氏名	石川　浩章
学位の種類	博士（農　学）
学位記番号	甲　第　８１　号
学位授与の日付	平成３１年３月２０日
学位授与の要件	信州大学学位規程第５条第１項該当
学位論文題目	The mass production of wild silk from Japanese oak silkmoth (*Antheraea yamamai*) cocoons （ヤママユの繭から得られる天蚕糸の増産に関する研究）
論文審査委員	主査　教　授　玉田　靖 教　授　梶浦　善太 准教授　塩見　邦博 准教授　白井　孝治 准教授　横山　岳　（東京農工大学） 教　授　孟　艶　（安徽農業大学）

論　文　内　容　の　要　旨

Silk produced by the Japanese oak silkmoth *Antheraea yamamai* is one of the most valuable and expensive types of silk due to its unique color, which is not present in the domestic silkmoth *Bombyx mori*. However, *A. yamamai* has low silk productivity and is associated with difficulty obtaining silk as filaments by reeling. In this study, *A. yamamai* breeding was achieved by backcross breeding for superior silk productivity; moreover, the effects of proteinase on the cocoon surface, reeling, and fiber properties of *A. yamamai* were discussed.

Chapter 1 presents the background of silk, wild silkmoths, and the objective of this study.

Chapter 2 describes the accomplishment of breeding of *A. yamamai* by backcrossing. Backcrossing was undertaken to breed strains with superior traits for producing silk by hybridization with a strain exhibiting a high fertilized female rate (SUB-52) and a strain with heavy cocoons (SUB-11). Backcrossed strains, B_n (n represents the number of generations), from third to seventh generations, were acquired and stored in this study. Upon comparing the percentages of cocoon shell weight among SUB-52, SUB-11, and each B_n statistically, B_6 was found to be superior to other strains in terms of silk productivity. Regarding the last backcrossed strain, B_7, the weight of cocoon and cocoon shell weight were much closer to those of the recurrent parent SUB-11. Based on these results, backcrossing should be limited until B_6.

Chapter 3 describes the effect of proteinase on removing calcium oxalate monohydrate in *A. yamamai* cocoons, method of reeling and the fiber properties of *A. yamamai* cocoons by using proteinase K for cocoon boiling. Difficulty with reeling is caused by organic adhesives, mainly in the form of calcium oxalate monohydrate. Cocoon pieces of *A. yamamai* were treated only with a phosphate buffer, proteinase K, or trypsin solution. Treated samples were analyzed by ATR-FTIR to determine the removability of calcium oxalate monohydrate. Although the effect of removing calcium oxalate monohydrate in the phosphate buffer was shown, calcium oxalate monohydrate could be removed more effectively and quickly by the combination of buffer and proteinase, especially proteinase K. The use of proteinase K on *A. yamamai* cocoons has the possibility of facilitating reeling. *A. yamamai* cocoons were treated with proteinase K solution or heated with 0.05% (w/v) $NaHSO_3$ solution as a conventional method. Cocoons were reeled using an automatic reeling machine to obtain cocoon filaments and the ratios of filaments weight and total weight of cocoon shell were calculated to determine the reeling efficiency (recovery). The recovery of cocoons treated with proteinase K was significantly higher than that by the conventional method. According to a tensile test, there was no significant difference between the tensile strength [N] per

denier [d] of cocoon filaments treated with proteinase K and that upon use of the conventional method. These results suggest that the method of using proteinase K solution on cocoons of *A. yamamai* for reeling enables more efficient obtainment of cocoon filaments with the same mechanical properties as those by the conventional method. This chapter also refers to the properties of fibers from the cocoons of SUB-11, SUB-52, and B_n treated with proteinase K. The results showed that the fiber properties were almost the same among all strains, which could be considered to indicate that filaments were not affected by the strains and backcrossing.

Chapter 4 describes the conclusion of the study and the future prospects are summarized.