Supplement 1. Metadata of the specimens illustrated in figures 1–6.

Sihvonen P, Lee KM, Lundsten K-E, Mutanen M. Genomic evidence suggests *Mesapamea remmi* is an imaginary species.

Figures 1A–1E. *Mesapamea remmi* male.

- 1a. adult. FINLAND, U: Hanko, 6640:3270 Tulliniemi, 3-6.7.2007, Lundsten K-E (coll. Lundsten, Espoo, Finland).
- 1b. genitalia. FINLAND, U: Hanko, 6640:3270 Tulliniemi, 3-6.7.2007, Lundsten K-E. Slide Sihvonen 2765 (coll. Lundsten, Espoo, Finland).
- 1c. aedeagus with everted vesica. FINLAND, U: Hanko, 6640:3270 Tulliniemi, 3-6.7.2007, Lundsten K-E. Slide Sihvonen 2765 (coll. Lundsten, Espoo, Finland).
- 1d. cornutus. FINLAND, U: Hanko, 6640:3270 Tulliniemi, 3-6.7.2007, Lundsten K-E. Slide Sihvonen 2765 (coll. Lundsten, Espoo, Finland).
- 1e. clavus. FINLAND, U: Hanko, 6640:3270 Tulliniemi, 3-6.7.2007, Lundsten K-E. Slide Sihvonen 2765 (coll. Lundsten, Espoo, Finland).

Figures 2A–2E. *Mesapamea secalis* male.

- 2a. adult. [FINLAND] Lohja, Mynterlä, 18.7.[19]90 (coll. Lundsten, Espoo, Finland).
- 2b. genitalia. [FINLAND] Lohja, Mynterlä, 18.7.[19]90. Slide Sihvonen 2763 (coll. Lundsten, Espoo, Finland).
- 2c. aedeagus with everted vesica. FINLAND 6692:363, N. Espoo, Nuuksio, Light trap 0165L, 25.07.-02.08.1999, Pekka Malinen leg. Slide Sihvonen 260 (coll. FMNH, Finland).
- 2d. cornutus. FINLAND 6692:363, N. Espoo, Nuuksio, Light trap 0165L, 25.07.-02.08.1999, Pekka Malinen leg. Slide Sihvonen 260 (coll. FMNH, Finland).
- 2e. clavus. FINLAND 6692:363, N. Espoo, Nuuksio, Light trap 0165L, 25.07.-02.08.1999, Pekka Malinen leg. Slide Sihvonen 260 (coll. FMNH, Finland).

Figures 3E–3E. *Mesapamea didyma* male.

- 3a. adult. FINLAND, U: Hanko, 6642:3280 Täktom, 27.7-4.8.2005, Lundsten K-E (coll. Lundsten, Espoo, Finland).
- 3b. genitalia. FINLAND, U: Hanko, 6642:3280 Täktom, 27.7-4.8.2005, Lundsten K-E. Slide Sihvonen 2764 (coll. Lundsten, Espoo, Finland).
- 3c. aedeagus with everted vesica. FINLAND 66893:1915, V: Houtskari, 01.-17.08.1999, Pekka Malinen & Larry Hulden leg. Slide Sihvonen 225 (coll. FMNH, Finland).
- 3d. cornutus. FINLAND 66893:1915, V: Houtskari, 01.-17.08.1999, Pekka Malinen & Larry Hulden leg. Slide Sihvonen 225 (coll. FMNH, Finland).
- 3e. clavus. FINLAND 66893:1915, V: Houtskari, 01.-17.08.1999, Pekka Malinen & Larry Hulden leg. Slide Sihvonen 225 (coll. FMNH, Finland).

Figures 4A–4C. *Mesapamea remmi* female.

- 4a. adult. FIN[LAND]-EK: Virolahti, Hämeenkylä, 6719021:3542548, 10-22.7.2016, Lundsten leg. (coll. Lundsten, Espoo, Finland).
- 4b. genitalia. FIN[LAND]-EK: Virolahti, Hämeenkylä, 6719021:3542548, 10-22.7.2016, Lundsten leg. Slide Sihvonen 2768 (coll. Lundsten, Espoo, Finland).
- 4c. genitalia. FINLAND, U: Hanko, 6640:3269 Uddskatan, 7-16.7.2007, Lundsten K-E. Slide Sihvonen 1119 (coll. Lundsten, Espoo, Finland).

Figures 5A–5B. *Mesapamea secalis* female.

- 5a. adult. [FINLAND] Espoo, Mäkkylä, 25.7.[19]88; 622 (coll. Lundsten, Espoo, Finland).
- 5b. genitalia. [FINLAND] Espoo, Mäkkylä, 25.7.[19]88; 622. Slide Sihvonen 2766 (coll. Lundsten, Espoo, Finland).

Figures 6A–6B. *Mesapamea didyma* female.

- 6a. adult. FINLAND U: Espoo, 6675:3384 Mäkkylä, 27.7-2.8.2007, Lundsten K-E (coll. Lundsten, Espoo, Finland).
- 6b. genitalia. FINLAND U: Espoo, 6675:3384 Mäkkylä, 27.7-2.8.2007, Lundsten K-E. Slide Sihvonen 2767 (coll. Lundsten, Espoo, Finland).

Supplement 2. Metadata of the specimens used in genomic studies.

Sihvonen P, Lee KM, Lundsten K-E, Mutanen M. Genomic evidence suggests *Mesapamea remmi* is an imaginary species.

Sample ID	Binomial without author	Sex	Country	Province	Site	latitude	longitude	Collecting date	Collector	Tissue	Voucher place
MM07063	Mesapamea remmi	F	Finland	Ka	Virolahti	60.5791	27.7660	1.-14.7.2007	Kalle Lundsten	leg	coll. Lundsten, Finland
MM07064	Mesapamea remmi	F	Finland	N	Hanko	59.8078	22.8825	7.-16.7.2007	Kalle Lundsten	leg	coll. Lundsten, Finland
MM07065	Mesapamea remmi	F	Finland	N	Hanko	59.8078	22.8825	7.-16.7.2007	Kalle Lundsten	leg	coll. Lundsten, Finland
MM07066	Mesapamea remmi	F	Finland	N	Tammisaari	59.9982	23.9350	7.-16.7.2007	Kalle Lundsten	leg	coll. Lundsten, Finland
MM07067	Mesapamea remmi	F	Finland	N	Hanko	59.7701	21.8176	20.6.-6.7.2007	Kalle Lundsten	leg	coll. Lundsten, Finland
MM07068	Mesapamea remmi	F	Finland	Ka	Joutseno	61.0580	28.4627	15.-22.7.2007	Kalle Lundsten	leg	coll. Lundsten, Finland
MM07069	Mesapamea remmi	F	Finland	N	Hanko	59.8078	22.8825	20.6.-6.7.2007	Kalle Lundsten	leg	coll. Lundsten, Finland
MM07070	Mesapamea remmi	F	Finland	N	Hanko	59.8078	22.8825	17.-25.7.2007	Kalle Lundsten	leg	coll. Lundsten, Finland
MM07071	Mesapamea remmi	M	Finland	N	Hanko	59.8078	22.8825	17.-25.7.2007	Kalle Lundsten	leg	coll. Lundsten, Finland
MM07072	Mesapamea remmi	F	Finland	Ka	Virolahti	60.5791	27.7660	3.-16.8.2007	Kalle Lundsten	leg	coll. Lundsten, Finland
MM07073	Mesapamea secalella	F	Finland	N	Espoo	60.1699	24.9102	1.-6.8.2007	Kalle Lundsten	leg	coll. Lundsten, Finland
MM07074	Mesapamea secalella	M	Finland	Ka	Joutseno	61.0580	28.4627	15.-22.7.2007	Kalle Lundsten	leg	coll. Lundsten, Finland
MM07075	Mesapamea secalella	F	Finland	N	Hanko	59.8084	22.9002	5.-12.8.2007	Kalle Lundsten	leg	coll. Lundsten, Finland
MM07076	Mesapamea secalella	F	Finland	N	Espoo	60.1699	24.9102	1.-6.8.2007	Kalle Lundsten	leg	coll. Lundsten, Finland
MM07077	Mesapamea secalella	M	Finland	N	Espoo	60.1699	24.9102	1.-6.8.2007	Kalle Lundsten	leg	coll. Lundsten, Finland
MM07078	Mesapamea secalella	F	Finland	N	Espoo	60.1699	24.9102	1.-6.8.2007	Kalle Lundsten	leg	coll. Lundsten, Finland
MM07079	Mesapamea secalis	F	Finland	N	Hanko	59.7701	21.8176	20.6.-6.7.2007	Kalle Lundsten	leg	coll. Lundsten, Finland
MM07080	Mesapamea secalis	M	Finland	Ka	Virolahti	60.5791	27.7660	23.7.-2.8.2007	Kalle Lundsten	leg	coll. Lundsten, Finland
MM07081	Mesapamea secalis	F	Finland	Ka	Virolahti	60.5791	27.7660	23.7.-2.8.2007	Kalle Lundsten	leg	coll. Lundsten, Finland
MM07082	Mesapamea secalis	F	Finland	Ka	Virolahti	60.5791	27.7660	23.7.-2.8.2007	Kalle Lundsten	leg	coll. Lundsten, Finland
MM07083	Mesapamea secalis	M	Finland	N	Tammisaari	59.9982	23.9350	26.7.-4.8.2007	Kalle Lundsten	leg	coll. Lundsten, Finland
MM07084	Mesapamea secalis	F	Finland	Ka	Joutseno	61.0539	28.7958	15.-22.7.2007	Kalle Lundsten	leg	coll. Lundsten, Finland
MM07085	Mesapamea secalella	F	Finland	N	Tammisaari	59.9982	23.9350	26.7.-4.8.2007	Kalle Lundsten	leg	coll. Lundsten, Finland
MM07086	Mesapamea secalis	M	Finland	Ka	Joutseno	61.0580	28.4627	15.-22.7.2007	Kalle Lundsten	leg	coll. Lundsten, Finland

Supplement 3. Sequencing success in studies taxa for mitochondrial COI and seven nuclear genes. GenBank accession numbers provided for successfully amplified genes, "missing" indicates lack of sequence data. Full names for the genes are as follows: COI: cytochrome c oxidase subunit I; EF1a: elongation factor 1 alpha; GAPDH: glyceraldehyde-3-phosphate dehydrogenase; IDH: isocitrate dehydrogenase; MDH: cytosolic malate dehydrogenase; RpS5: ribosomal protein S5; wingless: wingless gene; DDC: DOPA decarboxylase.

Sihvonen P, Lee KM, Lundsten K-E, Mutanen M. Genomic evidence suggests *Mesapamea remmi* is an imaginary species.

[illegible]

Supplement 4. Sequence information in the ddRAD and mitochondrial COI barcode sequencing data matrices. The ddRAD data matrices were generated with different parameters of clustering threshold (*c*) and minimum number of individuals per locus (*m*) value. Data matrices in bold were used for further data analyses.

Sihvonen P, Lee KM, Lundsten K-E, Mutanen M. Genomic evidence suggests *Mesapamea remmi* is an imaginary species.

Matrix	<i>c</i>	<i>m</i>	n loci	SNPs (%)	PIS (%)	Consensus (bp)	Missing (%)
ddRAD_c80m17	80	17	294	753 (1.51)	385 (0.77)	49,772	0
ddRAD_c85m17	85	17	312	803 (1.52)	417 (0.79)	52,830	0
ddRAD_c90m4	90	4	9,402	27,539 (1.82)	11,060 (0.73)	1,512,976	48.4
ddRAD_c90m10	90	10	3,354	12,255 (2.09)	6,213 (1.06)	587,492	22.3
ddRAD_c90m17	90	17	334	894 (1.53)	479 (0.85)	56,514	0
ddRAD_c95m17	95	17	318	667 (1.24)	331 (0.62)	53,665	0
mtDNA barcode	—	—	1	2 (0.33)	2 (0.33)	613	0

PIS, Number of parsimony informative SNPs.

Supplement 5. Maximum likelihood unrooted tree inferred in RAxML based on the most conservative data matrix, which consisted of 894 SNPs and 479 parsimony informative SNPs in 56,514 bp. The tree was inferred with 1,000 bootstrap replicates and the bootstrap values are indicated near branches. The dotted line corresponds to a priori root that was supported by the highest bootstrap value between *M. didyma* and *M. remmi* + *M. secalis*.

Sihvonen P, Lee KM, Lundsten K-E, Mutanen M. Genomic evidence suggests *Mesapamea remmi* is an imaginary species.