



HAL
open science

Temperature modulates fatty acids profiles in freshwater diatoms and the impact of herbicides

F. Demailly, I. Elfeky, M. Le Guédard, Mélissa Eon, P. Gonzalez, Soizic Morin

► To cite this version:

F. Demailly, I. Elfeky, M. Le Guédard, Mélissa Eon, P. Gonzalez, et al.. Temperature modulates fatty acids profiles in freshwater diatoms and the impact of herbicides. 5th Biofilm Workshop, Sep 2018, Kristineberg, Sweden. pp.1, 2018. hal-02609726

HAL Id: hal-02609726

<https://hal.inrae.fr/hal-02609726>

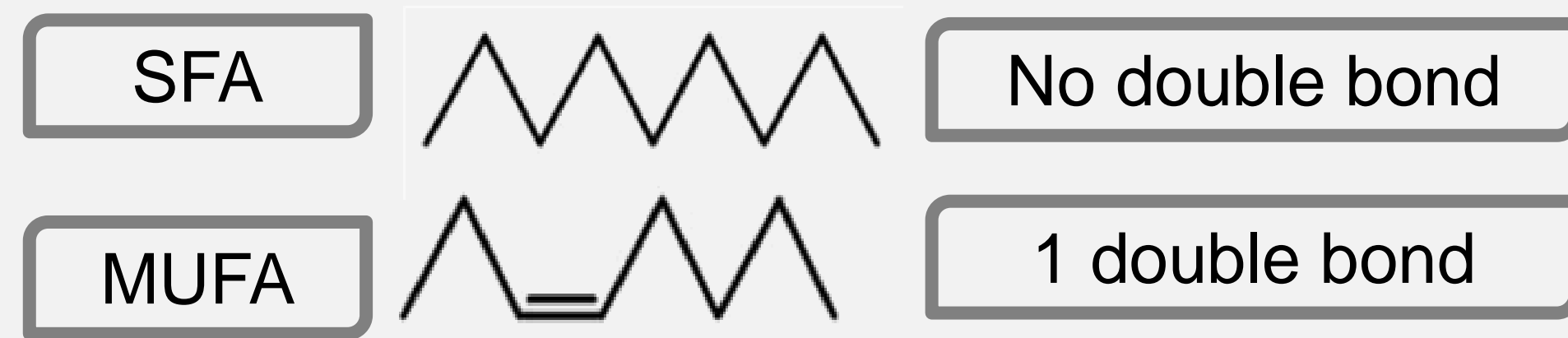
Submitted on 16 May 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

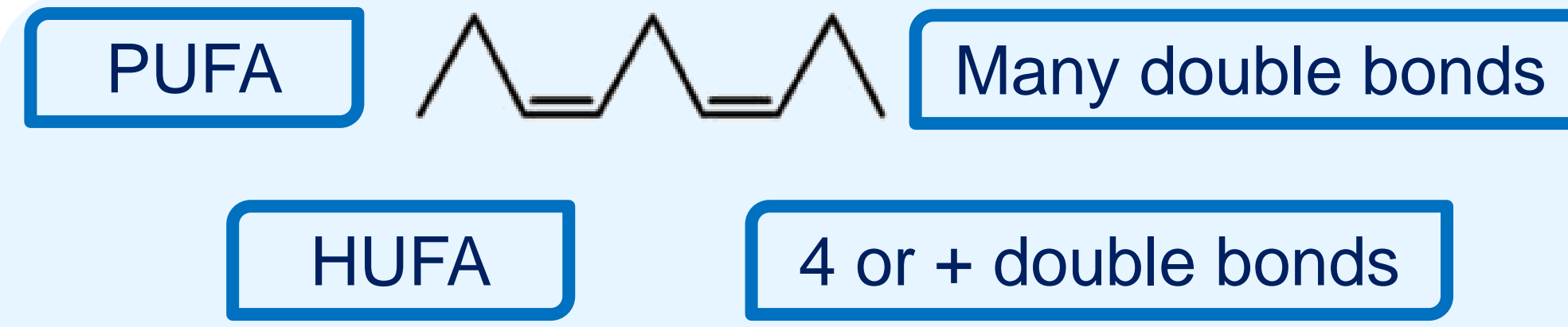
L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Introduction

1. What are fatty acids?



→ Reserve, metabolic energy



→ Structure of biological membranes

2. What are their functions?

1) Analysis of fatty acids often used to study trophic interactions

2) Microalgae with high proportion of HUFA: good source of food for animals: **high nutritional quality** (eicosapentaenoic acid **EPA**, Docosahexaenoic acid **DHA**)

3) Source of energy for metabolism at each trophic level

4) Transferred via herbivorous invertebrates to fish and man

5) Proportions of fatty acids vary with biotic and abiotic factors

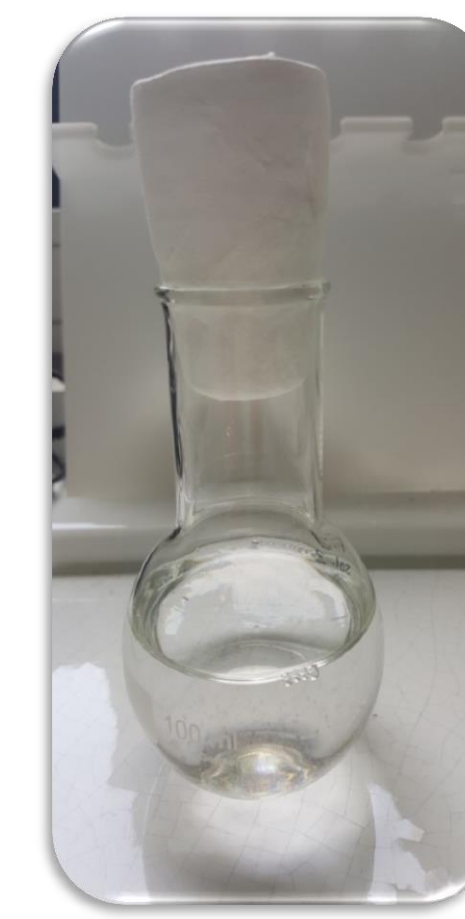
6) Including temperature and pesticide exposure

Hypothesis

❖ The temperature could modulate the response of **fatty acid profiles** to an exposure to **pesticides**

Materials and methods

1. Conditions of exposure



Dauta medium and diatom culture

Gomphonema gracile (GGRA)
Nitzschia palea (NPAL)
Exponential growth - 7 days

3 T° successively =
17.5°C – 20.5°C – 23.5°C
Light = 67 μmol.m⁻².s⁻¹

S-metolachlor / Diuron
C = 10 μg/l

2. Analysis of fatty acids



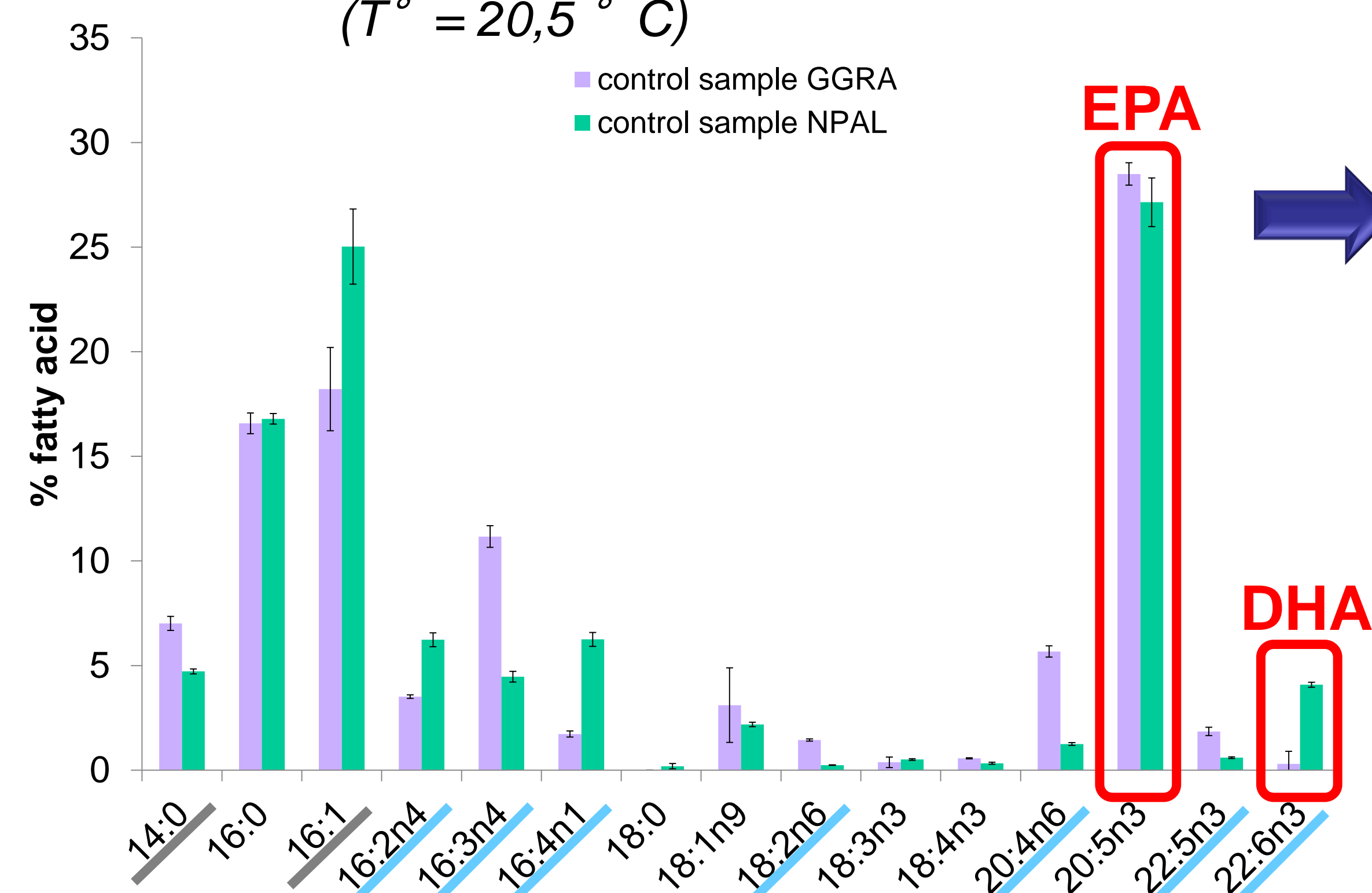
Gas chromatography

- T_{final}
- Transesterification
- Fatty Acid Methyl Ester
- Hexane extraction
- Gas chromatography (GC-FID)
- Percentage of total fatty acids

Results

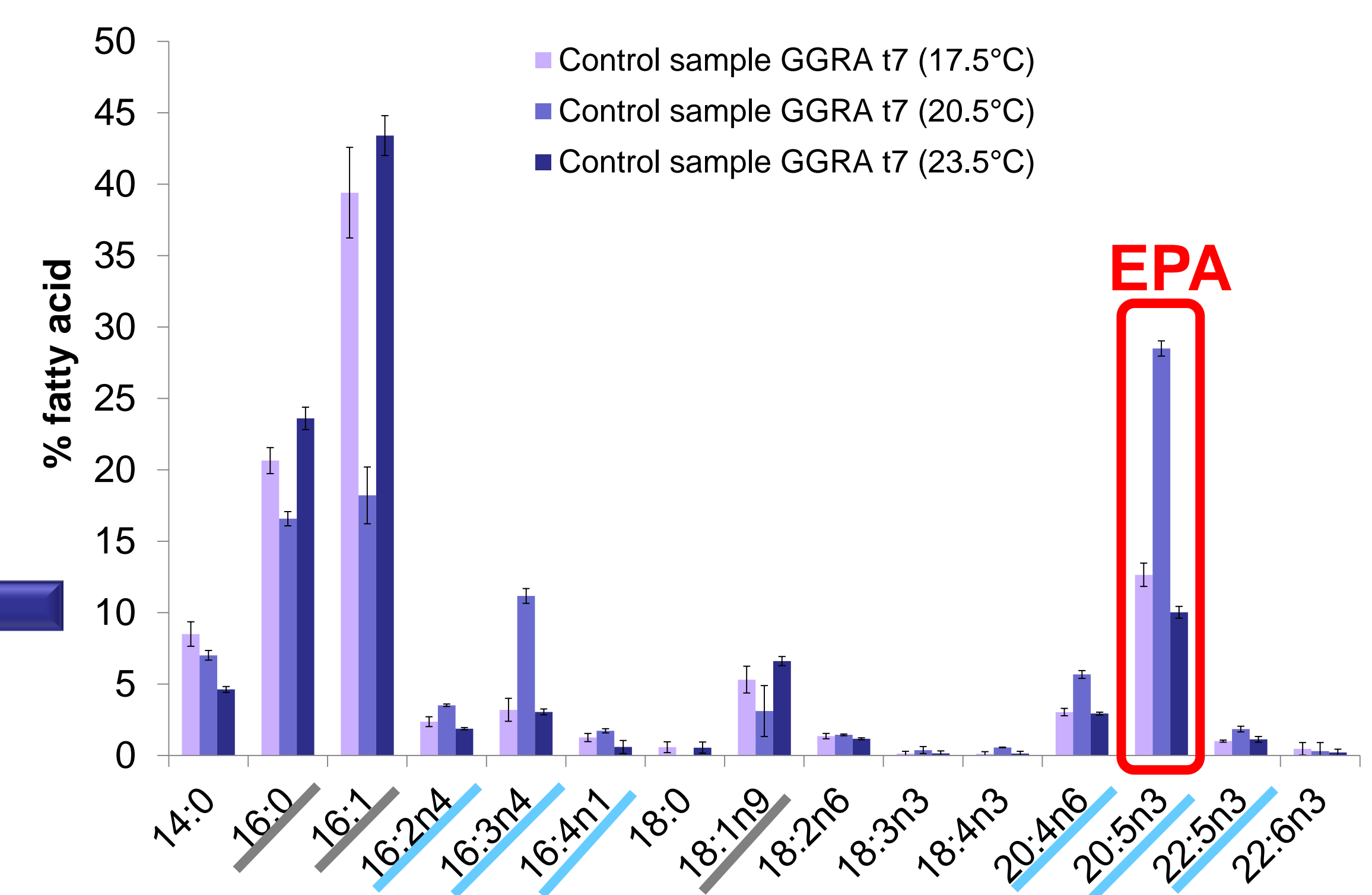
1. Fatty acid profile of GGRA and NPAL

(T° = 20,5 °C)



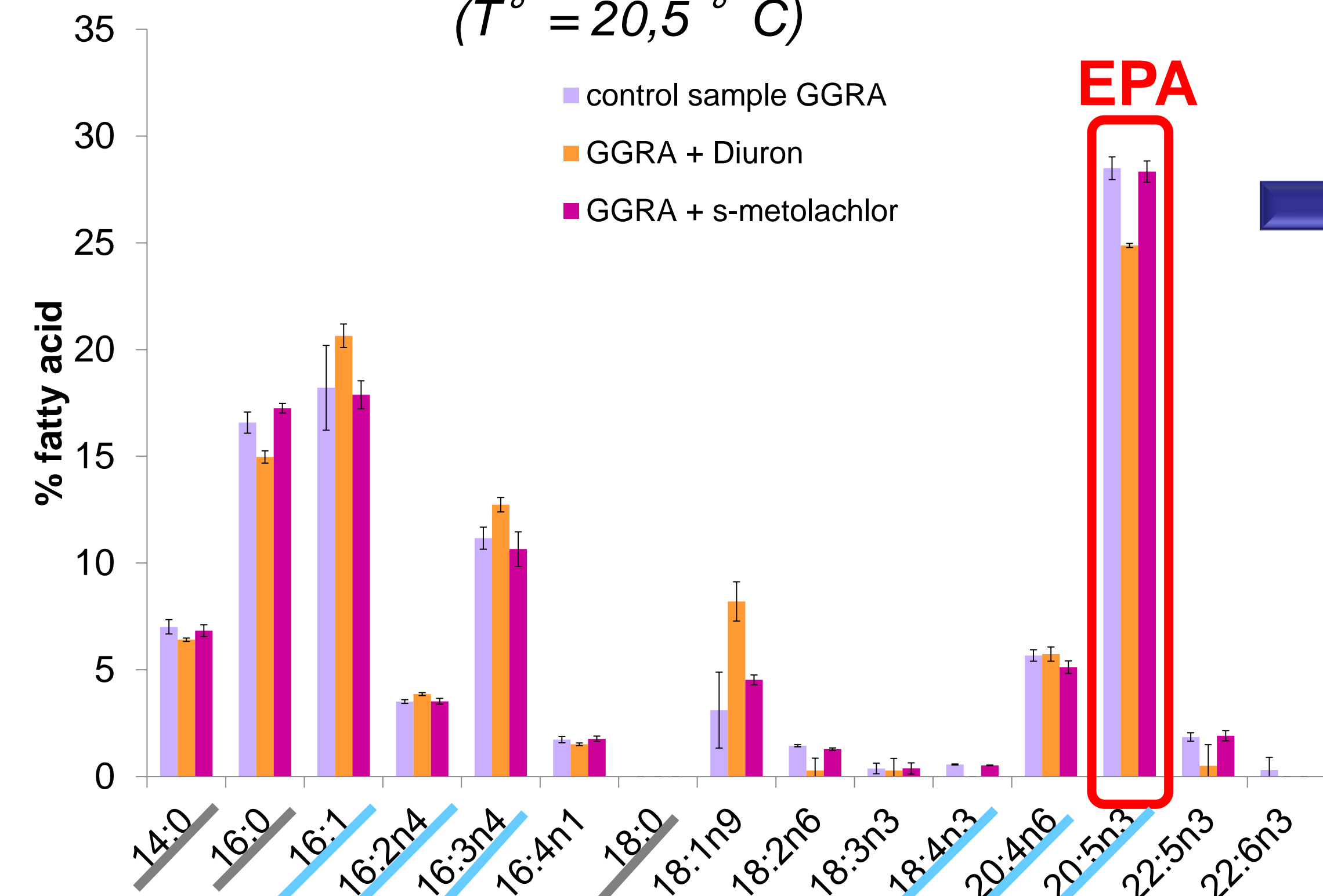
- ✓ Slight difference in **fatty acid of reserve**
- ✓ Slight difference in **fatty acid of membrane structure** (ex: **22:6n3**)
- ✓ Different **nutritional quality** of GGRA and NPAL
- ✓ No difference in **20:5n3**
- ✓ Difference of fatty acid profile **with temperature**
- ✓ 17,5 and 23,5 °C: more **fatty acid of reserve**
- ✓ 20,5 °C: more **fatty acid of membrane structure**
- ✓ **EPA** increase with T°=20,5°C

2. Effect of temperature on GGRA's fatty acid profile



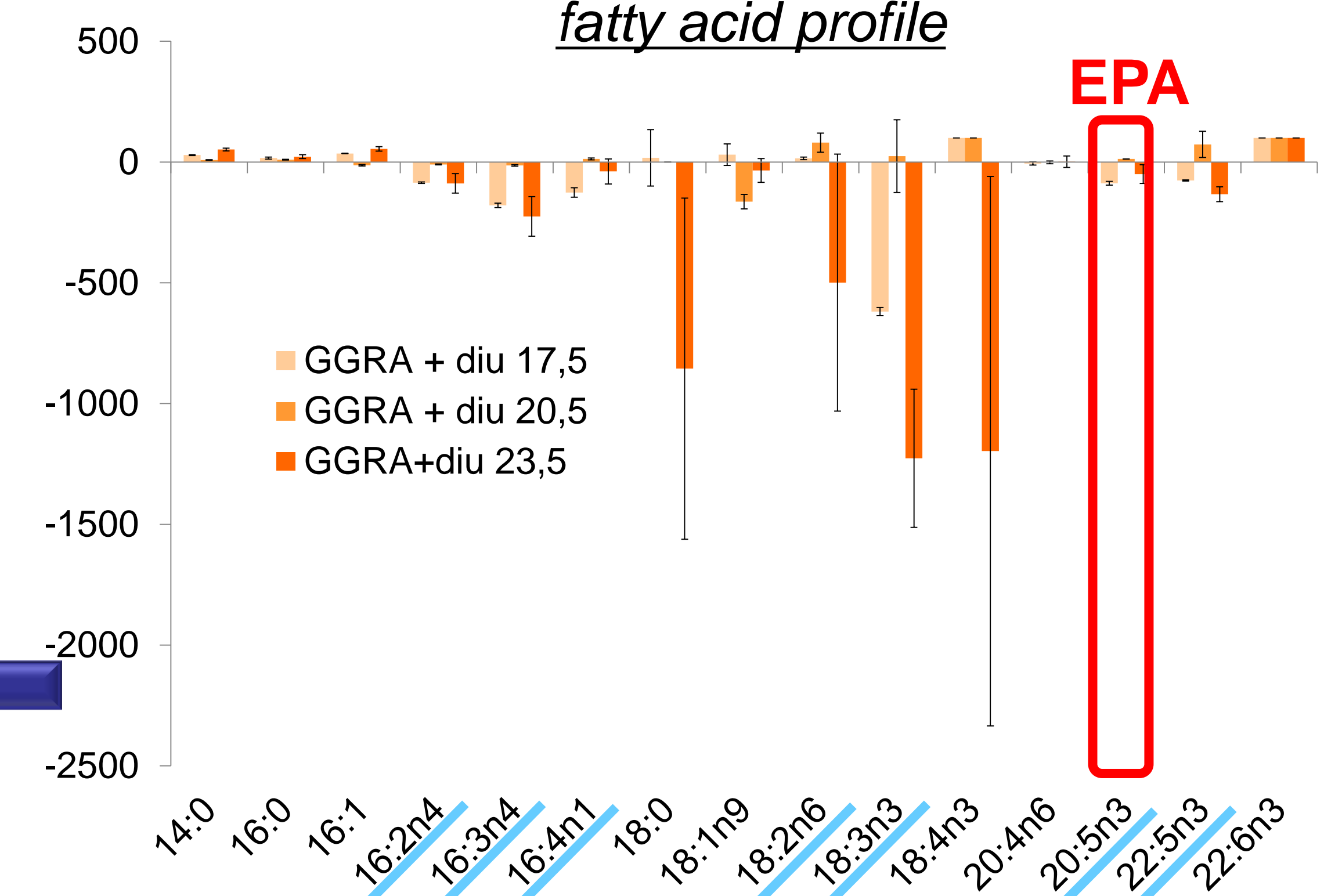
3. Effect of pesticide on GGRA's fatty acid profile

(T° = 20,5 °C)



- ✓ Slight impact of **s-metolachlor** on GGRA: decrease of 20:4n6
- ✓ No impact of **s-met** on **EPA**
- ✓ Impact of **diuron** on GGRA
- ✓ Impact on **fatty acid of reserve**
- ✓ Impact on **fatty acid of membrane structure**
- ✓ Decrease of **EPA** with diuron
- ✓ Difference of diuron impact **with temperature**
- ✓ T°= 17,5°C and 23,5°C: **less inhibition of fatty acid of membrane structure**
- ✓ **EPA** increase with T°=17,5°C and 23,5°C

3. Effect of temperature on diuron impact on GGRA's fatty acid profile



Conclusions

Interspecific variability demonstrated in literature (Aussant et al., 2018)

Variability of fatty acid profile with temperature demonstrated in literature
T° decrease → increase of PUFA (ex: EPA)
T° increase → decrease of PUFA (Li et al., 2014)

T°=20,5°C increase EPA and modify **nutritional quality** of GGRA

T°=20,5°C
S-metolachlor inhibits elongase enzymes (Robert et al. 2007)
Diuron inhibits EPA and modify **nutritional quality** of GGRA

-3°C and +3°C decrease impact of diuron?
Larras et al., 2013 demonstrated that higher temperature decreased pesticide impact on biofilm