DIWPA: DIVERSITAS in the Western Pacific and Asia

DIWPA News Letter

Office: Center for Ecological Research, Kyoto University, Otsu, Shiga, Japan

September 2026

No. 55

Message from the Chairperson

Keisuke Koba

This is a moment of new beginnings for Kyoto University, which was formally accredited as a University for International Research Excellence in July 2026. I welcome this milestone as an opportunity to reflect on the conditions that allow research to flourish. As Chairperson of DIWPA, I hope to help carry these values into our exchanges across the Western Pacific and Asia, with particular attention to the next generation of ecologists. For me, the university's new chapter and DIWPA's activities come together in a simple aspiration, to give curious people the opportunity to ask their own questions and the support to explore them with others.

In this issue, Dr. Yumiko Higuchi introduces her research on leaf shape and leaf-rolling weevils. Her article reminds us that questions about biodiversity can begin with careful attention to the organisms around us, and that even seemingly small observations can open the door to broader scientific questions.

This October, the DIWPA International Field Biology Course will return to Sri Lanka. As Dr. Hiroyuki Tanaka describes in this issue, participants from various countries will combine fieldwork with DNA analysis, gaining experience in connecting observations made in the field with molecular approaches. I hope they will also enjoy comparing observations, asking questions over meals, and discovering how differently others see the same forest. Sharing both the excitement and the uncertainty of research is an important part of learning together, and perhaps one of the most rewarding aspects of field biology.

My sincere thanks go to our contributors, the course organizers and hosts in Sri Lanka, and all who sustain DIWPA. I look forward to seeing the questions, friendships, and collaborations that will emerge from these encounters and to witnessing how they shape the next generation of ecologists.

Message from the Secretary General

Akira Yamawo

Ecology is changing rapidly. New observational and experimental techniques, large databases, and advances in data analysis now allow us to compare ecological processes across different organisms, ecosystems, regions, and spatial scales. As these resources continue to grow, connections among researchers working in different fields and countries will become increasingly important.

I was reminded of this at the recent international conference on behavioral ecology held in Turin, Italy. In conversations around the conference venue, the "Next Big Questions" in behavioral ecology often became a topic of discussion. Many of these conversations returned to a similar point: future progress will require stronger connections between behavior, ecological interactions, evolution, environmental change, and comparative patterns across species. These discussions also made me think about ecology more broadly. Many important ecological questions now extend beyond a single organism, ecosystem, research field, or region.

DIWPA has long connected ecologists working in different countries and ecosystems. This role is particularly important today, because ecological data, methods, and ideas can be shared and combined more readily than before. International networks such as DIWPA can help researchers exchange not only research results but also different approaches and perspectives. Such exchanges can also lead to questions and collaborations that would be difficult to develop within a single research group or country.

I hope that DIWPA will continue to provide opportunities for researchers with different backgrounds to meet, discuss their work, and develop new questions together. Stronger international connections will help us examine ecological processes across broader spatial and biological scales and improve our understanding of how natural systems are changing.

Report

Exploring the effect of leaf shape on leaf-rolling weevils

Yumiko Higuchi

Associate Professor
Center for Ecological Research, Kyoto University (Japan)

Herbivorous insects that build shelters

Rather than simply feeding on plants, some herbivorous insects manipulate plant tissues to build shelters. For example, the larvae of many lepidopteran species create leaf shelters by rolling or tying leaves with silk (Lill and Marquis 2007). Such shelters benefit insects by enhancing plant palatability, escaping from natural enemies, and/or ameliorating harsh abiotic environments (Lill and Marquis 2007, Cornelissen *et al.* 2016). Plants serve as both food and building materials for these insects. Here, I introduce the studies that explore how leaf shape affects the interactions between plants and leaf-rolling weevils.

Leaf-rolling weevils

The weevils in the family Attelabidae are one of the insect groups that are characterized by their maternal plant manipulation upon oviposition. The family generally consists of subfamilies Attelabinae and Rhynchitinae (Alonso-Zarazaga *et al.* 2023). Among them, Attelabinae and some Rhynchitinae species have the habit of creating leaf rolls to oviposit (Kobayashi *et al.*, 2012). Weevils in Attelabinae make tightly wrapped leaf rolls without any adhesives (Fig. 1). Usually, an ovipositing female lays one or two eggs inside a leaf roll, and a hatched larva grows by feeding only on the lamina inside a leaf roll to become an adult. Most Attelabinae weevil species use a large portion of a leaf to construct a leaf roll, and a previous study indicates that female weevils adjust leaf-roll construction according to leaf length and width (Sakurai 1988). Then, how does natural variation in leaf shape affect leaf-roll construction?

Leaf-rolling weevils on *Isodon* plants

Research was conducted in the Hokuriku region, on the Sea of Japan side of the country. *Isodon umbrosus* var. *hakusanensis* (Lamiaceae; hereafter *I. umbrosus*) is predominantly found in this region and grows naturally on the mid-elevated deciduous forest floor. While its pale purple flowers bloom in early fall, deeply lobed, fork-like leaves strikingly characterize this variety (Fig. 2).

Isodon plants are the primary hosts for the leaf-rolling weevil, *Leptapoderus praecellens* (as *Apoderus praecellens* in Higuchi and Kawakita 2019, 2022) (Fig. 3). In our field sites, several *Isodon* species grow closely with *I. umbrosus*. *Isodon trichocarpus* is one such species that bears broadly ovate, non-lobed leaves (Fig. 3). This situation provided a good opportunity to explore the effect of leaf shape on leaf-roll construction by *L. praecellens*. Across three natural stands where both *Isodon* species grew, we found that the number of leaf rolls per plant was lower on *I. umbrosus* than on *I. trichocarpus* (Higuchi and Kawakita 2019). However, when we experimentally fed *I. umbrosus* leaves to larvae, they grew as well as those fed *I. trichocarpus* leaves (Higuchi and Kawakita 2019). This means that larvae can grow without difficulty on *I. umbrosus*, if female weevils make leaf rolls on it. To clarify the effect of lobed leaf shape on leaf-roll construction, we offered the "lobed" and "non-lobed" manipulated *I. trichocarpus* leaves to female weevils in the laboratory. As a result, female weevils used "lobed" leaves less than "non-lobed" leaves for leaf rolling (Higuchi and Kawakita 2019). These results suggest that lobed leaf shape would negatively affect leaf-roll construction.

Fig.1. *Cycnotrachelodes roelofsi* making a wrapped leaf roll on *Styrax japonicus*

Fig. 2. *Isodon umbrosus* var. *hakusanensis* in bloom

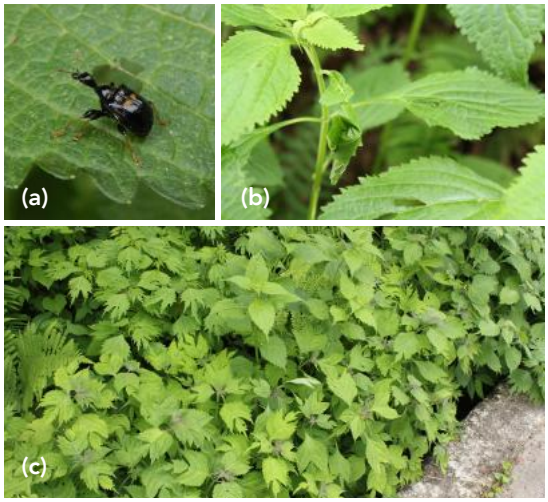


Fig. 3.
(a) An adult *Leptapoderus praecellens*
(b) A leaf roll created on *Isodon trichocarpus*
(c) A stand that both *I. umbrosus* var. *hakusanensis* (left) and *I. trichocarpus* (right) grow

When do female weevils stop making leaf rolls on *I. umbrosus*?

An ovipositing female does multiple steps to make a leaf roll; she firstly walks on a leaf surface multiple times with a routine circuit, then cuts the leaf at the base. After that, she bites the leaf to wilt, folds a half and rolls up from the leaf tip. After slightly rolling a leaf, she makes a hole to lay eggs, and then completely rolls up to form a leaf roll. When we observed leaf-roll construction behaviors by female weevils on the two *Isodon* species above, they walked but cut less frequently on leaves of *I. umbrosus* (Higuchi and Kawakita 2019). Walking before cutting leaves is considered to allow female weevils to inspect multiple conditions of the leaf, as well as to determine where to cut (Sakurai 1988, Park *et al*. 2012). *I. umbrosus* leaves would thus influence females' decision not to continue leaf-roll construction during this walking, and the lobed leaf shape may contribute to this.

Leaf-rolling weevils on *Boehmeria silvestrii*

Further study revealed that lobed leaf shape may work differently for another leaf-rolling weevil, *Phymatapoderus flavimanus* (as *P. pavens* in Higuchi and Kawakita 2022). Females of this weevil species use Urticaceae as host plants, including *Boehmeria silvestrii*, whose leaf shape is highly similar to that of *I. umbrosus* (Fig. 4). Based on field surveys, we found that female *P. flavimanus* weevils use a whole leaf to make a leaf roll on small, less lobed leaves, whereas they use one of the lateral lobes of a leaf when making leaf rolls on large, deeply lobed leaves (Higuchi and Kawakita 2022, Fig. 5). I have never observed such shape- and size- dependent leaf manipulation in *L. praecellens* on *I. umbrosus*. The reason for this difference is unclear, but it allows *P. flavimanus* to use a wide range of leaves for leaf rolls.

Leaf shape: Influential for shelter-building insects?

Some other architectural characteristics of host plants affect the colonization and behavior of shelter-building insects (Mueller and Dearing 1994, Marquis *et al.* 2002, Greeney *et al*. 2010). As for leaf shape, several studies indicate that it works for plant-herbivore interactions (Heinrich 1971, Brown and Lawton 1991, Dell'Aglio *et al.* 2016), but the number is relatively limited. By influencing the physical construction of leaf shelters, diverse but subtle variations in leaf shape, along with other plant characteristics, may shape interactions between plants and shelter-building insects.

References

Alonso-Zarazaga M. A. *et al.* 2023. Cooperative Catalogue of Palaearctic Coleoptera Curculionoidea, 2nd edition. Monografías electrónicas S.E.A. 14: 1–780.

Brown V. K. and Lawton J. H. 1991. Herbivory and the evolution of leaf size and shape. Philosophical Transactions of the Royal Society B 333: 265–272.

Cornelissen T., Cintra F. and Santos J. C. 2016. Shelter-Building Insects and Their Role as Ecosystem Engineers. Neotropical Entomology 45: 1–12.

Dell'Aglio D. D., Lasada M. E. and Jiggins C. D. 2016. Butterfly learning and the diversification of plant leaf shape. Frontiers in Ecology and Evolution 4: 81.

Greeney H. F., Walla T.R and Lynch R. L. 2010. Architectural changes in larval leaf shelters of *Noctuana haematospila* (Lepidoptera: Hesperiidae) between host plant species with different leaf thicknesses. Zoologia 27: 65–69.

Heinrich B. 1971. The effect of leaf geometry on the feeding behavior of the caterpillar of *Manduca sexta* (Sphinginae). Animal Behaviour 19: 119–124.

Higuchi Y. and Kawakita A. 2019. Leaf shape deters plant processing by an herbivorous weevil. Nature Plants 5: 959–964.

Higuchi Y. and Kawakita A. 2022. Shape-dependent leaf manipulation in the leaf rolling weevil *Phymatapoderus pavens* (Coleoptera: Attelabidae). Biological Journal of the Linnean Society 136: 1–12.

Kobayashi C., Okuyama Y., Kawazoe K. and Kato M. 2012. The evolutionary history of maternal plant-manipulation and larval feeding behaviours in attelabid weevils (Coleoptera; Curculionoidea). Molecular Phylogenetics and Evolution 64: 318–330.

Lill J. T. and Marquis R. J. 2007. Microhabitat manipulation: Ecosystem engineering by shelter-building insects. In: Cuddington K., Byers J. E., Wilson W. G., Hastings A. (eds) Ecosystem engineers, plants to protists. Academic Press, Burlington MA, pp 107–138.

Marquis R. J., Lill J. T. and Piccinni A. 2002. Effect of plant architecture on colonization and damage by leaftying caterpillars of *Quercus alba*. Oikos 99: 531–537.

Mueller U. G. and Dearing M. D. 1994. Predation and avoidance of tough leaves by aquatic larvae of the moth *Parapoynx rugosalis* (Lepidoptera: Pyralidae). Ecological Entomology 19: 155–158.

Park J., Lee J. E. and Park J. K. 2012. Leaf cutting-patterns and general cradle formation process of thirteen Apoderinae (Coleoptera: Attelabidae) in Korea: cradles of Attelabidae in Korea I. Entomological Research 42: 63–71.

Sakurai K. 1988. Leaf size recognition and evaluation of some attelabid weevils (2) *Apoderus balteatus*. Behaviour 106: 301–316.

Fig. 4. *Isodon umbrosus* var. *hakusanensis* (left) and *Boehmeria silvestrii* (right)

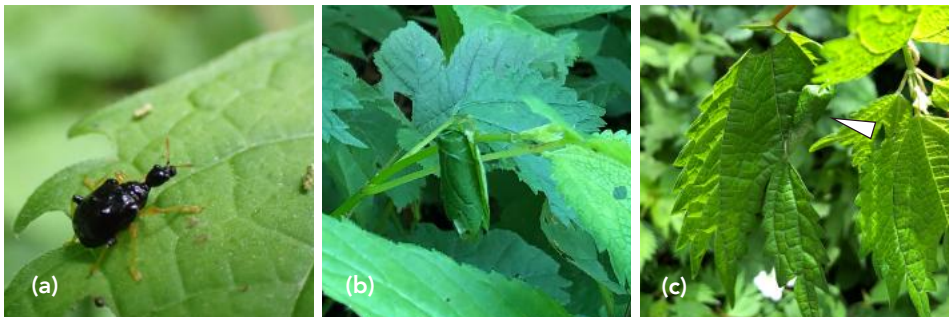
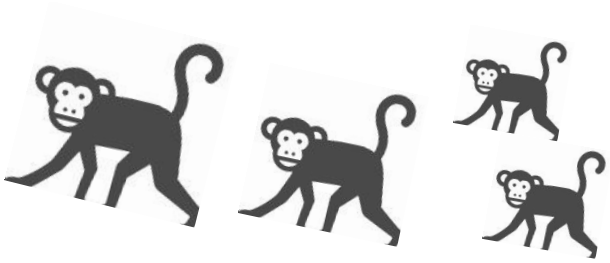


Fig. 5.
(a) An adult *Phymatapoderus flavimanus*
(b) A leaf roll constructed using a whole leaf
(c) A leaf roll constructed using one of the lateral lobes of a leaf

Hiroyuki Tanaka

Lead lecturer of 2026 DIWPA IFBC
Assistant Professor
Center for Primate Field Studies and
Center for Ecological Research,
Kyoto University (Japan)



This coming October, we will be holding the DIWPA International Field Biology Course (IFBC) in Sri Lanka. I am very pleased to be able to hold the IFBC in Sri Lanka again, following the 2025 DIWPA IFBC.

Last year, nine participants—including young researchers and students from Sri Lanka—and one doctoral student from India took part the course. They inspired one another and interacted not only through the ecological topics covered by the IFBC, but also through shared experiences of food culture and music. They told us that the DIWPA IFBC was a very meaningful experience for them.

This year, we have 10 participants from seven countries through the screening process. From reading their CVs, it is clear that they come from a wide variety of backgrounds. I am already very much looking forward to going into the forest with them and conducting DNA analysis together in the lab.

During the 2025 IFBC, we analyzed mitochondrial 16S ribosomal RNA using DNA extracted from feces collected from the field, to identify the species based on that sequence. We obtained some interesting results, such as detecting mtDNA from a toque macaque—which had been preyed upon—in leopard feces. This time we will again collect mammal feces during our fieldwork and attempt sex identification using the fecal DNA. While PCR amplification of mtDNA is relatively straightforward when using fecal DNA, amplifying genes from the nuclear genome is often difficult. Nevertheless, I intend to attempt the analysis of genes of amelogenin, SRY, ZFX, and ZFY on the sex chromosome.

By the way, I believe that “Okonomiyaki” (Japanese pancake with cabbage) is a dish that people around the world can enjoy. I have even hosted Okonomiyaki parties with international students here in Japan. When I made Okonomiyaki at the farewell party for the 2025 IFBC, both the Sri Lankan and Indian guests said it was delicious. They helped me make the Okonomiyaki partway through the party. This year, in addition to participants from Sri Lanka and India, we have participants from five other countries. I wonder if they will also find it delicious! I think one of the great things about Okonomiyaki is that it can be adapted for both vegetarians and vegans.

Ahead of the 2026 IFBC, I plan to hold a Zoom meeting with all the participants in mid-September so that we can introduce ourselves to one another. I will explain what Okonomiyaki is and ask them whether they would be interested in trying it!!

DIWPA OFFICE

Chairperson	**Keisuke Koba**	
Secretary General	**Akira Yamawo**	
Secretary	**Hiroshi Kudo**	**Shin-ichi Nakano**
	Shigeo Yachi	**Yumiko Higuchi**
	Hiroyuki Tanaka	
Assistant Secretary	**Akiko Seki**	

Center for Ecological Research Kyoto University

509-3, 2-chome, Hirano, Otsu, Shiga 520-2113, JAPAN
Tel : +81-77-549-8238
E-mail : diwpa@ecology.kyoto-u.ac.jp
http://diwpa.ecology.kyoto-u.ac.jp/