

Success in promoting plant growth for biodiesel

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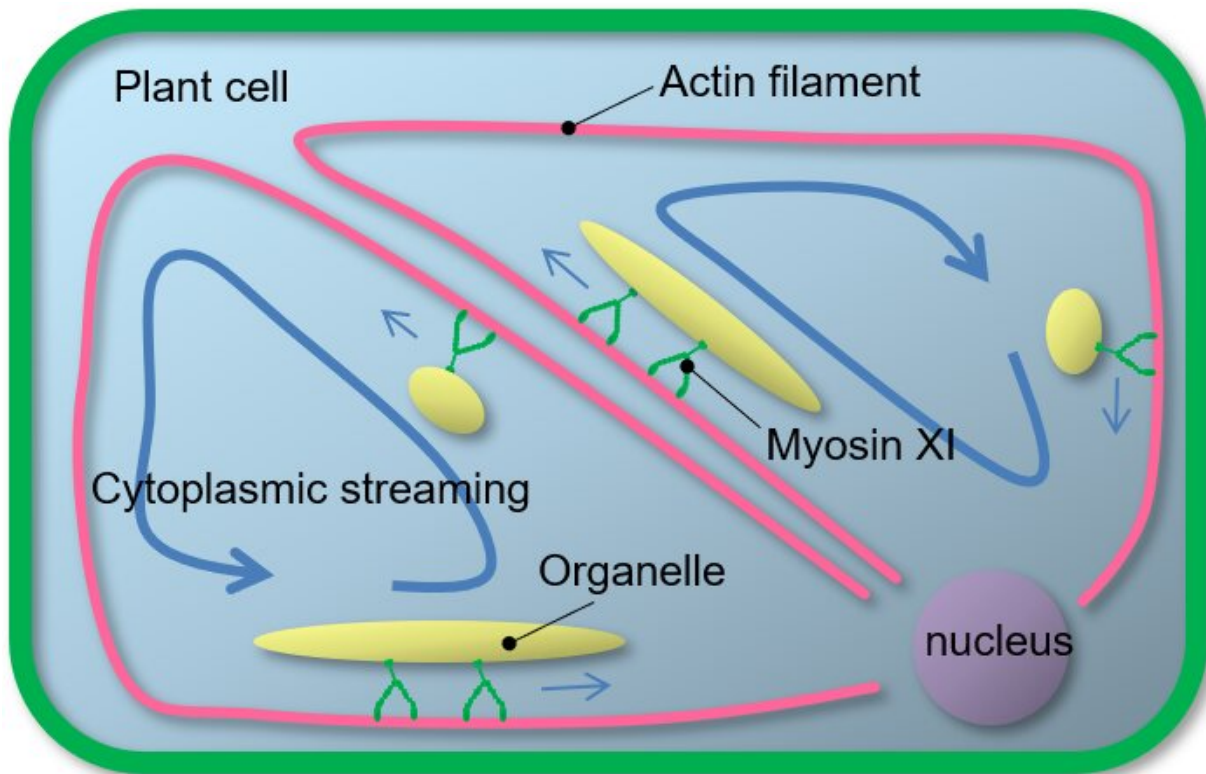


Fig 1: In the plant cell, actin filaments, which are cytoskeletal proteins, are stretched around. Plant myosin XI bound to organelles moves directionally on these actin filaments, resulting in active intracellular transport called cytoplasmic streaming. Myosin XI bound to organelle moves on actin filaments as if it was walking by alternating two motor domains. Credit: Motoki Tominaga

In JST Strategic Basic Research Programs, a group led by Zhongrui Duan (Researcher, Waseda University) and Motoki Tominaga (Associate professor, Waseda University) succeeded in promoting plant growth and increasing seed yield by heterologous expression of protein from *Arabidopsis* (artificially modified high-speed motor protein) in *Camelina sativa*, which is expected to be a useful plant for biodiesel.

Cytoplasmic streaming is seen in plant cells from algae to higher [plants](#) as a phenomenon of active cytoplasmic movement with organelles, such as the endoplasmic reticulum and mitochondria. It is known that [cytoplasmic streaming](#) is generated by the sliding of motor protein myosin XI, which is binding to organelles, along the cytoskeleton constituting actin filaments. Previously, the research group has achieved the growth promotion and increasing size of the model plant *Arabidopsis* by the development of high-speed-type myosin. This technology has been expected to apply to other [plant species](#) than *Arabidopsis*.

In this study, the research group showed that the increase of seed yield and the growth promotion of stems and leaves in *Camelina* could be achieved by heterologous expression of a high-speed-type myosin XI gene derived from *Arabidopsis* in *Camelina*.

Considering the increase of seed yield in *Camelina* enabled by the expression of high-speed-type myosin XI, it is expected to increase the productivity of biodiesel per area unit. In the future, it is hoped to increase the productivity and quality of camelina oil by co-expressing the genes related to fat synthesis and modification of fatty acid composition with high-speed-type myosin XI. Moreover, as the group showed that the promotion of [plant growth](#) by the high-speed-type myosin XI is also effective in other plant species than the model plant *Arabidopsis*, application development, such as the reduction of CO₂ and biomass, is also expected by increasing the production of plant resources, such as corn, rice, sugar cane, and jatropha.

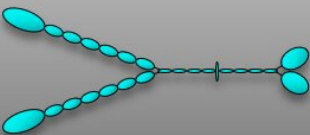
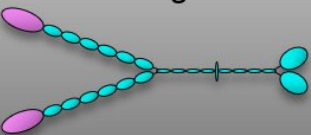
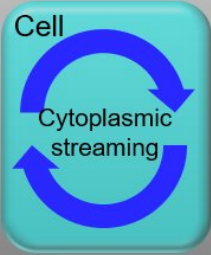


<p>Wild type Arabidopsis myosin XI-2</p>	<p>High-speed Chara-Arabidopsis chimeric myosin XI-2</p>
<p>➤ myosin speed Normal</p>	<p>High</p>
	
<p>➤ Cytoplasmic streaming velocity Normal</p>	<p>High</p>
<p>➤ Cell size Normal</p>	<p>large</p>
	
<p>➤ Plant size (Arabidopsis)</p>	
	

Fig. 2: Size enhancement of *Arabidopsis thaliana* by high-speed myosin XI High-speed myosin XI was developed by replacing the motor domain of *Arabidopsis* myosin XI, which determines the rate of cytoplasmic flow, with the motor domain of *Chara corallina*. Expression of high-speed of myosin XI increases the size of plants (*Arabidopsis thaliana*) concomitantly with elevation of cytoplasmic streaming velocity. Credit: Motoki Tominaga

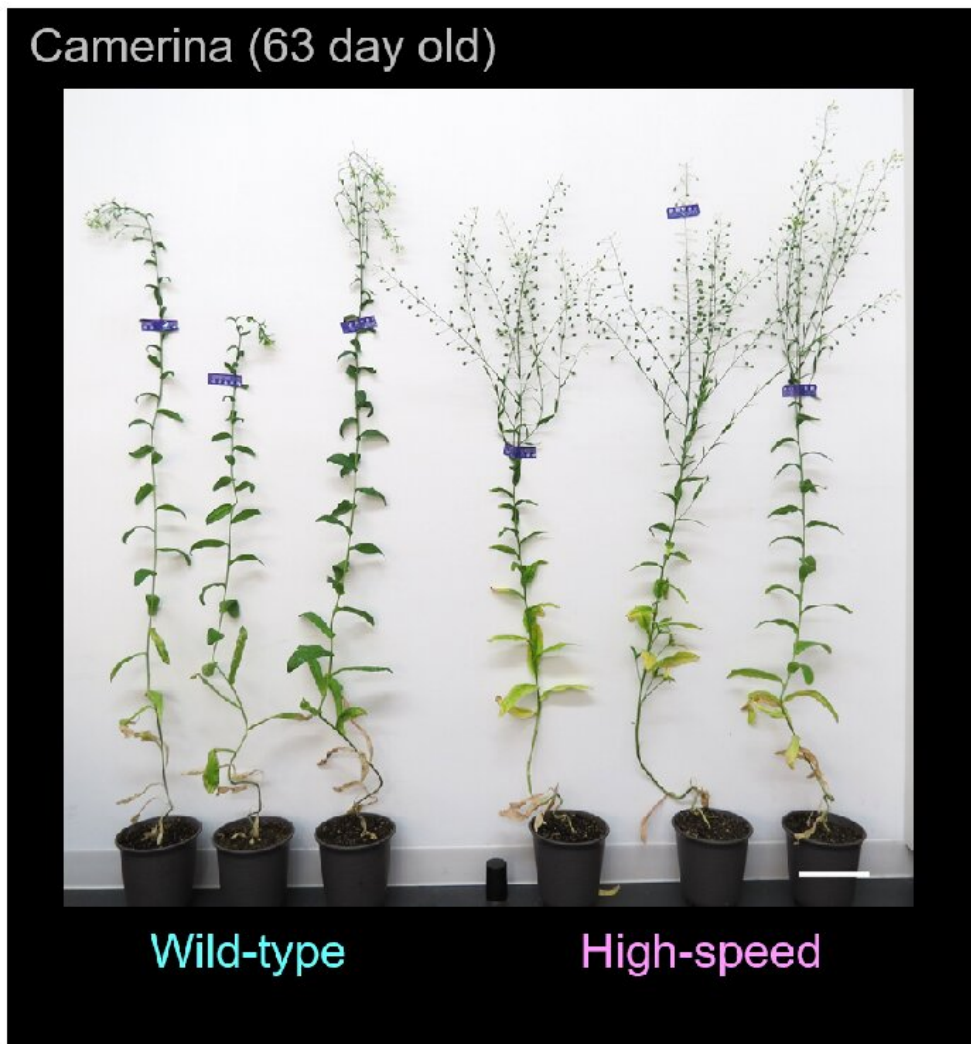


Fig. 3: High-speed myosin XI promotes camelina growth and increases the seeds number. Expression of high-speed *Arabidopsis* myosin XI-2 was found to promote the growth of camelina and increase the number of seeds (scale bar: 10 cm). Credit: Motoki Tominaga

More information: Zhongrui Duan et al, Heterologous transformation of *Camelina sativa* with high-speed chimeric myosin XI-2 promotes plant growth and leads to increased seed yield, *Plant Biotechnology* (2020). [DOI: 10.5511/plantbiotechnology.20.0225b](https://doi.org/10.5511/plantbiotechnology.20.0225b)

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