

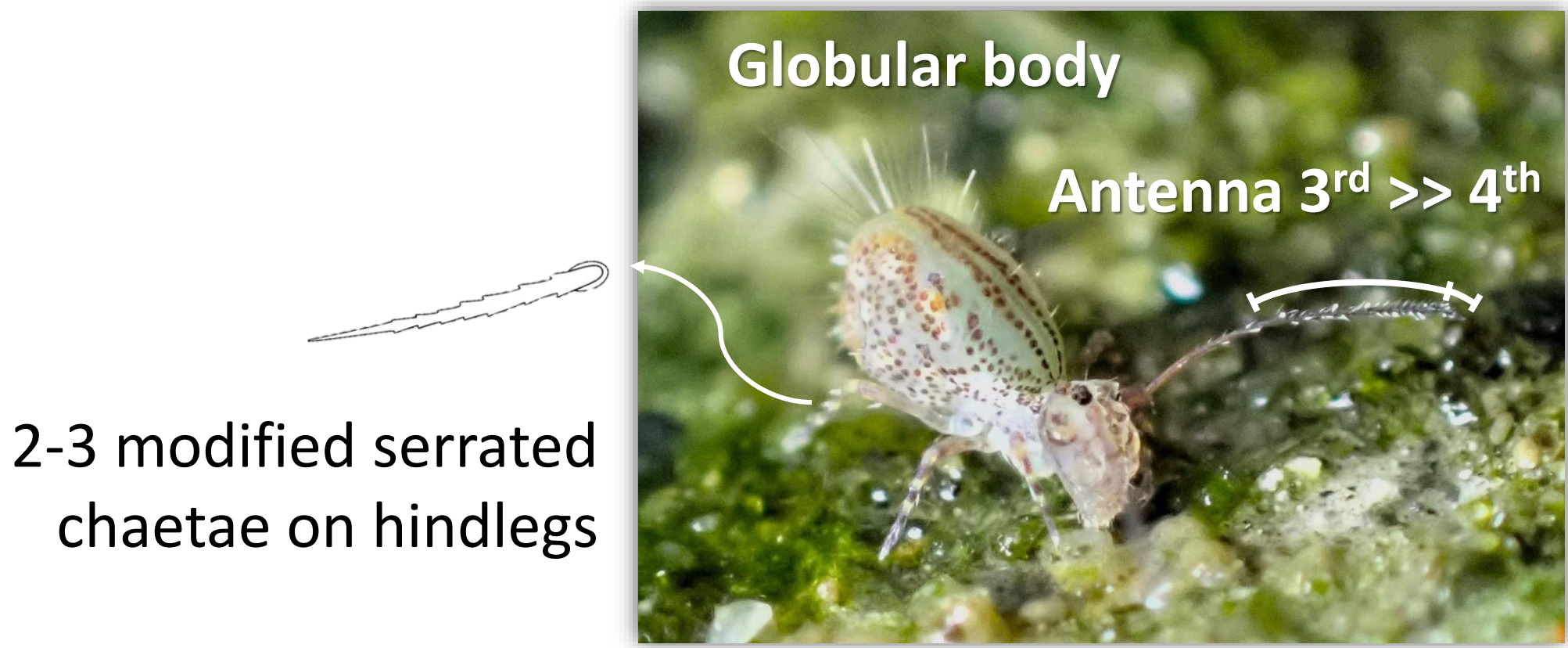
Investigating cryptic diversity of *Ptenothrix* (Dicyrtomidae, Collembola) with molecular and morphology methods

Hsin-Ju Cheng (鄭欣如)¹, Frans Janssens², Bruno Bellini³, Taizo Nakamori⁴, Chih-Han Chang (張智涵)^{1,5}

¹Institute of Ecology and Evolutionary Biology, National Taiwan University ²University of Antwerp, Antwerpen, Belgium
³Laboratório de Collembola, Departamento de Botânica e Zoologia, Centro de Biotecnologia, Universidade Federal do Rio Grande do Norte—UFRN, Lagoa Nova, Campus Universitário, Natal 59072-970, Brazil
⁴Department of Environment and Natural Sciences, Graduate School of Environment and Information Sciences, Yokohama National University, Yokohama 240-8501, Japan ⁵Department of Life Science, National Taiwan University

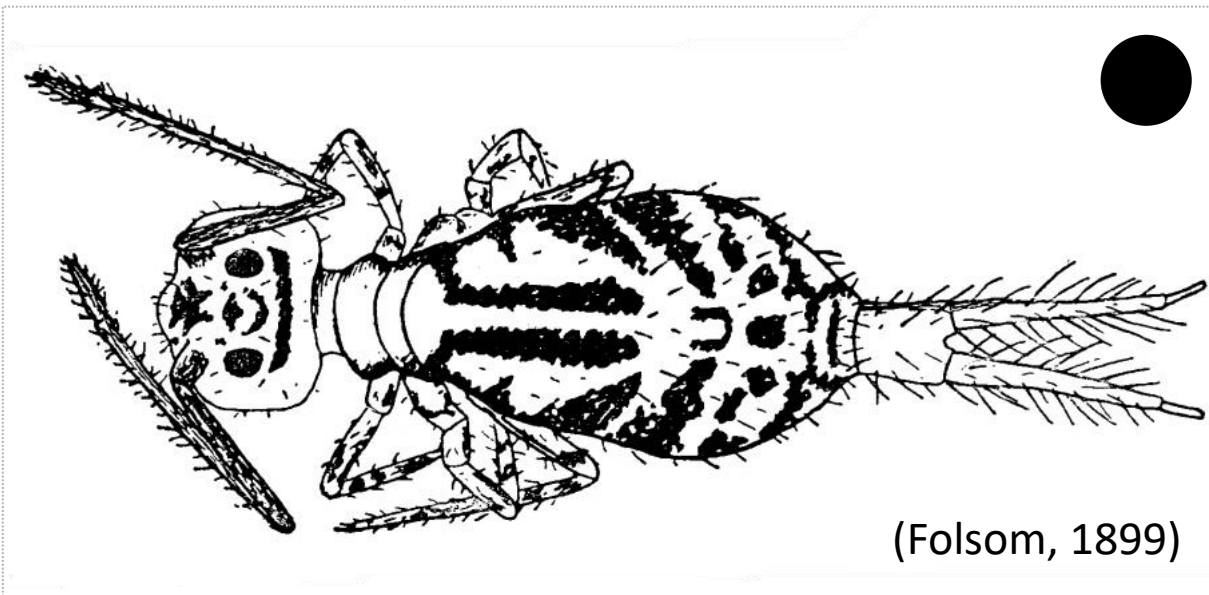


Introduction to *Ptenothrix*



- Atmobiote (surface-dwelling) springtails
 - Inhabiting in litter, rotten wood, understory...
 - Omnivore: feeding on microalgae, fungi...
 - 3 nominal species recorded in Taiwan, 96 worldwide
- (Cheng et al. 2022; Bellinger et al., 1996-2024)

What is the diversity of *Ptenothrix denticulata*-like species in Taiwan?

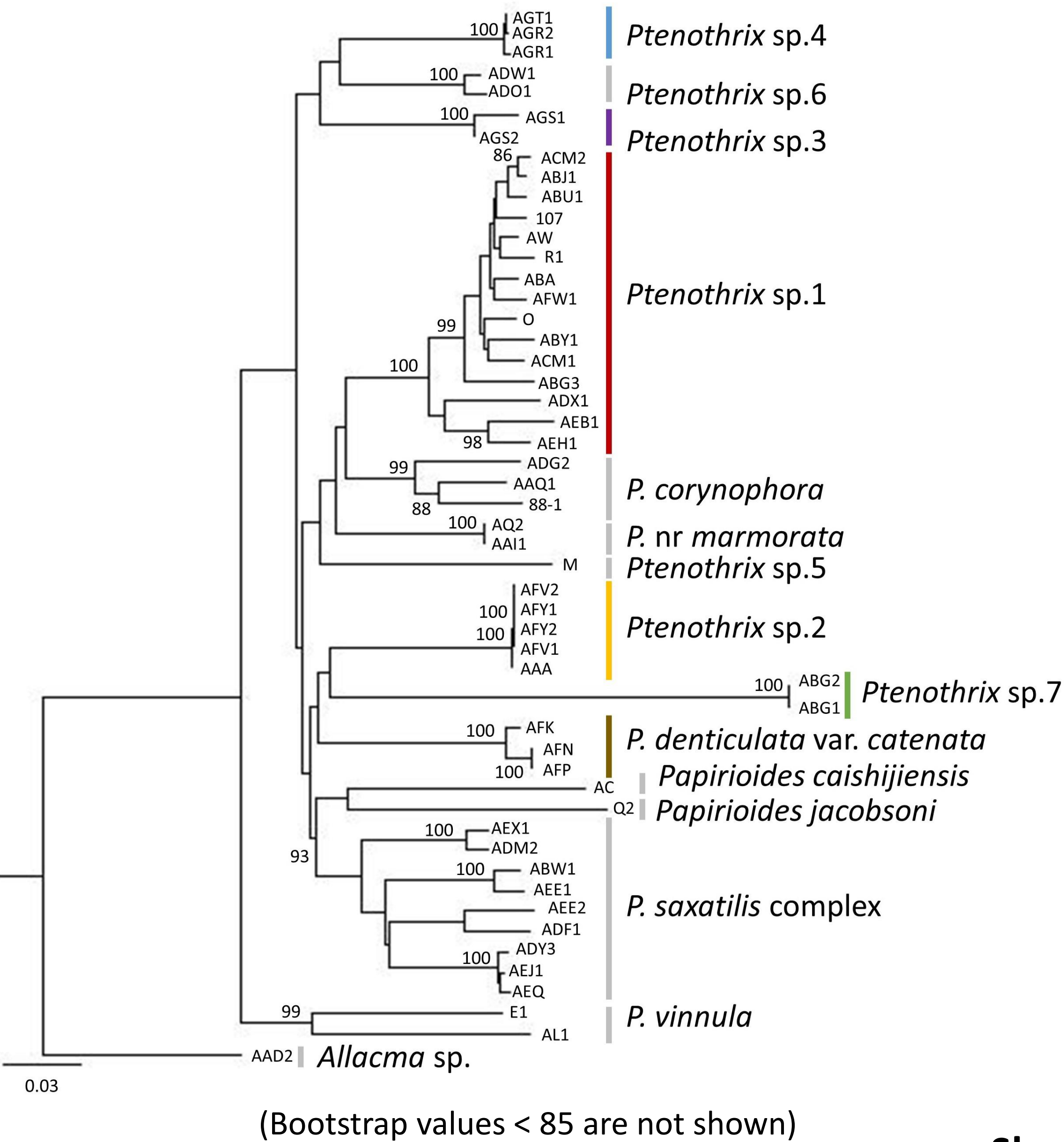


Material and methods

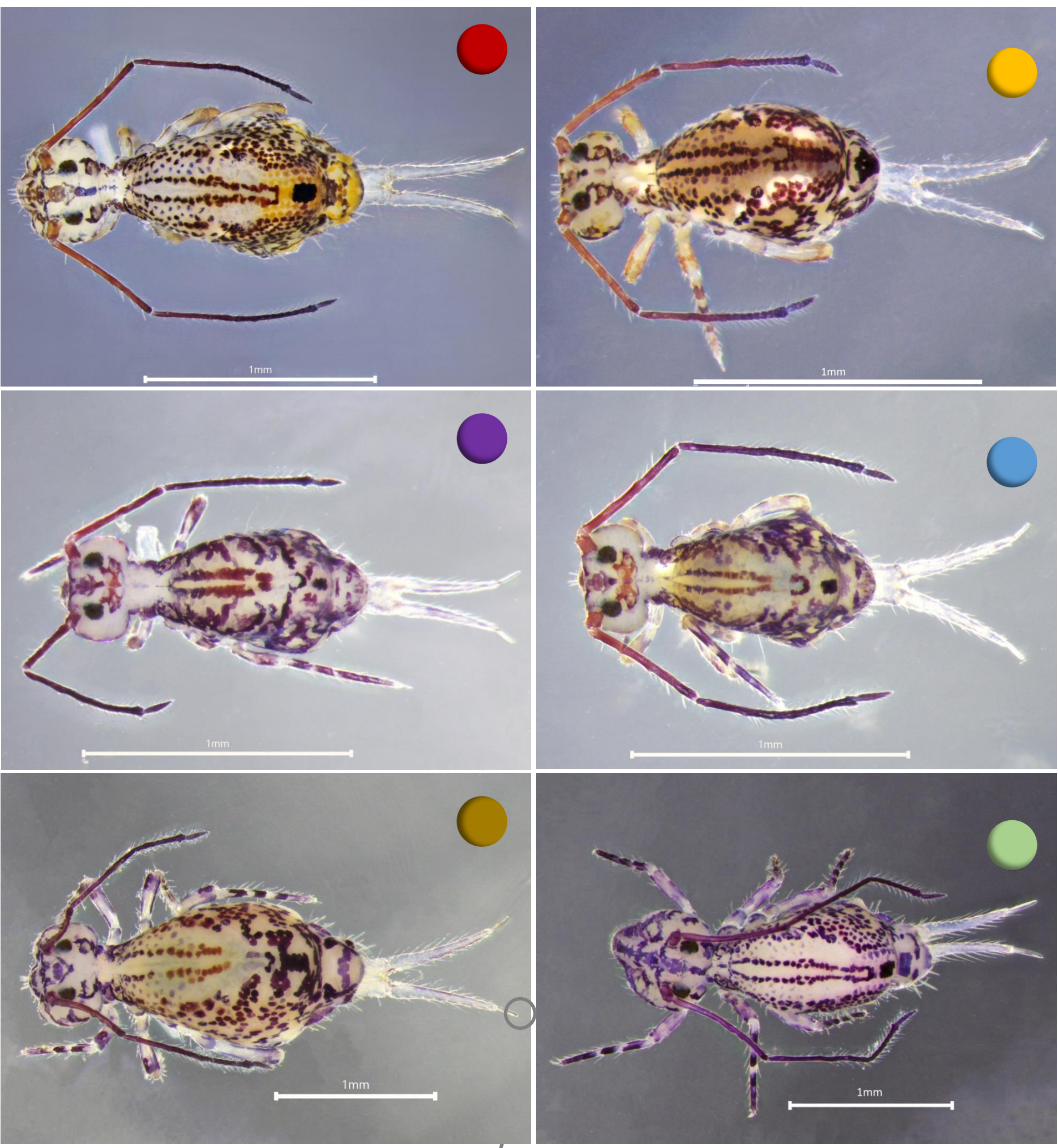


- Examining ethanol and slide specimens
- Extracting DNA and analyzing COI sequences
- Minimum interspecific p-distance of COI is 8% (Hogg & Hebert, 2004)

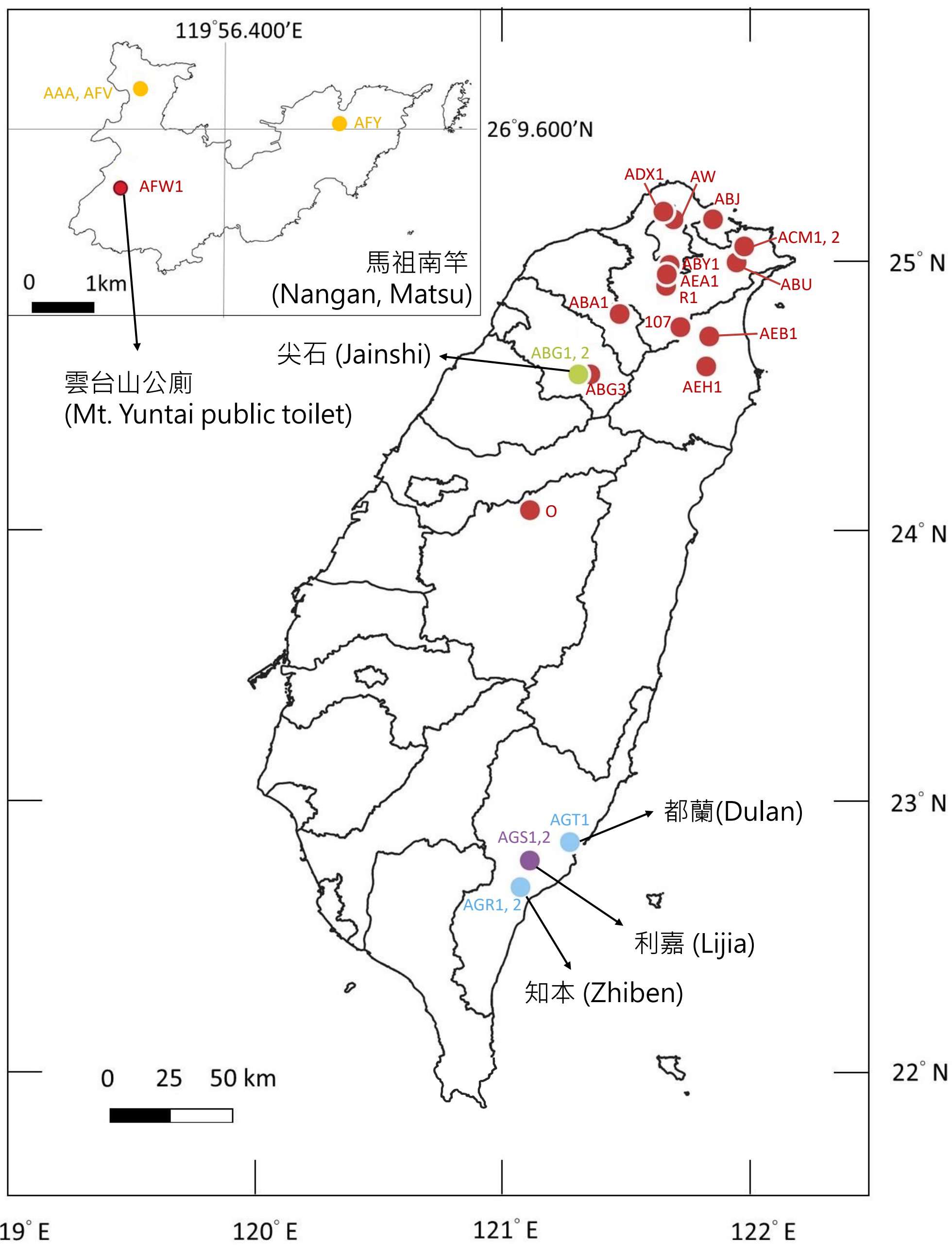
Neighbor-joining tree of COI



Habitus of the cryptic species

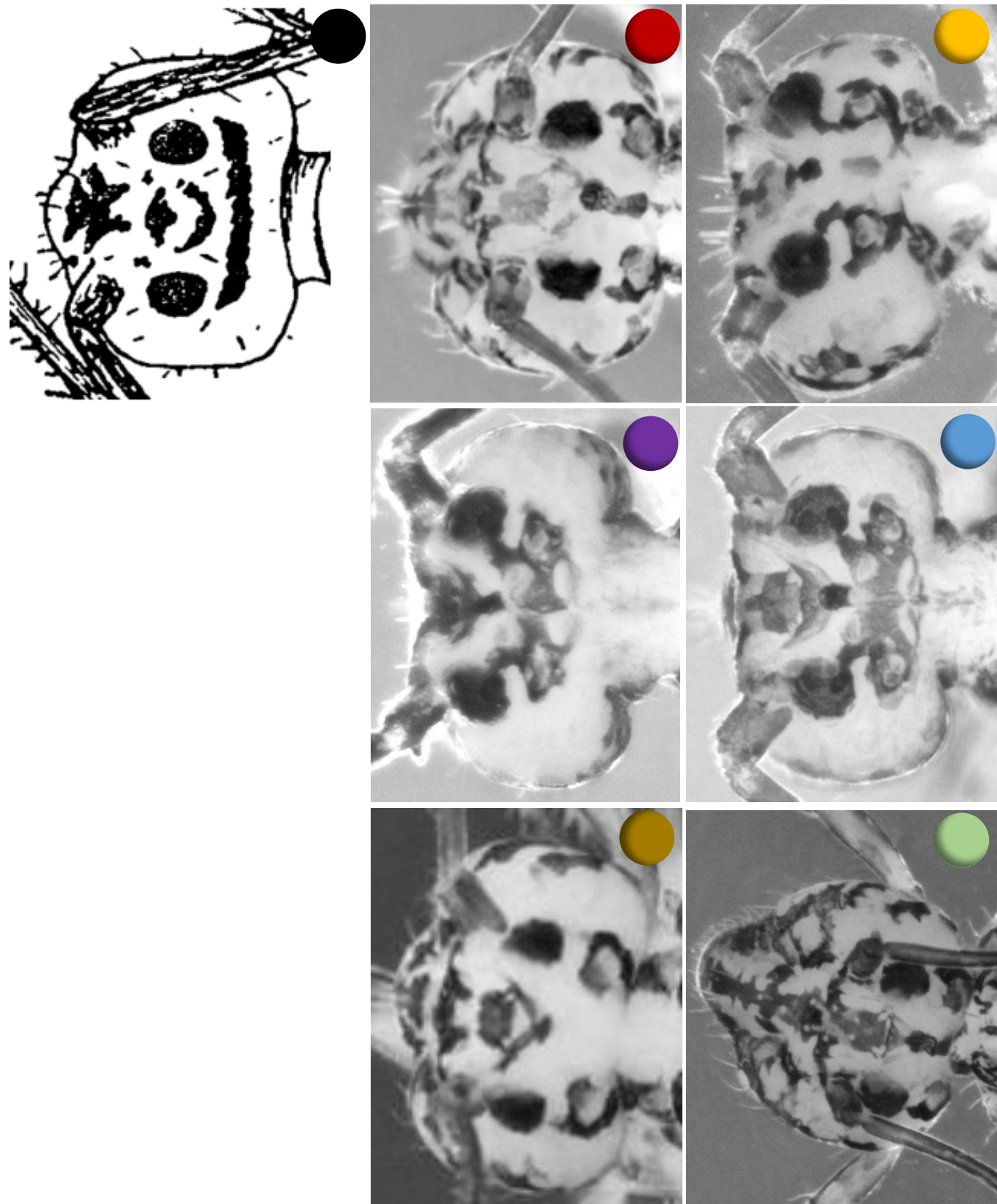


Specimens from main island and Matsu

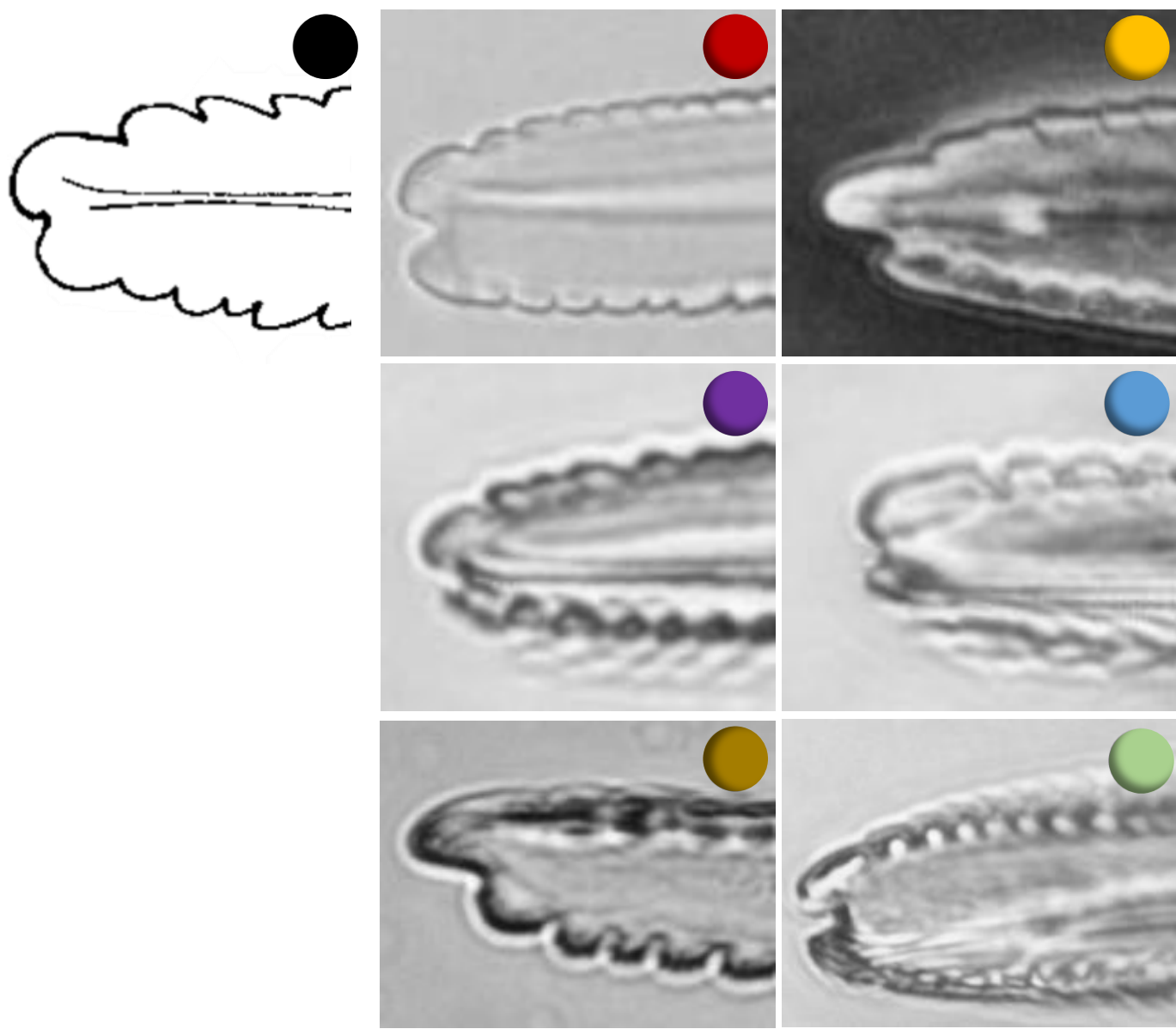


Red: *Ptenothrix* sp.1, yellow: *Ptenothrix* sp.2, purple: *Ptenothrix* sp.3, blue: *Ptenothrix* sp.4, green: *Ptenothrix* sp.7

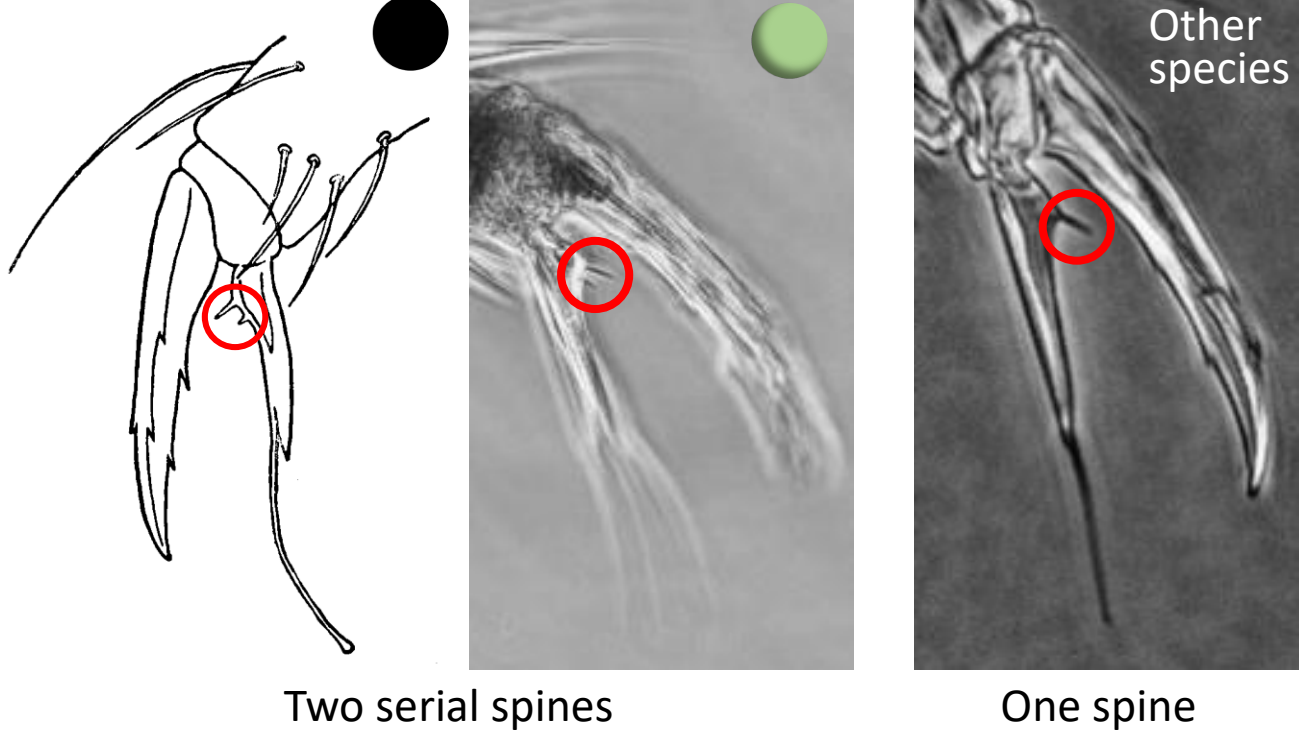
Head vertex color patterns



Shape of mucro tip



Unguiculus spines of claw



Intraspecific and interspecific genetic variations (%)

	sp.1	sp.2	sp.3	sp.4	sp.7	catenata	Papiroides jacobsoni
<i>Ptenothrix</i> sp.1	3-8.7 (n = 9)						
<i>Ptenothrix</i> sp.2	15.9-16.9	0 (n = 2)					
<i>Ptenothrix</i> sp.3	15.7-17.2	14.8-16.1	1.5 (n = 2)				
<i>Ptenothrix</i> sp.4	16.7-19.0	15.0-15.3	11.8-13.4	0.2-0.5 (n = 3)			
<i>Ptenothrix</i> sp.7	24.8-29.1	24.3-24.5	28.4-28.8	27.0-27.2	0 (n = 2)		
<i>P. denticulata</i> var. <i>catenata</i>	15.9-18.6	15.9	15.0-18.0	15.0-15.3	24.8-25.3	1.5 (n = 2)	
<i>Papiroides jacobsoni</i>	17.6-21.0	19.1	21.1	18.6-18.8	27.0	18.2-19.2	0 (n=1)

Genetic distances analyzed with Kimura's two-parameter model. Values with grey background color are intraspecific variations.

References

- Bellinger, PF, Christiansen, KA, Janssens, F. 1996-2023. Checklist of the Collembola of the World. <http://www.collembola.org>
- Cheng, HJ, Janssens, F, Chang, CH. 2022. An updated checklist of Collembola in Taiwan, with DNA barcoding of *Papiroides jacobsoni* Folsom, 1924 (Symphypleona, Dicyrtomidae). ZooKeys, 1123, 123.
- Folsom, J. W. 1899. Japanese Collembola. Part II. American Academy of Arts & Sciences. 34 (9): 261-274.
- Hogg, ID, Hebert, PD. 2004. Biological identification of springtails (Hexapoda: Collembola) from the Canadian Arctic, using mitochondrial DNA barcodes. Canadian Journal of Zoology, 82(5), 749-754.

Acknowledgements

Thanks Yu-Hsiang Ho, Dr. Jing-Fu Tsai, Dr. Mei-Ling Chan, Li-Hong Chen, Wei-tsen Liu, Chieh Kao, Bing-Chih Liou, Hsiang-Yun Lin for helping collect and borrow the samples in this study.

Discussion and Conclusion

- Five *P. denticulata*-like new species; sp.3 and sp.4 could be *P. denticulata*.
- Previously recorded *P. denticulata* in Cheng et al. (2022) is *Ptenothrix* sp.1.
- Specific color patterns and mucro shape are diagnostic characteristics.
- Further sample collections and chaetotaxy examination are needed.
- SEM images will solve the uncertainty and artifacts of slide images.
- Mechanisms of speciation and dispersal need further investigations.
- Overlooking cryptic species has underestimated Collembola diversity.