

The genetic assessment of chemotypes – a fast method for the discrimination of agricultural *Cannabis* cultivars

.... and CANNDAT – an Austrian-German database
surveying the distribution of *Cannabis* chemotypes in
European agricultural hemp

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Cannabis drug strains and agricultural hemp cultivars



Illegal drug strains
THC up to > 20%

~ 55 EU agricultural hemp
cultivars, THC < 0.2%

Morphological discrimination – sometimes difficult!

Cannabis drug strains and agricultural hemp cultivars



Seeds: devoid of THC



Old plant material: THC degradation



Roots: devoid of THC



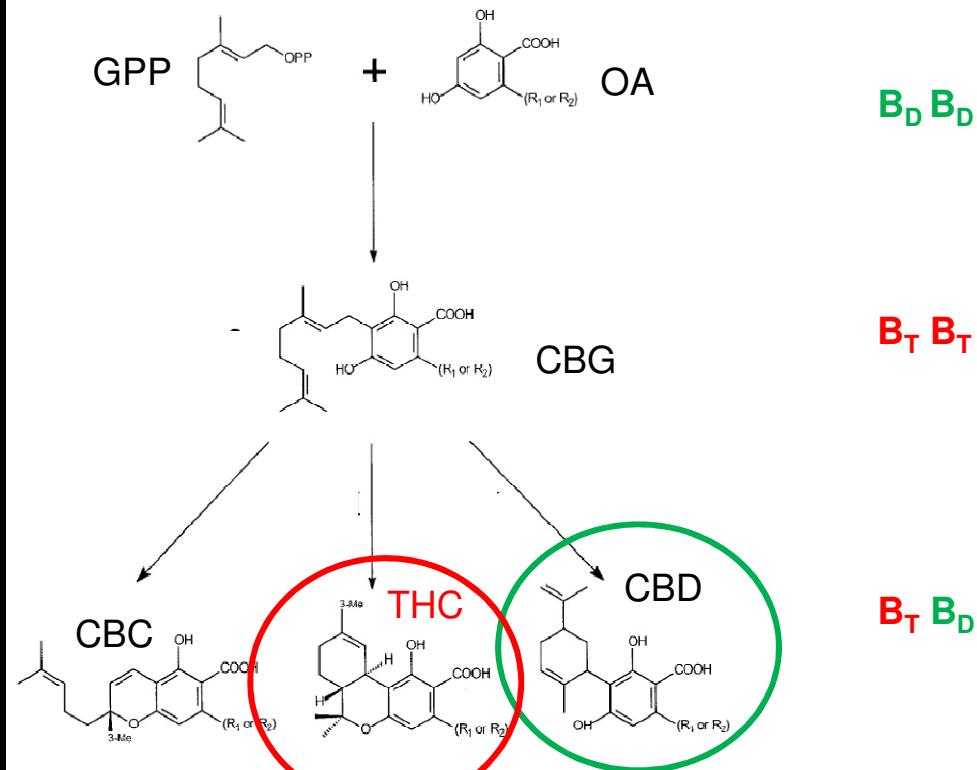
Young seedlings: low THC content

Absolute THC content – not always conclusive!

Cannabis reveals three chemotypes depending on CBD/THC ratio

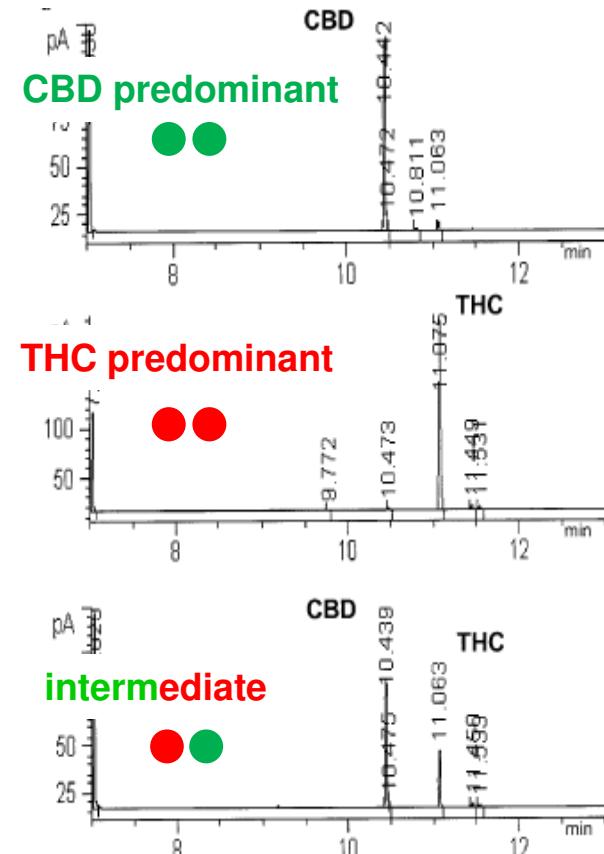
CBD/THC Ratio
constant throughout plant life
independent of external factors

THCA Synthase Gene
Two codominant alleles:
 B_T and B_D

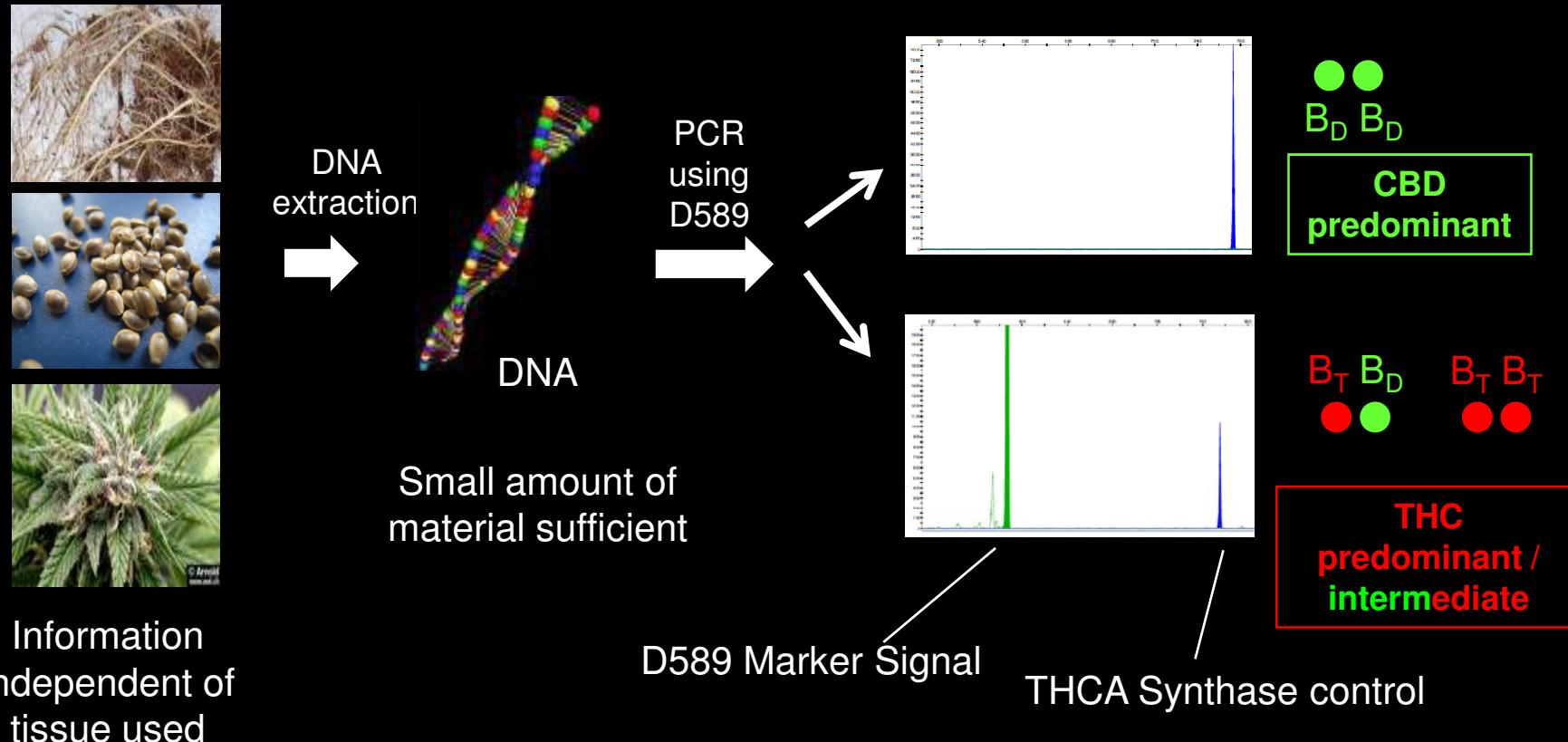


De Meijer et al. (2003)

Three discrete Chemotypes



Genetic determination of the chemotype: PCR-based DNA marker system D589



D589 detects sequence polymorphism (B_T allele) in **THCA synthase gene**
→ predicts chemotype with high accuracy in all tissues

D589 does not predict the absolute THC content!

$$\text{Total}_{\text{THC}} = \text{Crop Yield} \times \text{Total}_{\text{Cannabinoid}} \times \text{Proportion}_{\text{THC}}$$

Post-harvest events External factors

Total cannabinoid content
Multiple genetic factors

Cannabinoid composition → CBD/THC ratio
Predictable by Marker D589

⚠ No quantitative prediction!

.... and how about chemotype distribution?



Choice of **Chemotype** for a certain plant use
is man-made (= plant breeding)!

- **Drug production** aims at high THC yields

$B_T\ B_D$

→ B_T allele present in drug hemp individuals

$B_T\ B_T$

THC predominant /
intermediate

De Baker et al., 2012
Pacifico et al., 2008
Staginnus et al., 2014



- **Legal agricultural production (EU)**
has to conform with < 0,2% THC

expected

$B_D\ B_D$

CBD predominant

Individuals carrying B_T allele reported
Pacifico et al., 2008
Staginnus et al., 2014

→ **CANNDAT:** a systematic survey over chemotype distribution in agricultural hemp

CANNDAT - Systematic survey over agricultural cultivars grown in Europe (EU)

„European Catalogue of Agricultural Cultivars“ → legal basis for trading and subsidies → ~ 55 cultivars
(Article 17 -2002/53/EG)

„European Catalogue“ for Germany 2017	
Antal	KC Dora
Armanca	KC Virtus
Beniko	KC Zuzana
Cannakomp	Kompolti
Carma	Kompolti hibrid TC
Carmaleonte	Lipko
Chamaeleon	Lovrin 110
Codimono	Marcello
CS	Markant
Dacia Secuieni	Monoica
Delta-Ilosa	Rajan
Delta-405	Ratza
Denise	Santhica 23
Diana	Santhica 27
Dioica 88	Santhica 70
Eletta Campana	Secuieni Jubileu
Epsilon 68	Silvana
Fedora 17	Szarvasi
Felina 32	Tiborszallasi
Ferimon	Tisza
Fibranova	Tygra
Fibrol	Uniko B
Fibror 79	Uso-31
Finola	Wielkopolskie
Futura 75	Wojko
Ivory	Zenit
KC Bonusz	

Hanfsorten die für den Anbau 2017 in Deutschland nicht gestattet sind:

Bialobrzeskie	Carmagnola
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Der durchschnittliche THC-Gehalt aller Proben hat im zweiten aufeinander folgenden Jahr bei den Sorten Bialobrzeskie und Carmagnola den zulässigen Höchstgehalt überschritten.

- Additional: national catalogues of each country & OECD catalogue

>> Cultivars which may not be cultivated in 2017- their average THC content exceeded 0.2% in two succeeding years<<

CANNDAT - Systematic survey over agricultural cultivars grown in Europe (EU)

Laufende Nummer	Sortenbezeichnung	Probentyp	Konsumware
1	Anbo	SM	
4	Asso	SM	EHZ
6	Beniko	SM	SM
11	Bialobrzeskie	SM	EHZ
14	Campagnola	Konsumware	SM
15	Cannakomp	SM	SM
16	Carmagnola	SM	SM
18	Carmaleonte	SM	SM
19	Chamaeleon	SM	
20	Codimono	SM	SM
21	CS	SM	SM
23	Dioica 88	SM	SM
25	Eletta Campana	SM	SM
26	Epsilon 68	SM	SM
31	Fedora 17	SM	SM
35	Felina 32	SM	SM
42	Fedora 19	SM	EHZ
43	Fedrina 74	SM	SM
44	Ferimon	SM	SM
47	Fibranova	SM	EHZ
48	Fibrante	SM	Z
49	Ferimon 12	EHZ	sm
52	Fibrinor	SM	SM
53	Fibrimon 56	SM	SM
54	Fibrol	EHZ	EHZ
57	Finola	SM	SM
62	Futura	SM	SM
63	Futura 75	SM	SM
68	Goricka simba	SM	SM
69	Helena	SM	SM
70	Idalgo	SM	Konsumware

prototype sample

submitted when cultivar is licensed

certified seeds

supplied by official /maintenance breeder

harvested seeds

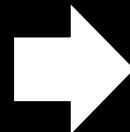
meant for production, not for sowing

- 131 samples collected
= representing 62 different cultivars
- 43 of these in „European Catalogue“
- mostly **prototype samples**

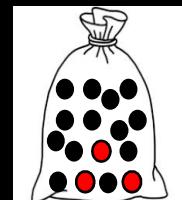
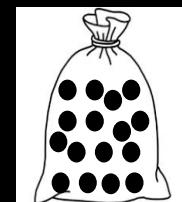


2 x 30 seeds of all 62 cultivars
investigated chemotype genetically
(5-seed bulk samples)

CANNDAT – a database surveying the distribution of *Cannabis* chemotypes in European hemp cultivars



- **Most** of the EU cultivars investigated reveal a **CBD predominant** chemotype ($B_D B_D$).
- **Some** cultivars marketed and grown in EU do contain **B_T alleles** to a certain (low) percentage!
- **The ratio** of B_T carrying individuals may vary during breeding process



- B_T allele carrying seed

The consortium provides **CANNDAT** - a database surveying...

Existence & frequency
of B_T -carrying seeds
in various cultivars

More information?

Contributions?



RheinlandPfalz
LANDESKRIMINALAMT

Thanks for listening!



.BK



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