別紙４

報告番号	※　甲　第　　　号

主　論　文　の　要　旨

論文題目 Elucidation of strigolactone-dependent seed germination pathway in the parasitic plant *Striga hermonthica*
(寄生植物ストライガにおけるストリゴラクトン依存的発芽促進経路の解明)

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論　文　内　容　の　要　旨

Striga hermonthica is a parasitic plant from the *Orobanchaceae* family that parasitizes to the root of its hosts plant and deprive them of nutrients for its own growth. Among *Striga* genus, *S. hermonthica* poses the greatest threats to food security as it infests a wide range of staple crops such as sorghum and maize. Expanding infestations of *S. hermonthica* seriously impact on agricultural production especially for smallholder farmers in Africa. However, eradication of this noxious witchweed remains challenging due to its unusual parasitic adaptations.

The obligate nature of this parasite that demands strong host-dependency to survive has lead to the evolution of its seeds that can stay dormant but viable in soil for decades until the host plants grown in proximity. Seeds of *S. hermonthica* recognize germination signals called strigolactones (SLs) that are exuded from the host root as an indication for the presence of food source and germinate. But before they become responsive to SLs, the dormant seeds require a period of incubation under warm temperature and moisture, a process termed “seed conditioning”. Yet, mechanism behind this process remains largely unknown largely due to the lack of transformation method available for this parasitic plant.

In Chapter 1, I applied chemical genetics approach and elucidated that plant hormone gibberellins (GA) play an important role in seed conditioning of *S. hermonthica*. This is supported by when the seeds were depleted of GA by biosynthesis inhibitor of this hormone during conditioning, they were strongly defective of SL-dependent germination. I further showed that GA positively regulates this process mainly by promoting the gene expressions of SL receptors that are crucial for germination. Consistent with this idea, GA deficit seeds showed aberrant SL perception when visualized with a fluorogenic SL probe. Based on these findings, we proposed a model of how the role of GA, which is usually the dominant germination cue in non-parasitic plants, could turn into indirectly regulating the seed germination of parasitic plants like *S. hermonthica*, to leave them solely dependent on host-derived signals to germinate.

On the contrary, recent studies on the seed germination pathway of *S. hermonthica* have enabled development of promising tools for modulating the life cycle of this parasite for eradication. For instance, discoveries of SL receptors encoded by diverged copies of *HYPOSENSITIVE TO LIGHT* (*HTL*) lead to development of highly potent SL agonist called Sphynolactone-7 (SPL7) that targets preferentially to the most sensitive receptor, ShHTL7 to elicit germination pathway. In field, SPL7 is applied to induce germination of *S. hermonthica* in the absence of host, and the germinated seedlings eventually after two weeks which eventually depleted *S. hermonthica* in soil. Nevertheless, many unknowns remain to be elucidated, for example the downstream components in the signaling pathway.

In Chapter 2, I performed a chemical suppressor screening of SPL7-dependent germination to study ShHTL7-mediated germination pathway in *S. hermonthica*. Through *Striga*-based germination assay, I obtained 41 small-molecule inhibitors that could potentially help to clarify different aspects of the pathway. Firstly, I conducted binding assays to further classified these series of inhibitors into Receptor-Targeting Compounds (RTCs) or non-RTCs. I successfully identified 9 RTCs with intriguing binding profile, and I continued to elucidate inhibitory mode of RTC2. Through biochemical analysis on protein-protein interaction with downstream partners coupled with receptor stability, I proposed a plausible allosteric inhibitory mode of RTC2 that acts through SPL7-bound ShHTL7.

In summary, my findings in Chapter 1 uncovered a new role of GA in promoting seed condition of *S. hermonthica* whereas my discoveries in Chapter 2 could potentially contribute to better understanding of ligand perception of ShHTLs that which activation mechanism still debatable for SL receptor in non-parasitic plants, and the non-RTCs could reveal more unknown components in the pathway. Thus, I envisaged that this work would contribute to development of better solutions for parasitic plant control.