

# 琉球大学学術リポジトリ

ヤマトシジミ *Zizeeria maha*  
における内部被曝の影響と *Zizeeria* および *Zizina* (鱗翅目: シジミチョウ科) の比較形態分析

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## Summary

Effects of internal irradiation in the pale grass blue butterfly *Zizeeria maha* and comparative morphological analysis of the grass blue butterflies *Zizeeria* and *Zizina* (Lepidoptera: Lycaenidae)

(ヤマトシジミ *Zizeeria maha* における内部被曝の影響と *Zizeeria* および *Zizina* (鱗翅目: シジミチョウ科) の比較形態分析)

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### Introduction:

Butterflies are sensitive to climate change. Their size, distribution and even color pattern could reflect the change in environmental conditions. Researchers adopt these features to use butterflies as environmental indicators. The Japanese pale grass blue butterfly *Zizeeria maha* is one of such butterflies which have been extensively used as environmental indicator. In recent studies this butterfly has shown morphological abnormality and increased mortality due to the biological effects of radioactive materials (especially Cs-137) released from the collapsed Fukushima Nuclear Power Plant (FNPP). Researchers found Cs-137 radioactivity as the main cause of such morphological abnormalities and high mortality rate. However, toxicity of non-radioactive cesium as a possible cause of death was not evaluated.

The present study assessed the possibility of cesium's chemical activity as the potential factor for morphological abnormality and high mortality in *Z. maha*. Additionally, radioactive Cs-137 was also employed to perform internal exposure study under laboratory conditions. Third instar larvae were fed at low as well as very high concentrations (0.1Bq~10KBq/200mg) of radioactive cesium. For both of the studies an artificial diet (AFSI-112) was formulated and used successfully. This species of butterfly is a multivoltine species with life cycle of about a month. They are widely distributed in Japan except Hokkaido and are available almost throughout the year, especially at Ryukyu Islands chain. With a wingspan of about 30 mm and weak flight ability, they make a perfect species to be reared in a 300 mm<sup>3</sup> rearing cage under laboratory conditions.

### Results and Discussion:

Chemical cesium ingestion in *Z. maha* larvae were neither highly toxic nor caused any morphological deformities in adults, thus ruling out its chemical toxicity as a possible cause. The lethal dose fifty (LD<sub>50</sub>) for Cesium chloride (CsCl) in *Z. maha* is now estimated to be more

than the case of rat (2500 mg/kg). Moreover, under laboratory conditions, *Z. maha* were found to be equally tolerant to radioactive Cs-137. Survivable rate in laboratory conditions were higher as compared to the survival rate in field conditions of previous reports on biological effects of radioactive cesium. This finding rules out Cs-137 as the sole cause for dramatic biological effects around nuclear disaster affected areas.

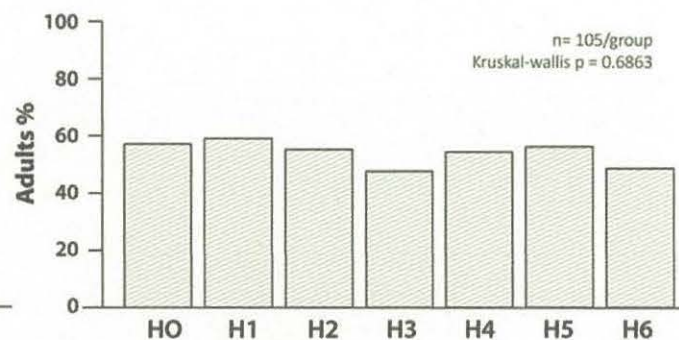
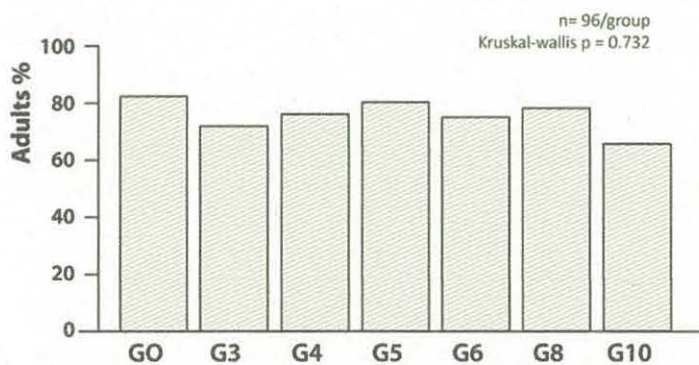


Fig 1: Survival rate of CsCl fed *Z.maha* in artificial diet. Control G0 is ddH<sub>2</sub>O.

Fig 2: Survival rate of radioactive Cs-137 fed *Z.maha* in artificial diet. Control H0 is ddH<sub>2</sub>O.

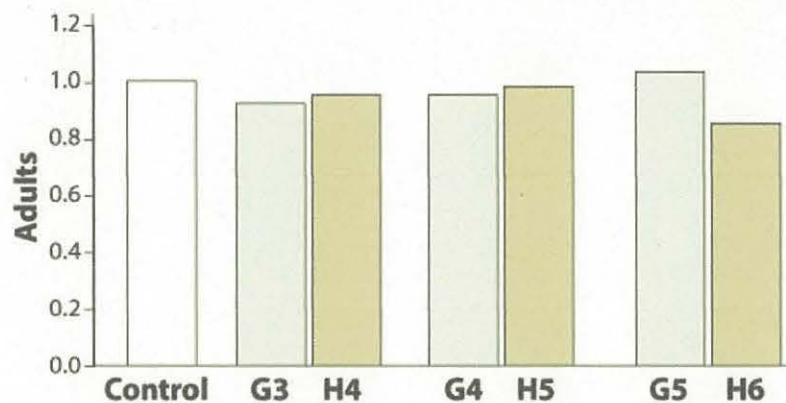


Fig 3: Comparison of survival rate of CsCl fed group (G3, G4, G5) and radioactive C-137 fed group (H4, H5, H6) after normalization of value with control (ddH<sub>2</sub>O). Concentration of cesium in each combinations are equal to each other i.e. Cs in G3=H4, G4=H5 and G5=H6.

### Conclusion:

From the data it could be concluded that CsCl at the present concentration is not toxic enough to kill the *Z.maha* larvae nor it causes any morphological abnormalities in its adult stages. Similarly in laboratory conditions, *Z. maha* larvae are highly tolerant to radioactive Cs-137. This also suggests that radioactivity alone is not responsible for such high mortality and morphological abnormality.

Such direct comparative experiments would definitely be helpful in understanding and pin-pointing the exact cause and impacts of radioactive pollution on environment and its inhabitants.