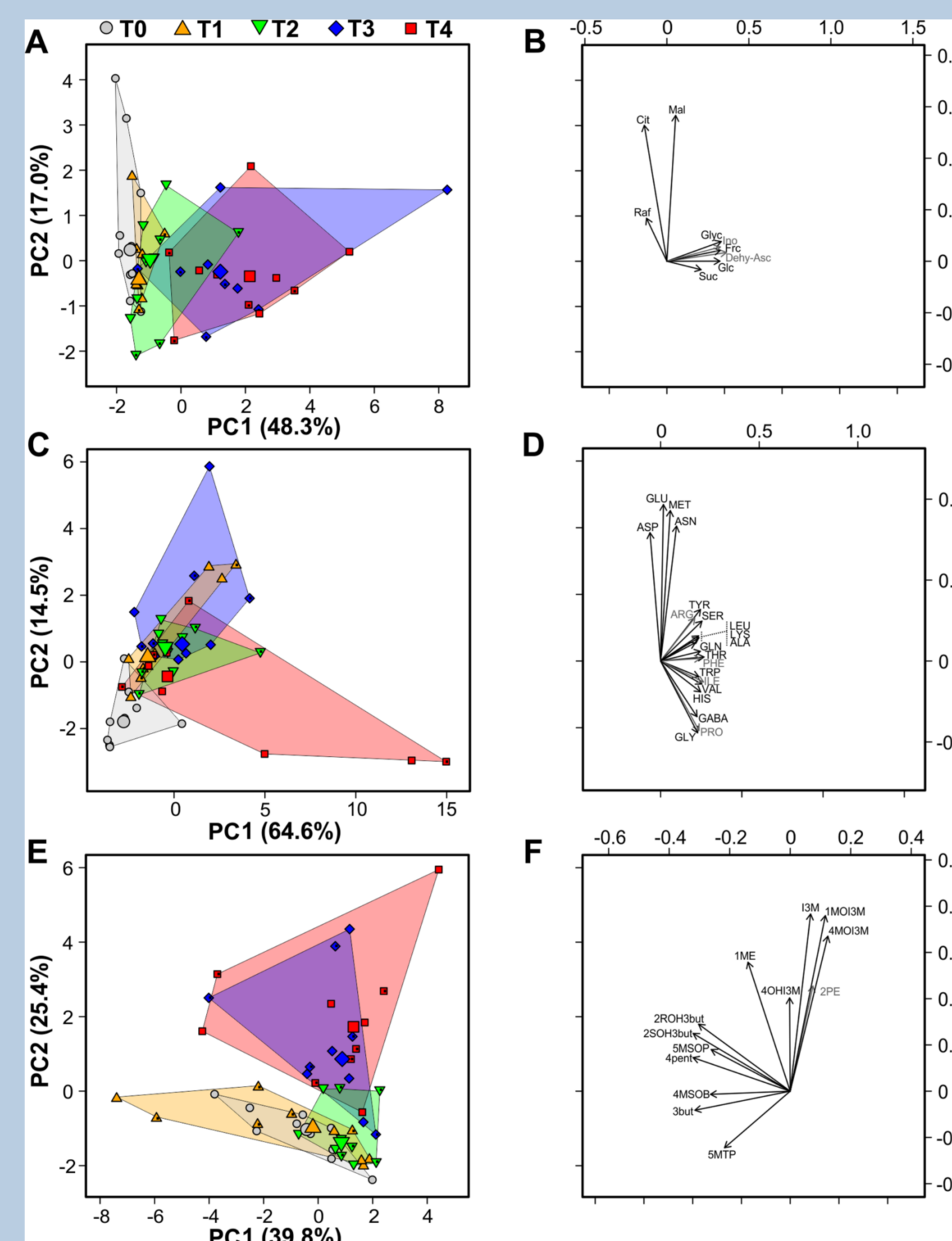
Identifying changes of the rapeseed metabolome during moist storage and correlation between sensory attributes and profiles of volatile compounds of virgin rapeseed oils as influenced by time.

Storage of rapeseeds (*Brassica napus*) under moist conditions for one (T1) to four (T4) days.



Metabolite profiling:

- ✓ Carbohydrates, organic acids, cyclic polyol *myo*-inositol (GC-MS)
- ✓ Amino acids (UHPLC-FLD)
- ✓ Glucosinolates (HPLC-DAD)



A-D: Primary metabolites

- ✓ 29 primary metabolites were identified.
- ✓ Increase of most primary metabolites already after one day of moist storage.
- ✓ Strongest metabolic shifts at three to four days.
- ✓ Increased metabolite pool sizes of glucose, fructose, glyceric acid, dehydroascorbic acid, *myo*-inositol, and most amino acids.

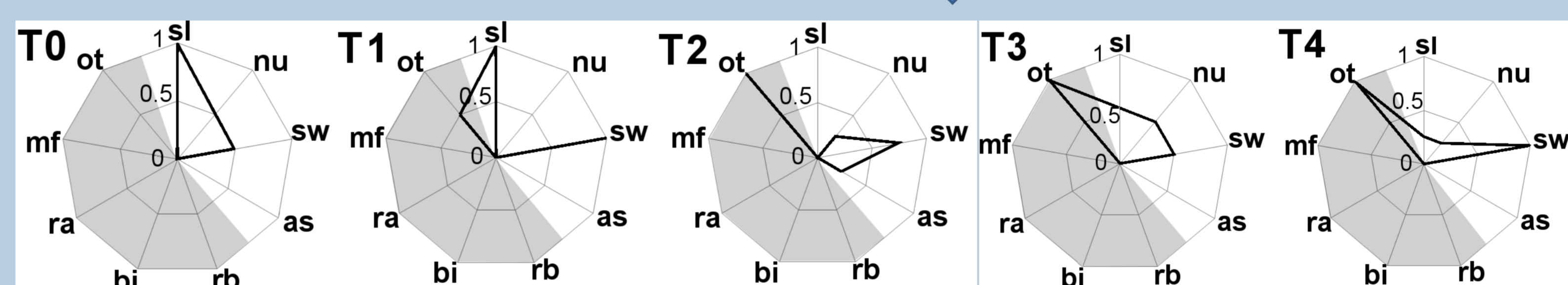
E-F: Glucosinolates

- ✓ Clear separation of T3 and T4 group from T0 and T1 group, T2 group in between.
- ✓ Metabolic shift started after two days of moist storage.
- ✓ Shift was mainly driven by increase of indole glucosinolates and, to a lesser extent, the benzyl glucosinolate gluconasturtiin.
- ✓ Aliphatic glucosinolates were unaffected or even decreased.

Principal component analyses of metabolites (A, B: carbohydrates, organic acids, one cyclic polyol; C, D: amino acids; E, F: glucosinolates) of rapeseeds after storage under moist conditions for zero (T0) to four (T4) days.



Pressing of rapeseed by a screw press and **sensory evaluation** of the resulting oils by a trained panel.

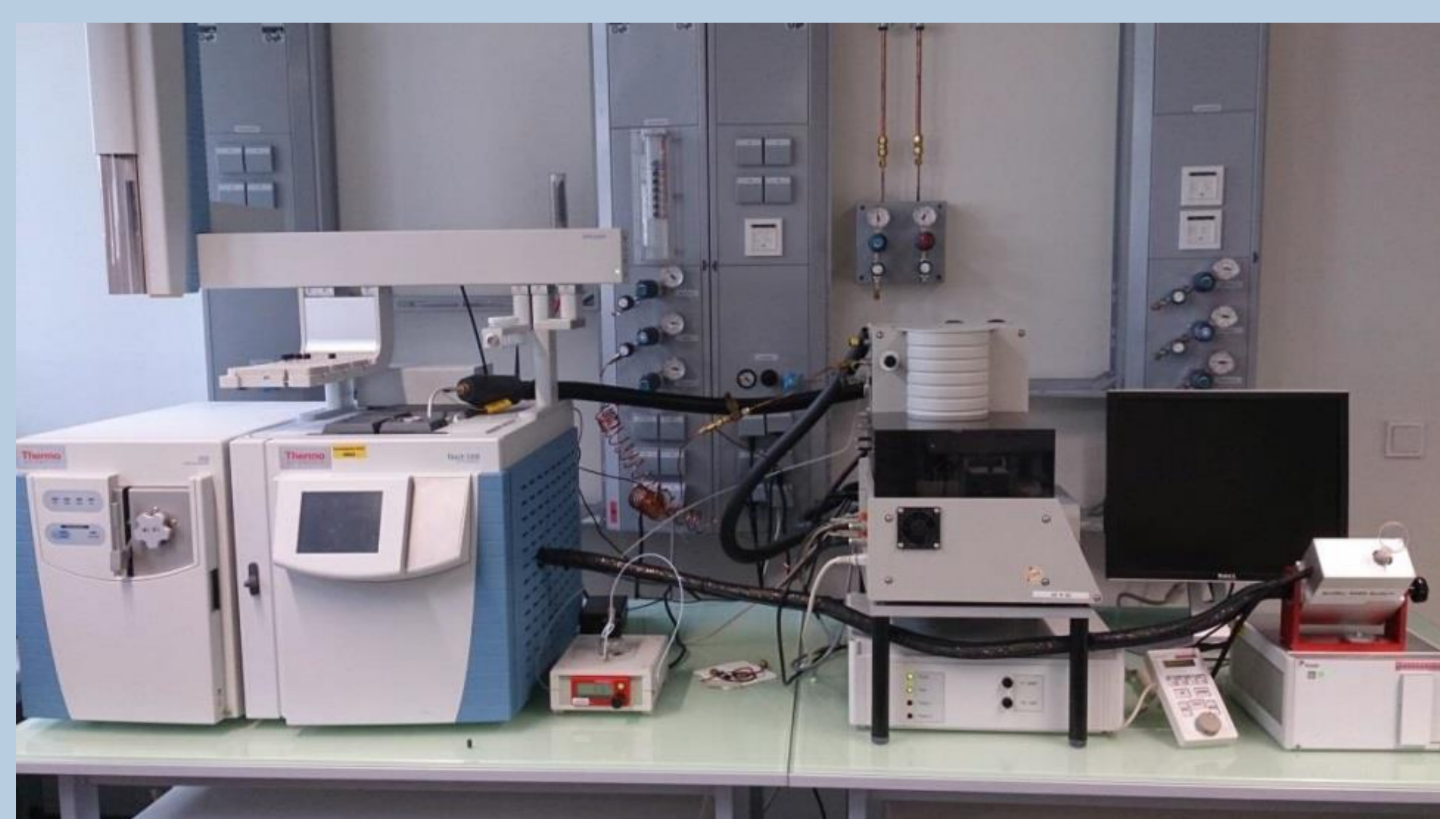


Abbreviations:
sl seed-like
nu nutty
sw strawy/woody
as astringent
rb roasted/burnt
bi bitter
ra rancid
mf musty/fusty
ot others
off-flavor area

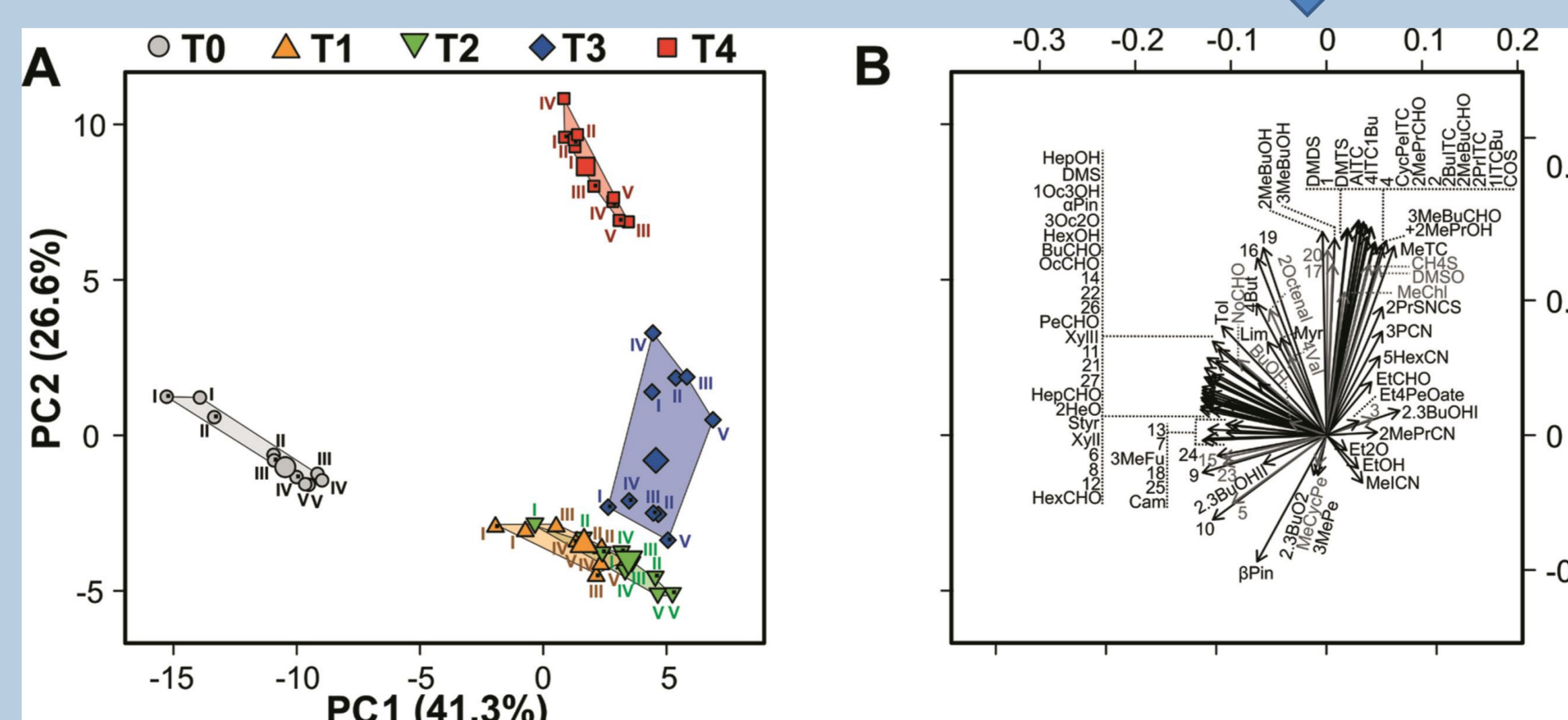
Sensory quality of virgin rapeseed oils pressed from seeds stored under moist conditions for zero (T0) to four (T4) days.

With increasing storage time intensity of the sensory attributes

- ✓ seed-like and nutty **decreased**
- ✓ strawy/woody and astringent **increased**
- ✓ **germinated appeared** and **increased** from the second day of moist seed storage on.



Determination of the **profile of volatile compounds** → dynamic headspace GC-MS.



Principal Component Analysis including volatile compounds of virgin rapeseed oils after storage of the corresponding seeds under moist conditions for zero (T0) to four (T4) days.

- ✓ Shift in volatile profiles with time under moist storage.
- ✓ Moist storage is reflected in the profile of volatile compounds.
- ✓ Alcohols, aldehydes, and dimethyl sulfide may be derived from amino acids via Strecker degradation.
- ✓ Nitriles and isothiocyanates are degradation products of glucosinolates.

Conclusion

- ✓ Moisture during storage results in **rapid metabolic shifts** of sugars, amino acids and glucosinolates in rapeseeds along with changes of the volatile profiles of the corresponding virgin rapeseed oils leading to **atypical and undesirable sensory impressions**.
- ✓ Therefore **proper storage conditions** with moisture contents of the seeds of around 7 % are **necessary** to ensure high sensory oil quality.