

**Nuptial feeding and genital coupling of *Neopanorpa* scorpionflies (Insecta: Mecoptera: Panorpidae) with notal organs of various lengths**

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**Supplementary material**

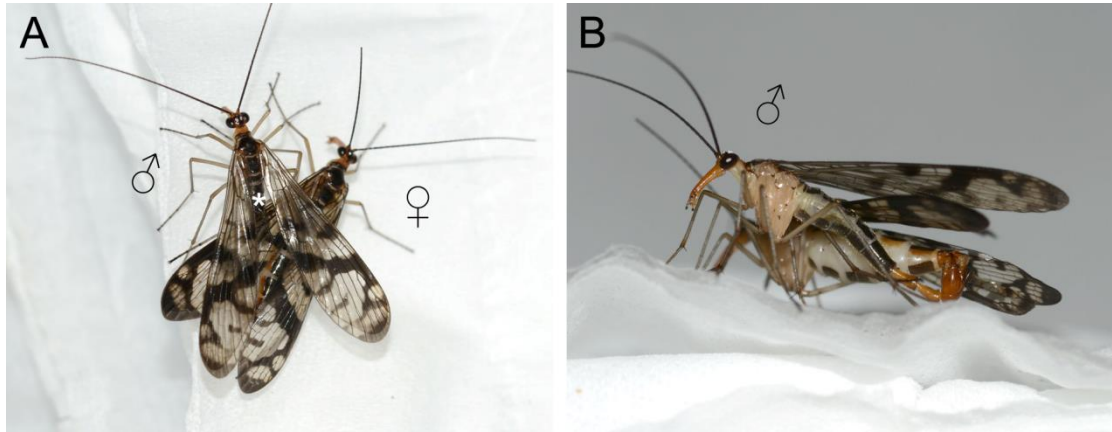


FIGURE S1 Mating process of *Neopanorpa longiprocessa*. a, a male uses the extremely elongated notal organ (\*) to seize the wings of a female; b, the male obtains a coercive mating.

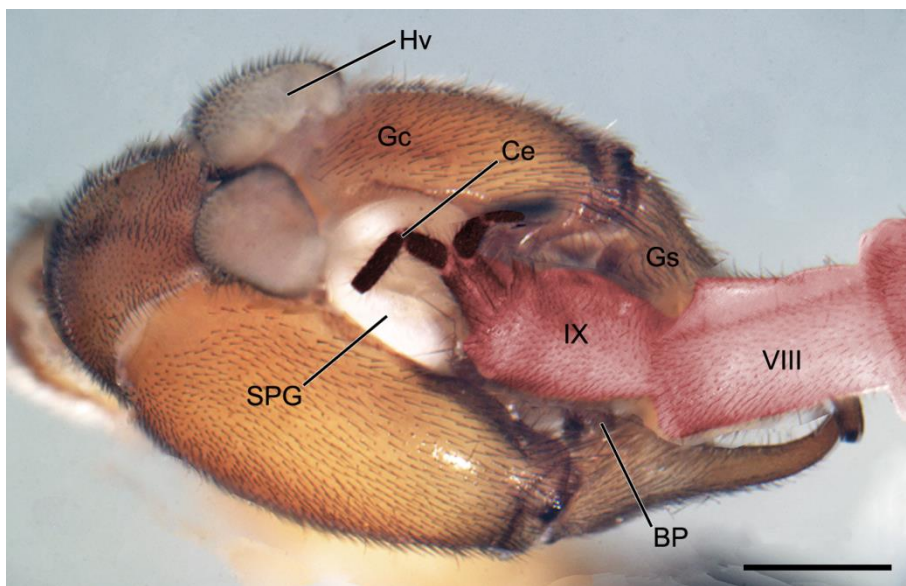


FIGURE S2 Coupling genitalia of *Neopanorpa lui* to show the basal processes grasp the female lateral membranes of the genital segments (the male genital structures are situated on the left, the female on the right; terminal end of female is colored in red). BP, basal process; Ce, cercus; Gc, gonocoxite; Gs, gonostylus; Hv, hypovalve; SPG, sex pheromone glands. Scale bars = 0.5 mm.

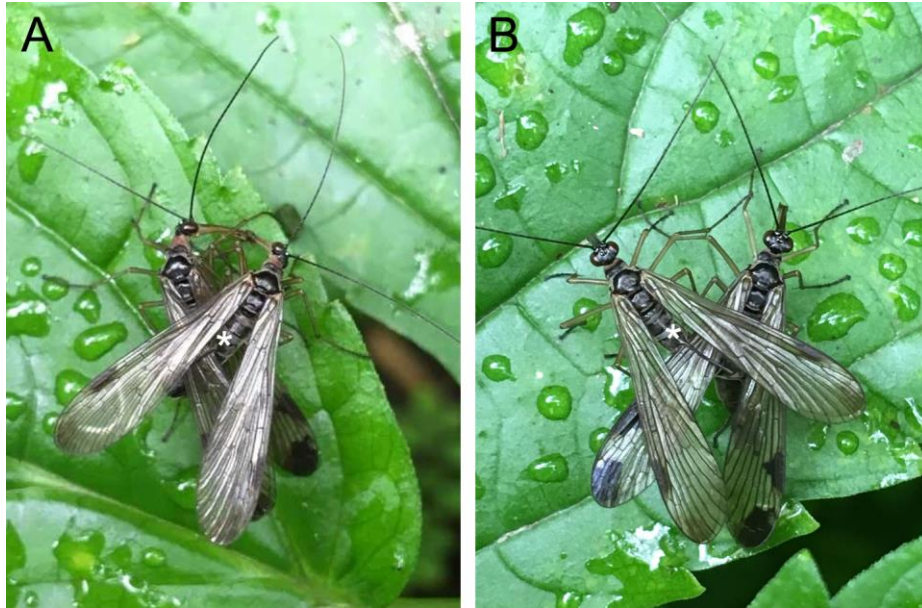


FIGURE S3 Mating process of *Neopanorpa setigera*. a, a male and a female connect their mouthparts to each other to form a mouth-to-mouth mode; b, a male uses the extremely elongated notal organ (\*) to seize the wings of the female and tries to establish a coercive mating (Photo by Gui-Lin Hu).

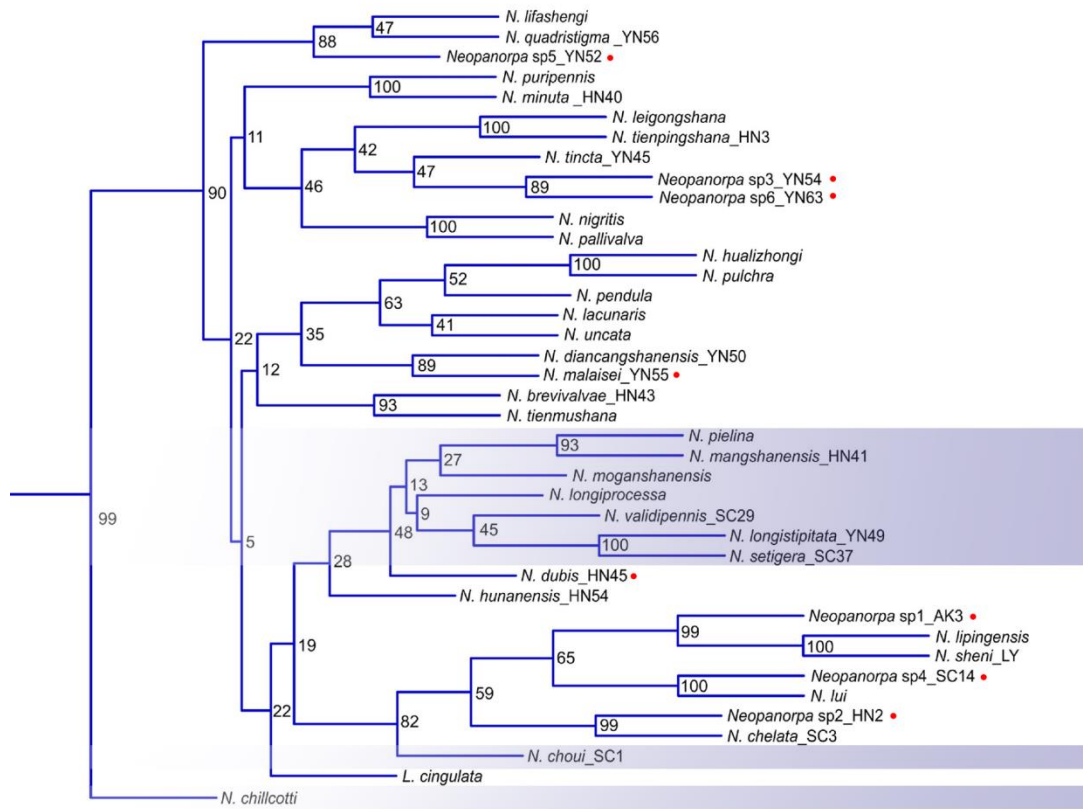


FIGURE S4 An interception of *Neopanorpa* part of the strict consensus tree of Miao et al. (2019) based on combined data of *cox1*, *cox2*, and 28S rRNA. The species with the developed and extremely elongated notal organ are marked in purple. The others species most bear a weakly- or mediumly notal organ. The red dot marks the absence of the information of the length of the notal organ.

TABLE S1 Lengths of the notal organ of 32 species of *Neopanorpa* in the phylogenetic tree of Miao et al. (2019)

Species	Length	Level	Source/references
<i>Neopanorpa brevivalvae</i> Chou & Wang, 1988	Extending to medium portion of A4	Medium-sized	Wang & Hua, 2019b
<i>N. chelata</i> Carpenter, 1938	Extending to medium portion of A4	Medium-sized	Wang & Hua, 2019b
<i>N. choui</i> Cheng, 1949	Extending to medium portion of A8	Extremely developed	Wang & Hua, 2019b
<i>N. chillcotti</i> Byers, 1971	Extending to anterior portion of A5	Developed	Wang & Hua, 2019b
<i>N. diancangshanensis</i> Wang & Hua, 2018	Extending to anterior portion of A4	Weakly-developed	Wang & Hua 2018b
<i>N. hualizhong</i> i Hua & Chou, 1998	Extending to anterior portion of A4	Weakly-developed	Wang & Hua, 2019b
<i>N. hunanensis</i> Huang & Hua, 2005	Extending to medium portion of A4	Medium-sized	Wang & Hua, 2019b
<i>N. lifashengi</i> Hua & Chou, 1999	Extending to anterior portion of A4	Weakly-developed	Wang & Hua, 2019b
<i>N. lipingensis</i> Cai & Hua, 2009	Extending to anterior portion of A4	Weakly-developed	Wang & Hua, 2019b
<i>N. longiprocessa</i> Hua & Chou, 1997	Extending to medium portion of A5	Extremely developed	Wang & Hua, 2019b
<i>N. longistipitata</i> Wang & Hua, 2018	Extending to posterior portion of A6	Extremely developed	Wang & Hua, 2018b
<i>N. lacunaris</i> Navás, 1930	Extending to medium portion of A4	Medium-sized	Wang & Hua, 2018b
<i>N. leigongshana</i> Zhou & Zhou, 2012	Extending to anterior portion of A4	Weakly-developed	Wang & Hua, 2019b
<i>N. lui</i> Chou & Ran, 1981	Extending to anterior portion of A4	Weakly-developed	Wang & Hua, 2019b
<i>N. mangshanensis</i> Chou & Wang, 1988	Extending to anterior portion of A5	Developed	Wang & Hua, 2019b
<i>N. minuta</i> Chou & Wang, 1988	Extending to anterior portion of A4	Weakly-developed	Wang & Hua, 2019b
<i>N. moganshanensis</i> Zhou & Wu, 1993	Extending to posterior portion of A6	Extremely developed	Wang & Hua, 2019b
<i>N. nigritis</i> Carpenter, 1938	Extending to medium portion of A4	Medium-sized	Wang & Hua, 2019b

TABLE S1 Lengths of the notal organ of 32 species of *Neopanorpa* in the phylogenetic tree of Miao et al. (2019) (*cont.*)

species	Length	Level	Resource
<i>N. pallivalva</i> Zhou, 2003	Extending to medium portion of A4	Medium-sized	Wang & Hua, 2019b
<i>N. pendula</i> Qian & Zhou, 2001	Extending to medium portion of A4	Medium-sized	Wang & Hua, 2019b
<i>N. pielina</i> Navás, 1936	Extending to anterior portion of A5	Developed	Wang & Hua, 2019b
<i>N. pulchra</i> Carpenter, 1945	Extending to medium portion of A4	Medium-sized	Wang & Hua, 2019b
<i>N. puripennis</i> Chou & Wang, 1988	Extending to medium portion of A4	Medium-sized	Wang & Hua, 2019b
<i>N. quadristigma</i> Wang & Hua, 2018	Extending to medium portion of A4	Medium-sized	Wang & Hua, 2018b
<i>N. setigera</i> Wang & Hua, 2018	Extending to posterior portion of A6	Extremely developed	Wang & Hua, 2018a
<i>N. sheni</i> Hua & Chou, 1997	Extending to anterior portion of A4	Weakly-developed	Wang & Hua, 2019b
<i>N. tienmushana</i> Cheng, 1957	Extending to anterior portion of A4	Weakly-developed	Wang & Hua, 2019b
<i>N. tienpingshana</i> Chou & Wang, 1988	Extending to medium portion of A4	Medium-sized	Wang & Hua, 2019b
<i>N. tincta</i> Wang & Hua, 2018	Extending to medium portion of A4	Medium-sized	Wang & Hua, 2018b
<i>N. pallivalva</i> Zhou, 2003	Extending to medium portion of A4	Medium-sized	Wang & Hua, 2019b
<i>N. validipennis</i> Cheng, 1949	Extending to anterior portion of A5	Developed	Cheng, 1949
<i>L. cingulata</i> Byers, 1971	Extending to medium portion of A4	Medium-sized	Specimens observation