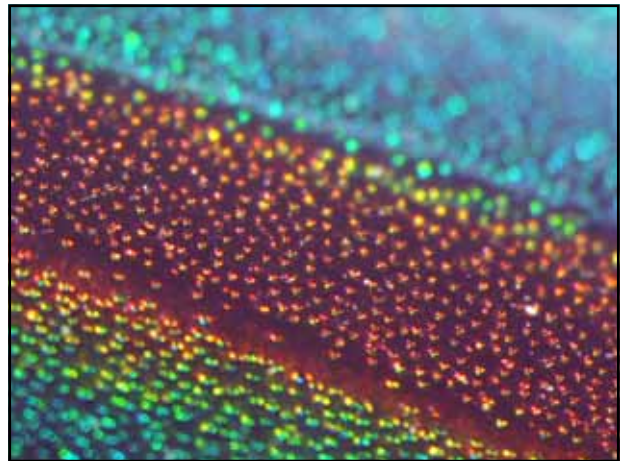


Structural Color of Coleoptera

Terai Mina

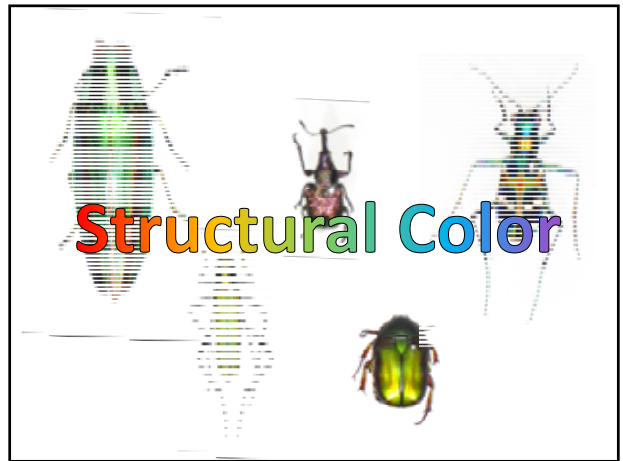


Tamamushi no zushi



<http://plaza.rakuten.co.jp/takacyan/diary/201110050000/>

Structural Color



Purpose

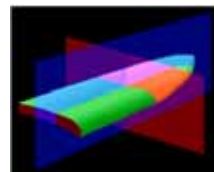
To research the mechanics of coleopteran structural color

To find out the mechanics of creating the markings on wings (difference in color) and occurring color variations

Observation of surfaces and sections with digital microscope

- Observing the wing surface structure.
- Embedding samples in paraffin and observing the section.

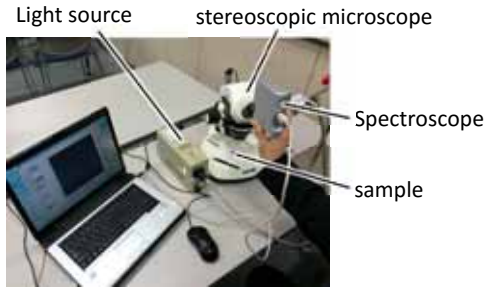
* Cutting wings vertically(,)



* Cutting angled wings()



The measurement of spectrum



Circularly polarized light reflection

- Sugarcane white grub
- Soy bean beetle
- *Kyotoaohanamuguri*

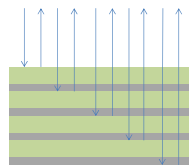


Multilayer film interference

- Jewel beetle
- drone beetle

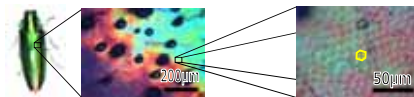


Multilayer film interference



It is the effect when wavelength reflected by each film layer interfere with each other.

Jewel beetle (*Chrysochroa fulgidissima*)



[Observation of multilayer film structure by observing sections]



Jewel beetle (*Chrysochroa fulgidissima*)

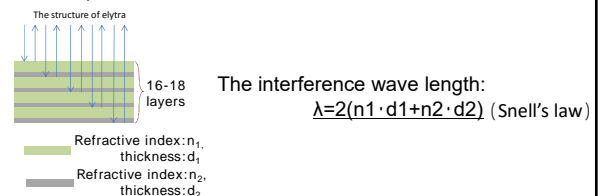


Our conclusion:

Layers of the red part are thicker than the green part.

Jewel beetle (*Chrysochroa fulgidissima*)

[Study of color difference]



The differences of colors depend on the thickness of the layers.

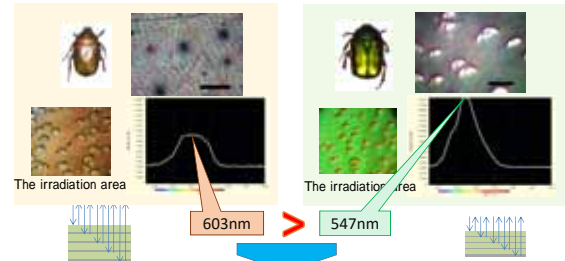
Jewel beetle (*Chrysochroa fulgidissima*)



Our conclusion:

Layers of the red part are thicker than the green part.

the color variations in drone beetles (*Pseudotorynorhina japonica*)



The coating layers of the brown one are thicker than that of the green one.

Retracement



References

- “シリーズ生命機能 生物ナノフォトニクス 構造色入門” (Shuichi kinoshita, asakura-shoten, 2010)
- “構造色研究会” web site (<http://mph.fbs.osaka-u.ac.jp/~ssc/>)

Researched with

Kanzaki Shihoko, Kim Yongi, Fujiwara Shintaro, Yabe Kiyotaka, Yamakawa Kazunari

Quiz 1

What is the name of the miniature shrine made with Jewel Beetle?

1. Tamamushi no mushi (玉虫之虫)
2. Tamamushi no zushi (玉虫厨子)
3. Tamamushi no bushi (玉虫武士)
4. Tamamushi no sushi (玉虫寿司)



Quiz 2

What does the Jewel Beetle's color difference depends on?

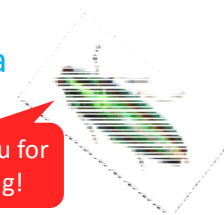
1. Thickness of the coating layers
2. Temperature
3. The number of layers
4. Its feeling



Structural Color of Coleoptera

Terai Mina

Thank you for listening!



Circularly polarized light reflection

→ Structure of elytra which reflect circularly polarized light



Counterclockwise helix

The filter : circularly polarizing plate



Circularly polarized light reflection

→ Sugarcane white grub

• Soy bean beetle

• *Kyotoaohanamuguri*



Multilayer film interference

• Jewel beetle

• drone beetle



Sugarcane white grub (*Anomala albopilosa*)

Sugarcane white grub



Seen as green

Seen as black

Jewel beetle



Seen as usual

It reflects only circularly polarized light! It doesn't reflect it!

Circularly polarized light reflection

• Sugarcane white grub

→ Soy bean beetle

• *Kyotoaohanamuguri*



Multilayer film interference

• Jewel beetle

• drone beetle



Color variations in Soy bean beetle (*Anomala rufocuprea* Motschulsky)



the structure on the surface

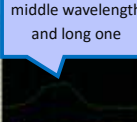
[4 color types]



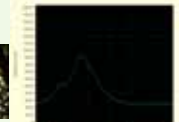
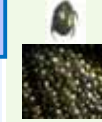
• Deep blue



Peak between the middle wavelength and long one



• Green type



The irradiation area

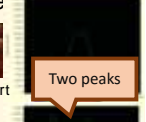
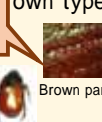
• Red type



This part doesn't reflect circularly polarized light



• Brown type



Two peaks

Color variations in Soy bean beetle (*Anomala rufocuprea* Motschulsky)

⇒ There is need to futher scrutinize about the data based on the following.

Considerations:

1. In addition to the structural color, there might be **some effects of pigment**.
2. There is a possibility that **spiral pitch isn't uniform** in an individual.
3. How does the color reflected by circularly polarized light change according to the difference in **the incidence angles**?

Circularly polarized light reflection

- Sugarcane white grub



- Soy bean beetle



- ⇒ • *Kyotoaohanamuguri*



Multilayer film interference

- Jewel beetle



- drone beetle



Kyotoaohanamuguri(*Protaetia lenzi*)



- Shaving the surface of the male wing, the same polish as the female appears.
- Both of male and female have the same peak of spectrum.


 The male wing is covered with something.