Science and Technology Group
Annual Report FY2023

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1 Introduction

The genome of higher organisms is composed of more than 90% of non-coding genomic regions. A recently large number of non-coding RNAs transcribed from these intergenic regions have been identified in many organisms. However, most biological functions remain unknown in plants and animals.

I identified more than **770 types of reproductive long non-coding RNAs and numerous small RNAs derived from these long non-coding RNAs in rice** (Komiya *et al.*, 2014; Fig.2A). **The major aim of this research is to elucidate the comprehensive reproductive system via NON-coding RNAs in plants and the significance of non-coding genomic regions presented in higher organisms.**

2 Activities and Findings

2-1 Spatial Distribution of ARGONAUTEs-mediated Silencing in Stamen

Argonaute protein (AGO) in association with small RNAs is the core machinery of RNA silencing, an essential mechanism for precise development and defense against pathogens in many organisms.

We identified two AGOs, **AGO1b and AGO1d, that interacting with 1st Uracil-small RNAs (U-small RNAs) derived from germline-specific long non-coding RNAs. In addition, AGO1b and AGO1d cell type-specifically regulate stamen development by acting as mobile carriers of U-small RNAs from the soma to the germ cells.** Our study also highlights a new mode of reproductive RNA silencing via the specific nuclear and cytoplasmic localization of three AGOs, AGO1b, AGO1d, and MEL1, in rice germ cells (Figure 2B; Tamotsu … and Komiya, 2023 *Nature Commuications*).

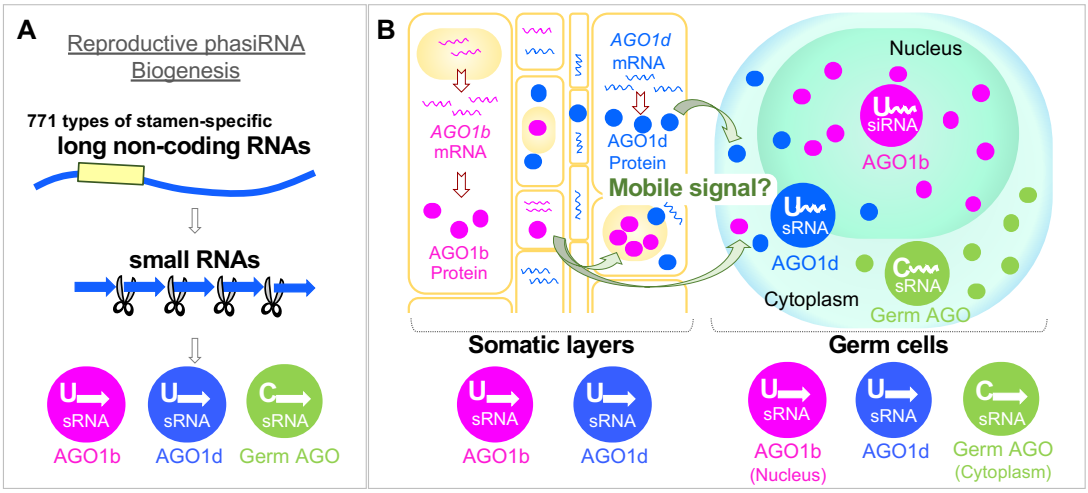

Figure 2. Spatial RNA silencing via small RNA delivery in stamen developments.
Reproductive Non-coding RNA pathways in rice. Reproductive long non-coding RNAs processing results in the production of numerous small RNAs. During stamen development, 1st Uracil (U) small are loaded into Soma Argonautes, which are distinct from Germ Argonautes association with 1st Cytosine small RNAs.
(A) The spatial RNA silencing via small RNA delivery in stamen developments.

2-2 Silencing System of Stamen-specific PhasiRNAs Derived from Long Non-coding RNAs

Moreover, I reviewed the biogenesis, diversification, spatiotemporal expression pattern and function of small RNAs and ARGONAUTEs complexes in plants (Komiya 2023).

3 My group members and Collaborators

1. **Dr. Zein Eddin Bader, Researcher**
2. **Ms. Hinako Tamotsu, Technician**
3. **Ms. Moe Yamamoto, Technician**
4. **Dr. Suteera Viboonyasek, Technician**
5. **Dr. Koji Koizumi, OIST Science imaging section**
6. **Dr. Ayako Yokoi, National Agriculture and Food Research Organization**

4 Publications (†:Corresponding author)

1. Tamotsu, H., Koizumi, K., Briones, A. and **Komiya, R**†. Spatial distribution of three ARGONAUTEs regulates the anther phasiRNA pathway. ***Nature Communications*** 14:3333 (2023).

2. **Komiya, R**＊. Silencing system of stamen-specific phasiRNAs derived from non-coding RNAs. ***SEIKAGAKU*** 95, No.3 (2023).
小宮怜奈. 非コードゲノムに由来する phasiRNAs の雄しべサイレンシング機構. **生化学第** 95 巻. 第 3 号 (2023)

3. **Komiya, R**†. Small RNAs in Rice Reproduction. ***JIKKEN IGAKU*** (2024 *in press*).
小宮怜奈. イネ生殖組織の small RNA. (2024 予定) .

5 External Funding

1. **Japan Science and Technology Agency, FORESTO research**
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2. **Japan Society for the Promotion of Science (JSPS), Transformative Research A**
PI: **Komiya R.** April 2023~ March 2025

3. **The Naito Foundation**
PI: Komiya R. December 2020 ~ March 2024.