# Interspecific and intraspecific differences in the composition of epigastric lipids in *Monochamus Geyer*

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**reporter： Ding jun**

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# 1. Introduction

# 1.1 Introduction

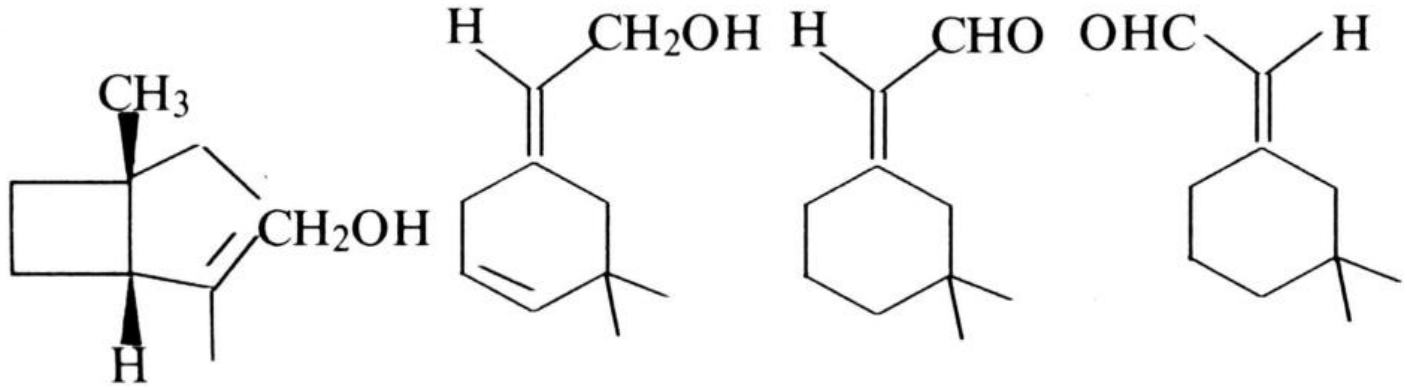
Monochamus galloprovincialis

Monochamus saltuarius

*Monochamus alternatus*

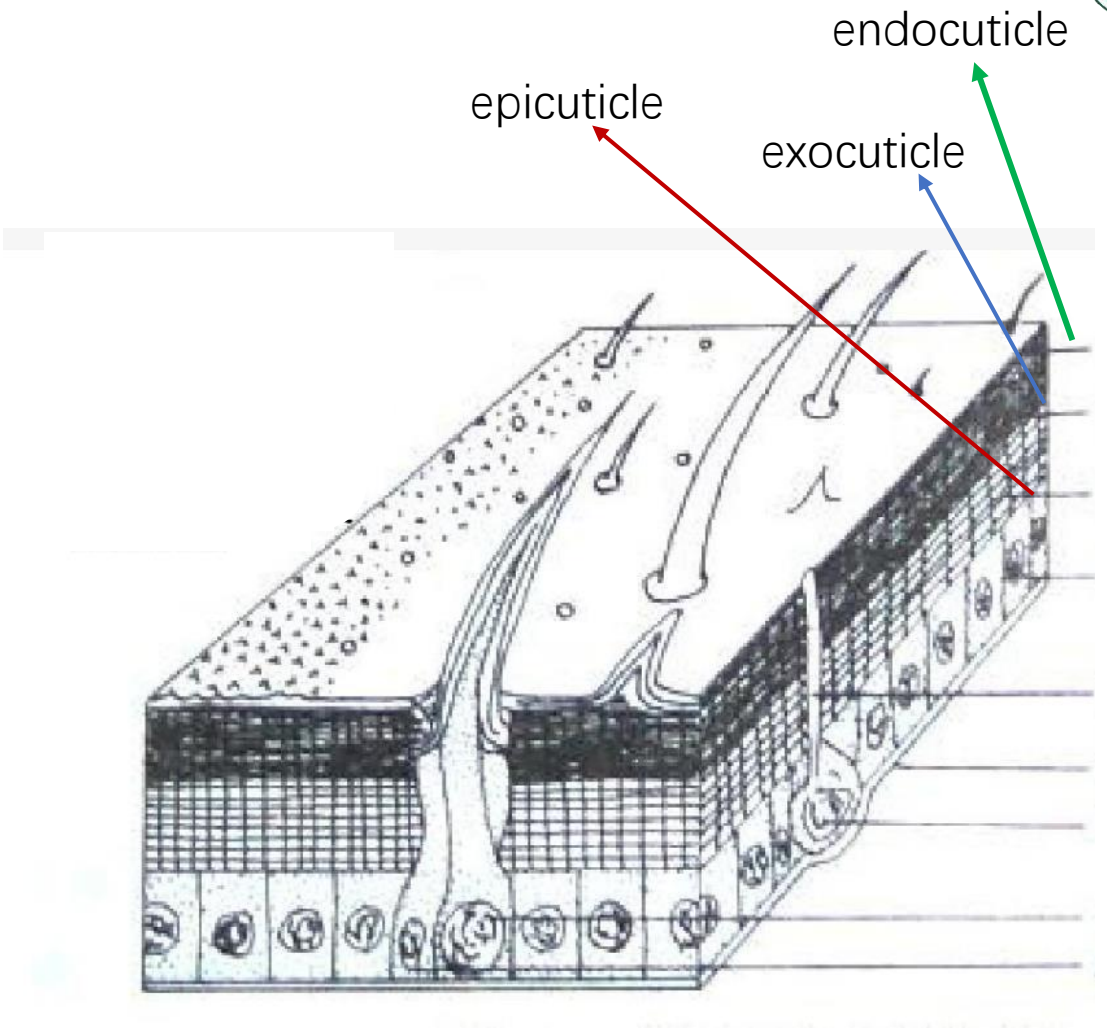
# 1.1 Introduction

- At present, the biological and ecological characteristics, occurrence rules and control methods of the *Monochamus* have been studied deeply at home and abroad.
- Most of the insect pheromones are synthesized by some compounds in the surface sebum, so the study on the composition of the insect surface sebum compounds provides a basis for the subsequent research and development of pheromones, and also provides a reference for the study of other insect sex pheromones.



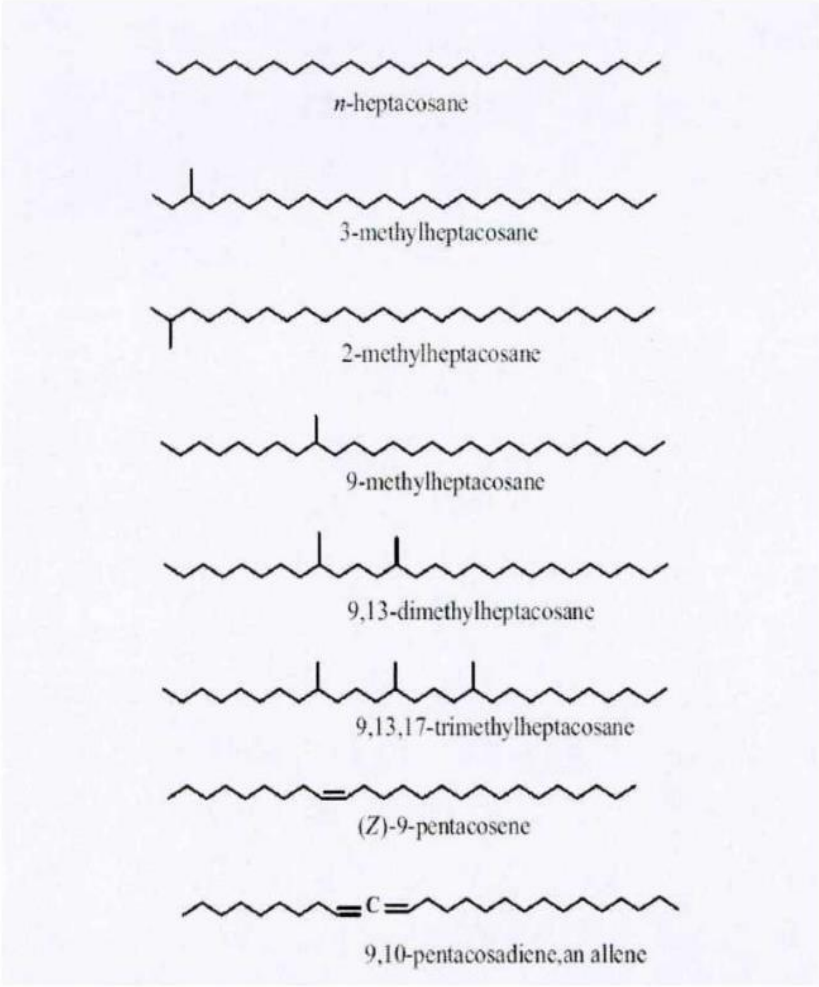
# 1.2 Introduction

Insect surface lipids, also known as body surface wax, refer to long chain compounds with hydrophobic CH2 groups contained in the insoluble upper epidermis of insects. Most of the research on body surface lipids has focused on insects, and most of the research on insect surface hydrocarbons. Body surface lipids play a fundamental role in the growth and development of insects 。



# 1.2 Introduction

The chemical composition of lipid on insect body surface is mainly composed of hydrocarbons, wax esters, fatty acids, fatty alcohols, aldehydes, ketones and other substances. CHC is the most important component of lipid on insect body surface. It exists widely in different tissues and organs of insects, and shows specific distribution pattern in different developmental stages and different genders. There are hundreds of insect CHC activities that have been reported so far. The carbon chain length of saturated branch CH is generally between C11-C43, and most of them have odd carbon chains. The carbon chain length of methyl hydrocarbon is usually C15-C50, and the chain length of monounsaturated CH is C15-C45.




Typical structure of hydrocarbon in insect body surface

# 2. Materials and methods

# 2.1Materials and methods





First, insect traps are arranged in the forest to trap adult insects, and the pestilence wood is cut back in the forest, and it is cut open in the laboratory to find the larvae and feed for subsequent research

The captured insects were separately packed into finger tubes and soaked in pure alcohol. The insects were brought back to the laboratory and placed in a -20° refrigerator for subsequent experiments.

•CHC extraction was extracted using n-hexane and then tested with gc-ms

# 2.1Materials and methods

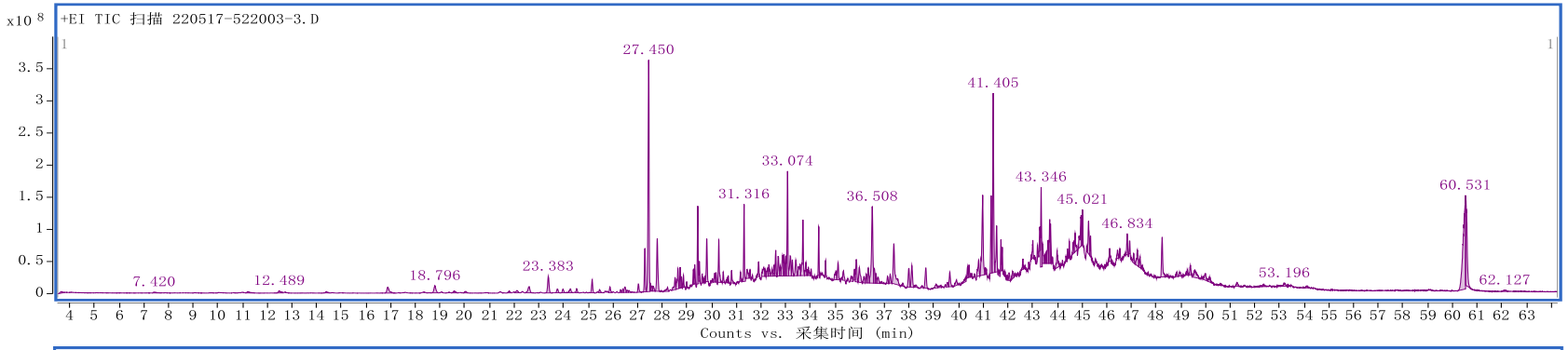
- **Collect sample information**

| species | Place of collection | (E) | (N) | altitude（M) | Host | quantity | 采集人 |
|---|---|---|---|---|---|---|---|
| *Monochamus alternatus* | Jiangxi quannan | 114.38968 | 24.65302 | 329 | *Pinus massoniana* | 50 | DINGJING |
| *Monochamus alternatus* | Jiangxi dexing | 117. 539 | 28.994 | 158 | *Pinus massoniana* | 50 | DINGJING |
| *Monochamus alternatus* | Zhejiang hangzhou | 120.21551 | 30.25308 | 15 | *Pinus massoniana* | 50 | DINGJING |
| *Monochamus alternatus* | Hubei enshi | 109.48655 | 30.30104 | 476 | *Pinus massoniana* | 50 | DINGJING |
| *Monochamus alternatus* | Fujiansaning | 116.41338 | 39.91092 | 266 | *Pinus massoniana* | 50 | DINGJING |
| *Monochamus alternatus* | Sichuan panzhihua | 101.73812 | 26.49841 | 1214 | Pinus yunnanensis | 50 | DINGJING |
| *Monochamus alternatus* | Shanning ningshan | 108.1420211 | 33.34849812 | 1127 | *Pinus tabuliformis/Pinus armandii* | 50 | DINGJING |
| *Monochamus alternatus* | Henan jigongshan | 114°05′43.10″ | 31°48′42.53″ | 671 | *Pinus massoniana* | 50 | DINGJING |
| *Monochamus alternatus* | Shanxi jincheng | 116.41338 | 39.91092 | 1072 | *Pinus bungeana* | 50 | DINGJING |
| *Monochamus alternatus* | Guizhou guiyang | 26.37.13 | 106.55.17 | 1077 | *Pinus taeda* L | 50 | DINGJING |
| *Monochamus alternatus* | Hunan changsha | 113.08093 | 28.24595 | 40 | *Pinus massoniana* | 50 | DINGJING |
| *Monochamus alternatus* | Jiangsu nanjing | 118.8921 | 31.32751 | 10 | *Pinus massoniana/Pinus thunbergii Parl* | 50 | DINGJING |
| *Monochamus alternatus* | Sichuan yibing | 104.43.34 | 28.58.47 | 380 | *Pinus massoniana* | 50 | DINGJING |
| *Monochamus galloprovincialis* | Heilongjiang jiagedaqi | 124.1051 | 50.3201 | 405 | *Pinus sylvestris* var | 10 | DINGJING |
| *Monochamus galloprovincialis* | Orleans, France | 1.90602 | 47.87706 | 115 | *Pinus sylvestris* var | 40 | Gaochenglong |
| Monochamus alternatus | Liang ning | 124°13'3．925" | 41°56'23028" | 174 | *Pinus sylvestris* var | 40 | Houzehai |

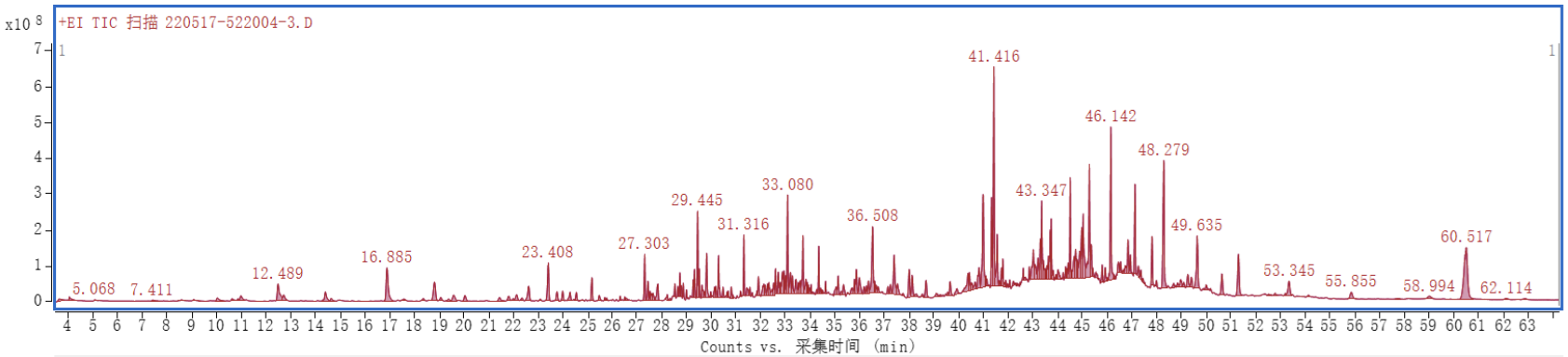
# 3. Results

# 3.1 Results

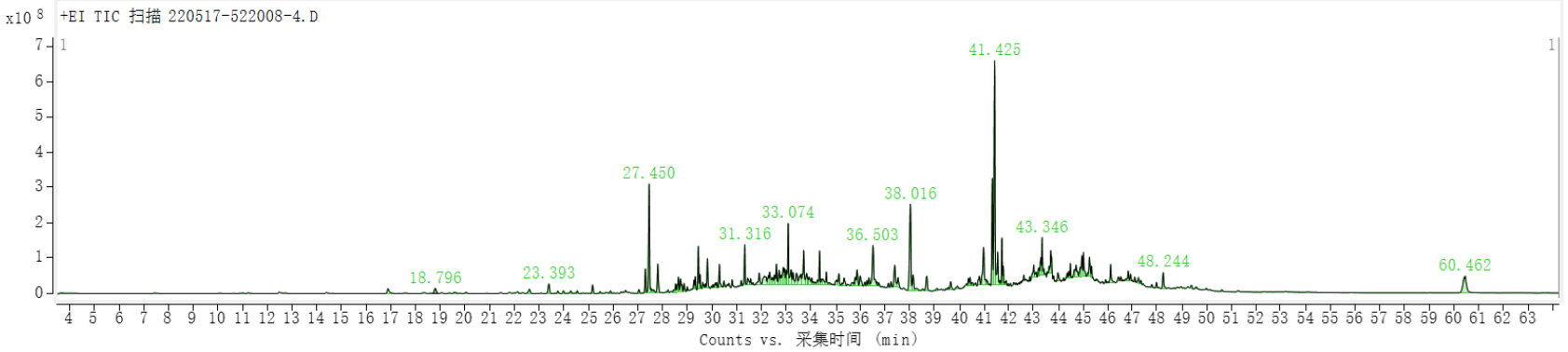
•Study on the composition of three kinds of surface sebum of *Monochamus*




*Monochamus galloprovincialis*



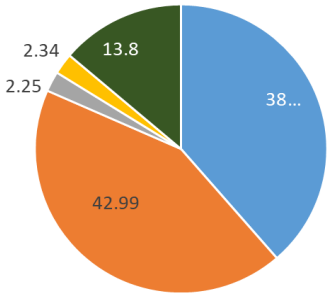

*Monochamus saltuarius*



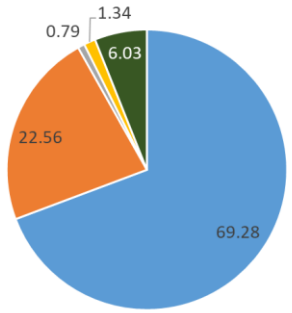

*Monochamus alternatus*

# 3.2 Results

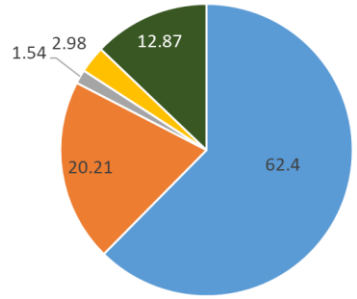
*Monochamus alternatus*




*Monochamus saltuarius*




*Monochamus galloprovincialis*



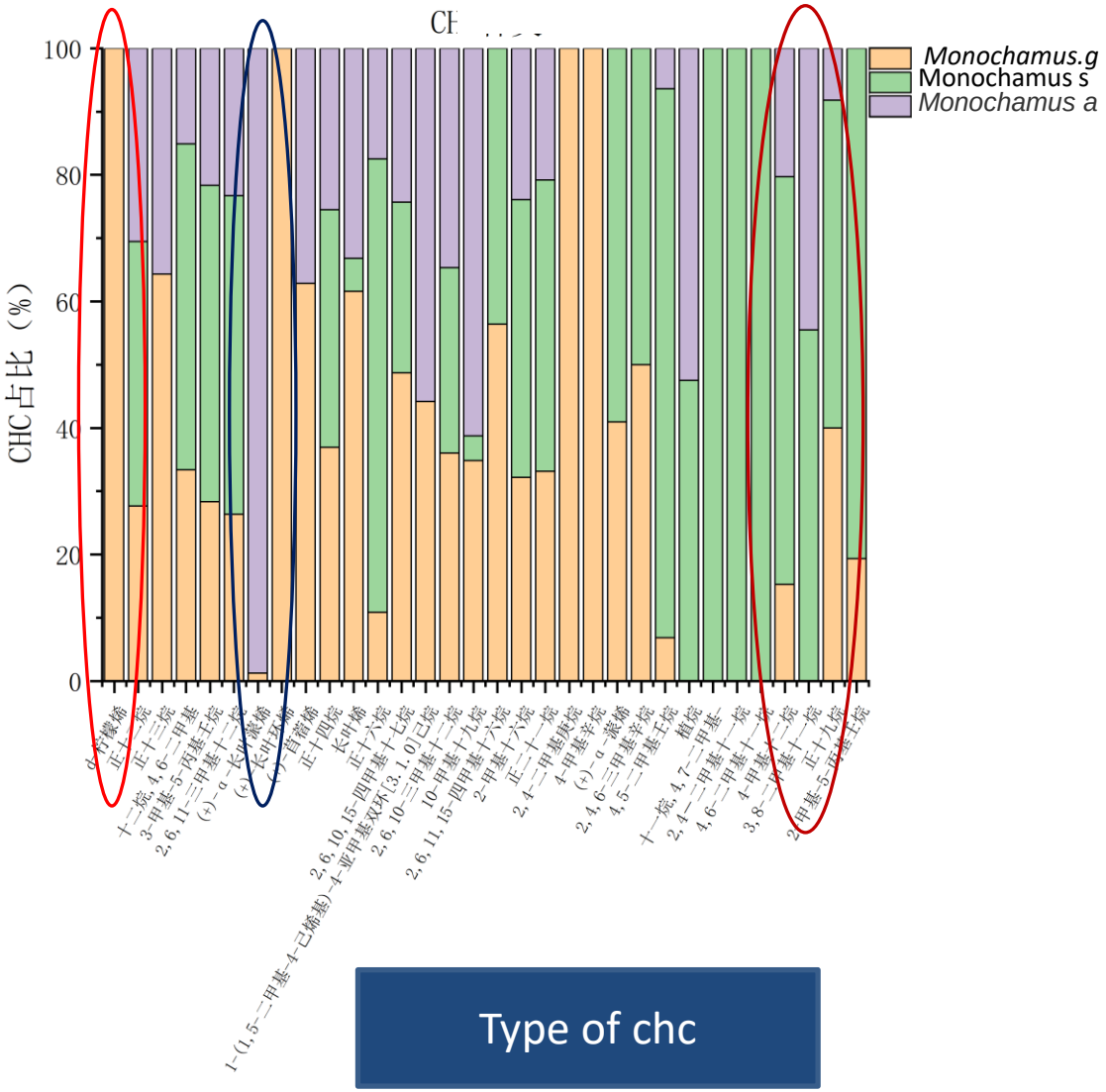

**chc** **ester** **alcohol** **aldehydes** **others**

According to the composition analysis of the mass spectra of the three insects, the main components of the surface sebum of the two species were CHC, which accounted for 69.28% and 62.4% respectively, followed by ester, which accounted for 22.56% and 20.21% respectively, while the main components of the surface sebum of the two species were ester (42.99%). The next was CHC (38%). In some geographical populations, CHC was the main component, followed by ester, and the rest were some alcohols and aldehydes, accounting for a very small proportion. The reasons for this difference may be host difference and geographical distribution.

# 3.3 Results

- Differential analysis of CHC components in three Monochamus

According to CHC difference analysis, the three *Monochamus* species contain 31 CHC compounds in total, including 6 n-dodecane, n-trisecane, n-teteecane, n-hexadecane, n-octane, 4-methylheptane and 4-methyloctane, among which 2, 4-dimethylheptane and 4-methyloctane are unique specific compounds of Longicorn. Undecane,4, 7-dimethyl -, 4, 6-dimethylundecane, 4,6 dimethylundecane is a specific compound unique to Picea SPP. Among Longhorned beetles, (+) -α-pinene was the most abundant specific compound. The main host species of pinenes may be pine, and pinenes are volatiles of pine

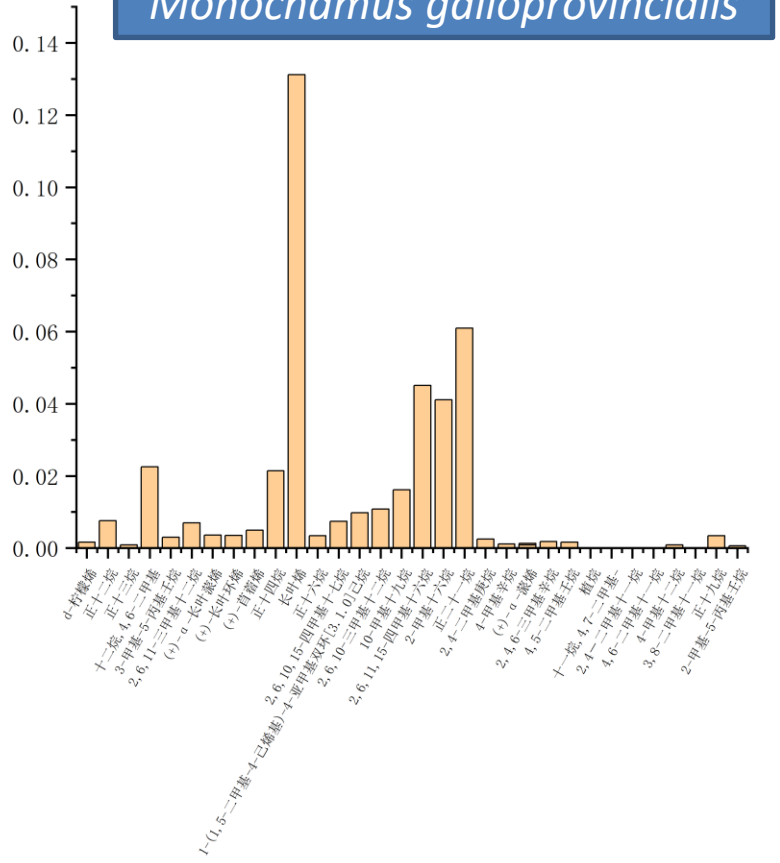



Type of chc

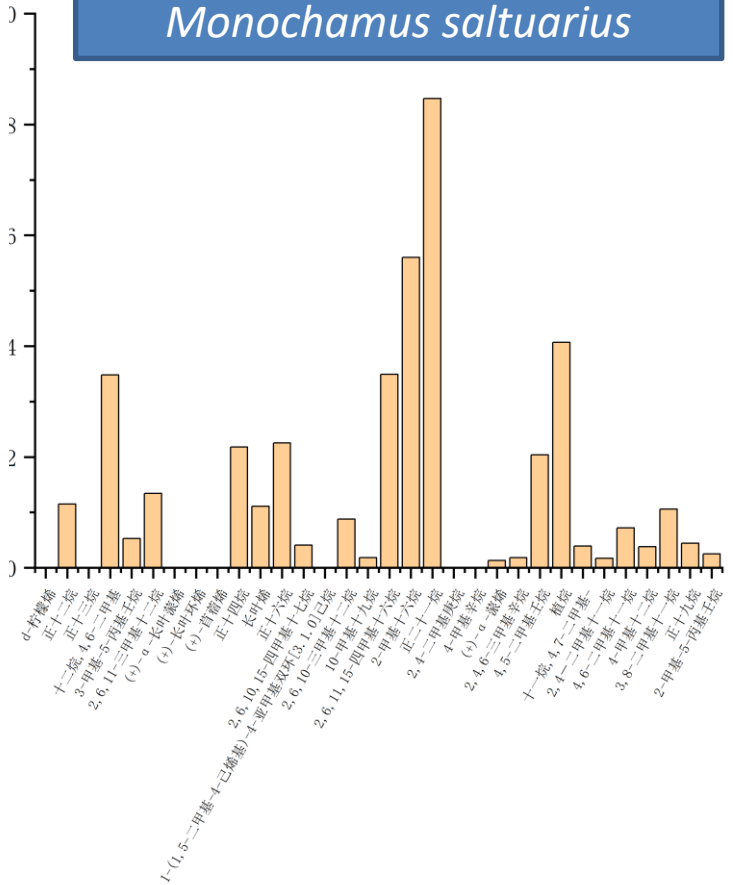
# 3.4 Results

## Analysis of CHC content difference among three insects

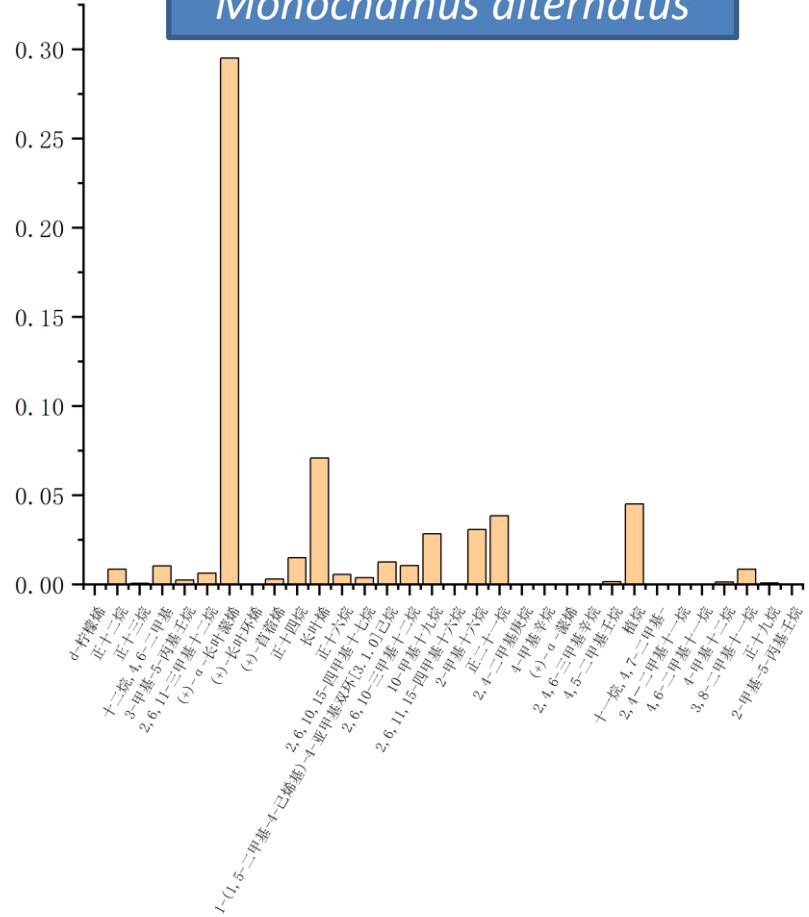
*Monochamus galloprovincialis*




*Monochamus saltuarius*



*Monochamus alternatus*



# 3.4 Results

## Analysis of CHC content difference among three insects

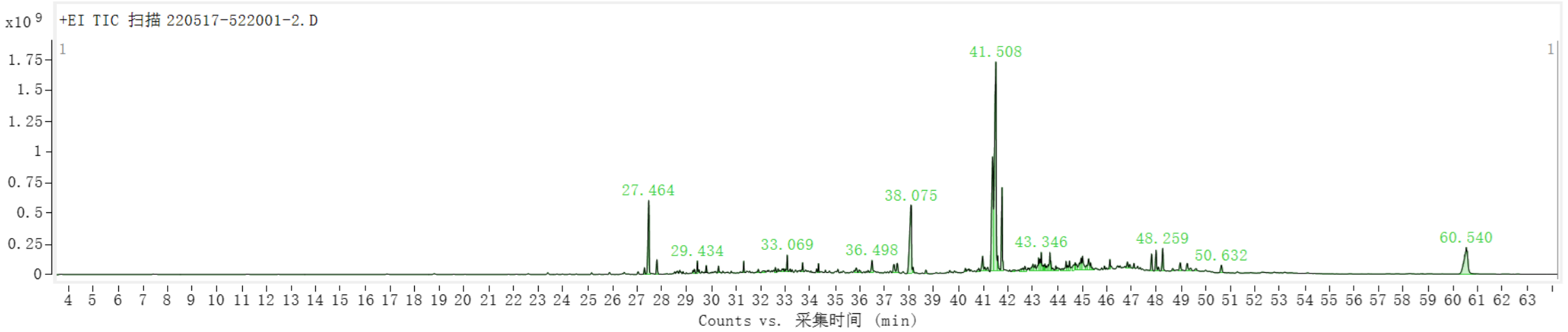
✓ There are 32 kinds of surface sebum components in *Monochamus galloprovincialis*, among which the highest content of CHC is long leaf olefin (13.12%), followed by n-xanthane (6.09%), 2,6,11, 15-tetramethylhexadecane (4.51%), 2-methylhexadecane (4.11%), n-tetradecane (2.14%). Dodecane,4, 6-dimethyl (2.25%), the number of carbon atoms increases from C10 to C20. The more carbon atoms, the greater the intermolecular force, the higher the melting boiling point, and the adaptability of insects to ambient temperature will increase.

✓ Among the three kinds of *Monochamus*, *Monochamus saltuarius* has the highest content of compounds, including 46 kinds of surface lipid components, among which n-xanthane (8.47%) has the highest content, followed by 2-methylcetane (5.60%), phytane (4.07%) and other CHC components, and the number of carbon atoms is also between C10-C20. There are also other esters of C27 and C47.

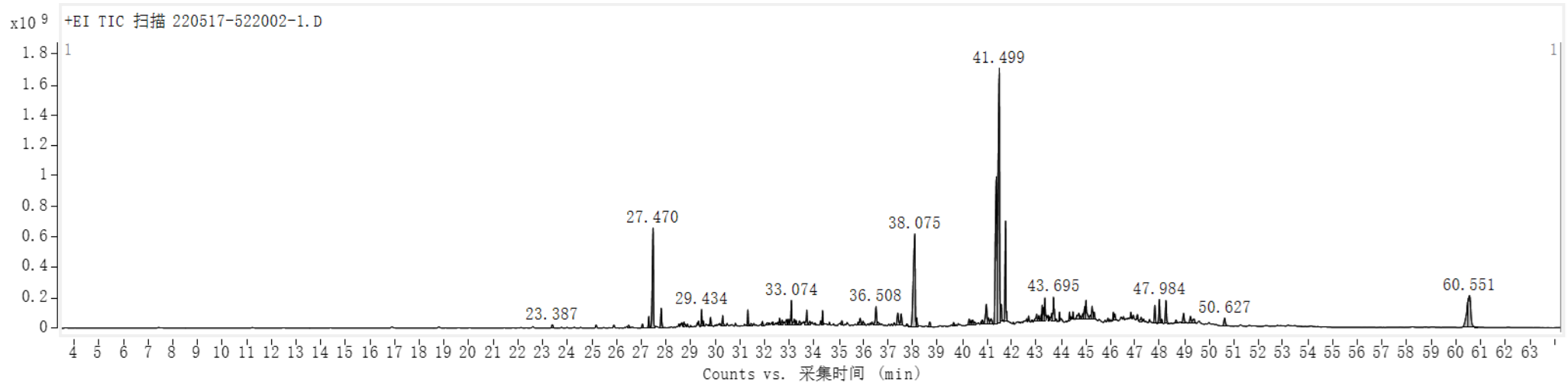
✓ Among the three, there were 21 kinds of **hydrocarbon** components, among which (+) -α-pinene was the most abundant (16%), followed by longleaf olefin (7.08%) and phytane (4.50%).

# 3.4 Results

## Intraspecious differences: Female differences in *Monochamus alternatus*



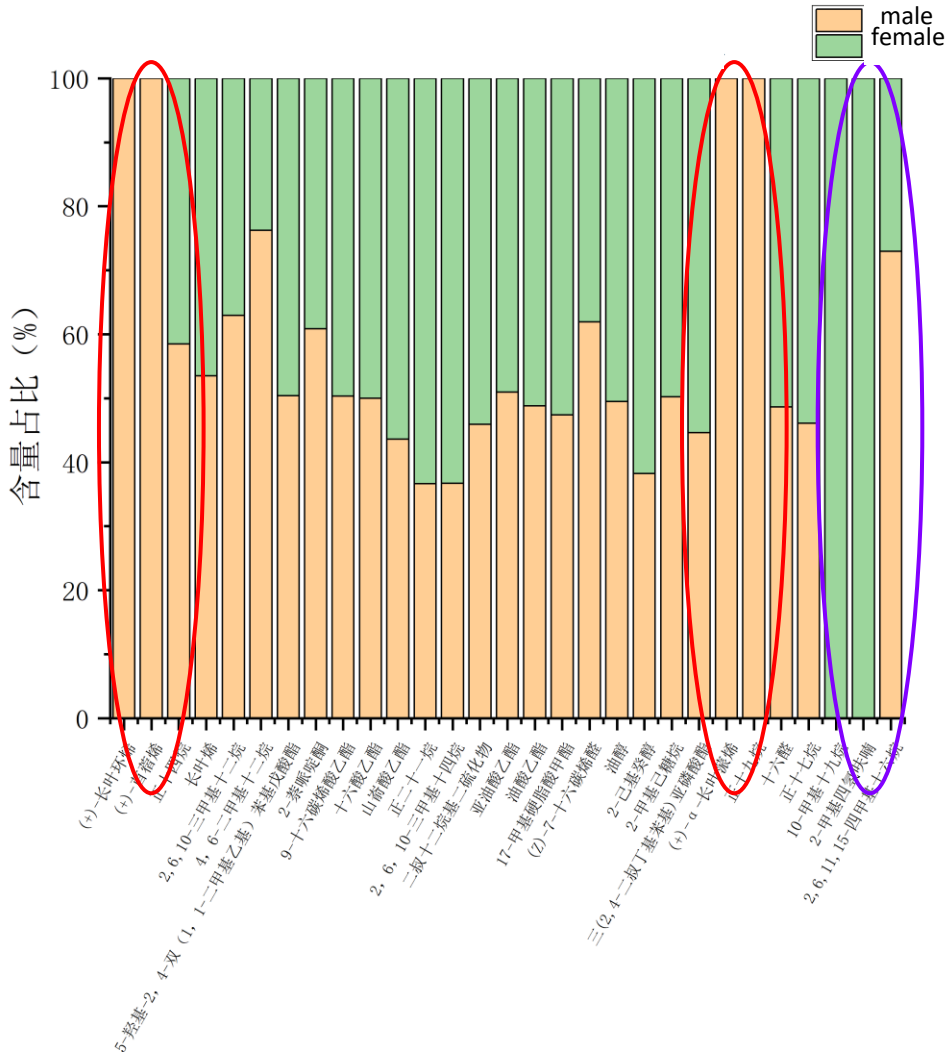

female




male

# 3.4 Results

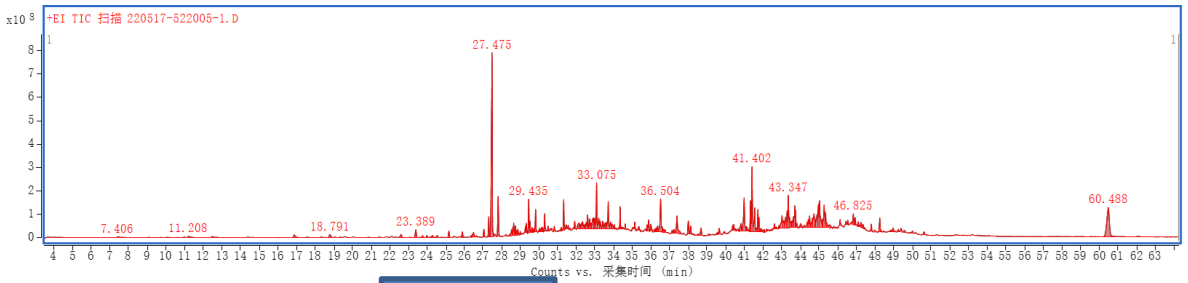
•Intraspecious differences: Female differences in *Monochamus alternatus*



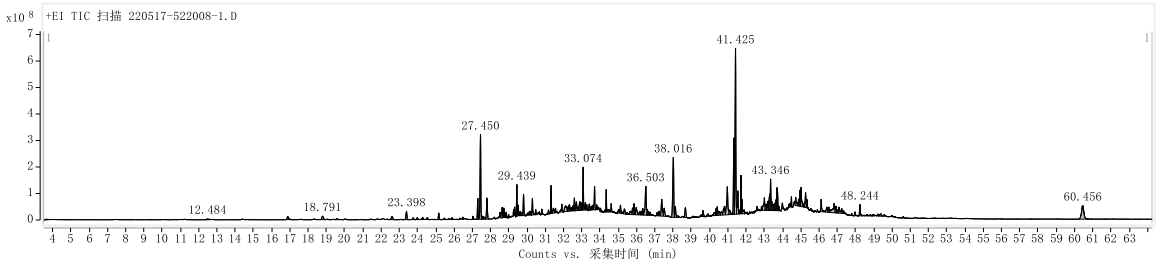

It was found that 1 was specific in both content and composition. The male contained four specific compounds, namely (+) -longylcycloene, (+) -alfalfa, (+) -α-pinene and n-19, while the female contained two specific compounds, 10-methyl-19 and dimethyl-tetrahydrofuran, which were speculated to be sex pheromones. Subsequent confirmatory experiments will be carried out.

# 3.4 Results

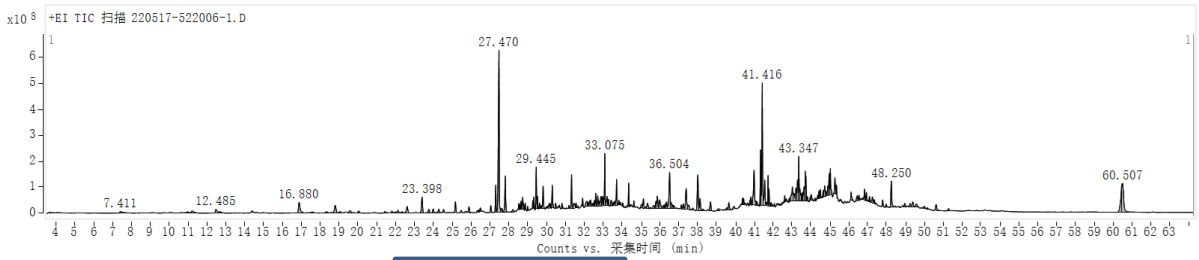
•Analysis of CHC difference among different geographic populations of *Monochamus alternatus*



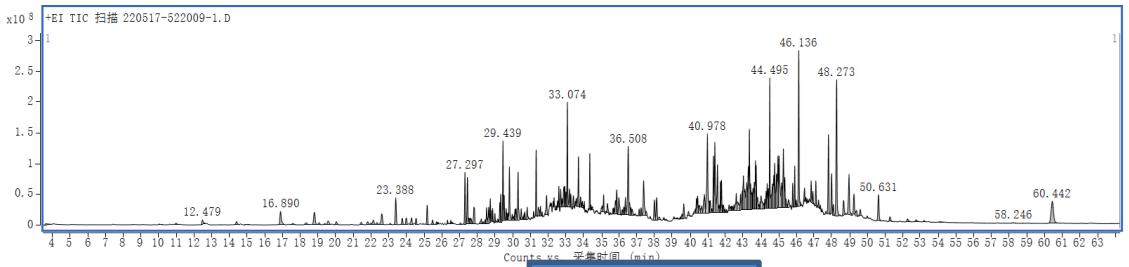

Fujian



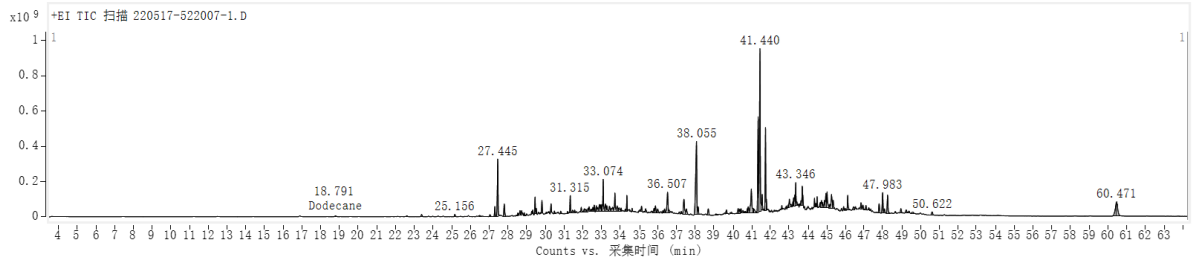

JiangxiDexing



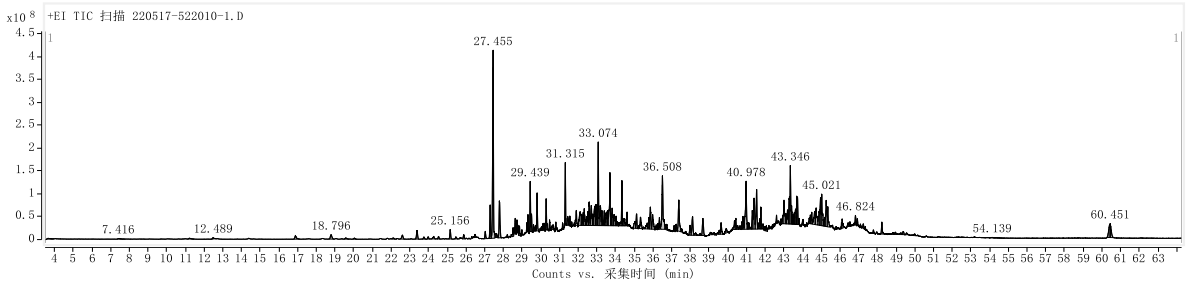

Zhejiang




Sichuan



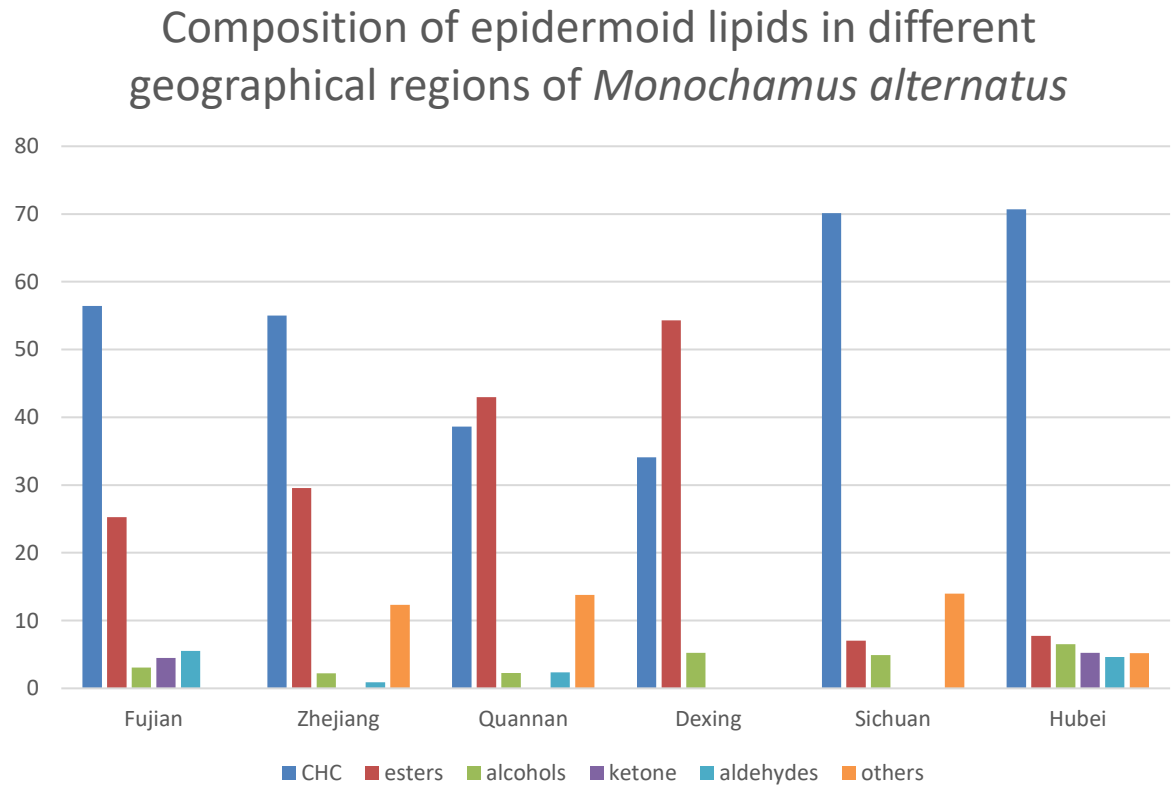

JiangxuiQuannan




Hubei

# 3.4 Results

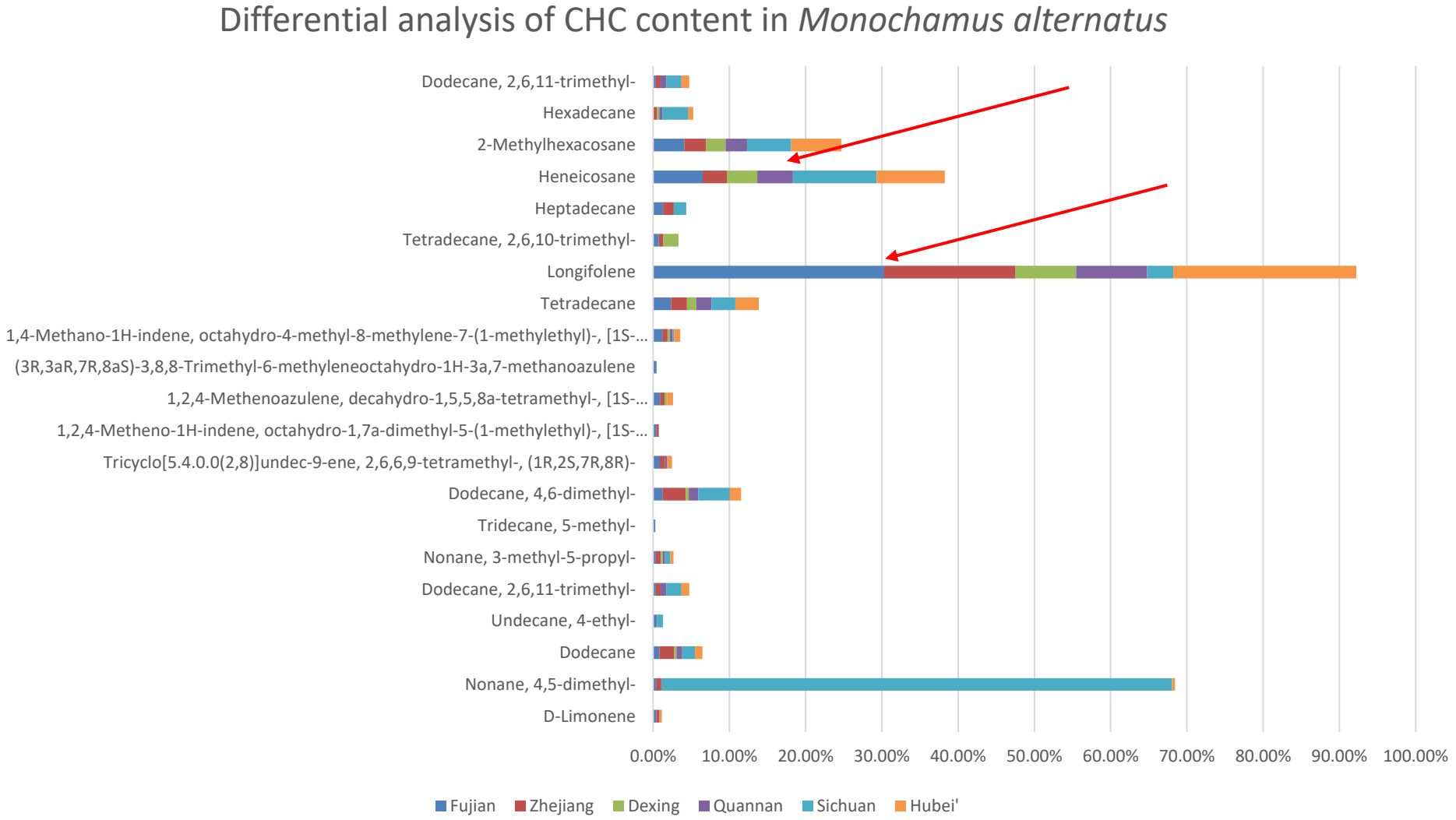
•Composition of epidermoid lipids in different geographical regions of *Monochamus alternatus*




The analysis of the components of the mass spectrum showed that CHC was the main component of the sebum, followed by ester alcohols, aldehydes and some other components that were not detected. In terms of different geographical regions, the proportion of ester was higher than that of CHC in the two regions of Jiangxi Province, which may be caused by the geographical difference and the difference of feeding.

# 3.4 Results

•Differential analysis of CHC content in *Monochamus alternatus*



# 4. Discussion

# 4.1 Discussion

- In this study, the surface sebum composition of three Longhora species was analyzed, and it was found that there were significant differences in the composition and content of the surface sebum between the three longhora species. Each Longhora species had individual specific compounds, which also had significant differences in the content, and these specific compounds could be used to distinguish the species between the two species
- During the difference analysis between the male and female of Longophora songmo species, it was found that there were also specific compounds, with 4 kinds of males and 2 kinds of females, and their contents were also different. It is preliminarily inferred that they may be insect sex pheromones or some other contact pheromones produced during mating, and verification experiments will be conducted after adult emergence.
- In the study of longhorned beetles of the same species and different geographical areas, it was found that with the rise of geographical latitude, the carbon chain length of insect epidermis also increased in this way, from C20 to C40 in turn. It was inferred that the carbon chain length was related to the thermal insulation and water retention function of insect epidermis, which needed to be further studied


# THANKS