

**Supplementary material for**

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Article title: **Novel *Metschnikowia* yeasts from the gut of green lacewing (Neuroptera: Chrysopidae) in Japan**

Yuma Yoshihashi<sup>1,2</sup>, Yousuke Degawa<sup>1,3,\*</sup>

<sup>1</sup>Sugadaira Research Station, Mountain Science Center, University of Tsukuba, 1278-294 Sugadaira-kogen, Ueda, Nagano 386-2204, Japan

<sup>2</sup>ORCID: 0000-0002-2672-263X

<sup>3</sup>ORCID: 0000-0002-5955-1187

\* Corresponding author

Yousuke Degawa

e-mail: [degawa@sugadaira.tsukuba.ac.jp](mailto:degawa@sugadaira.tsukuba.ac.jp)

**Table S1** Taxa and their sequences used in the molecular phylogenetic analysis

| species name                                             | strain No.   | 28S        | ITS      |
|----------------------------------------------------------|--------------|------------|----------|
| <i>Clavispora lusitaniae</i>                             | NRRL Y-11827 | U44817.1   |          |
| <i>Clavispora opuntiae</i>                               | NRRL Y-11820 | U44818.1   |          |
| <i>Metschnikowia agaves</i>                              | NRRL Y-17915 | U84243.1   |          |
| <i>Metschnikowia andauensis</i>                          | NRRL Y-48695 | AJ745108.1 |          |
| <i>Metschnikowia anglica</i>                             | NRRL Y-7298  | MG050907.1 |          |
| <i>Metschnikowia australis</i>                           | NRRL Y-17414 | U76526.1   |          |
| <i>Metschnikowia bicuspidata</i> var. <i>bicuspidata</i> | NRRL YB-4993 | U44822.1   |          |
| <i>Metschnikowia bicuspidata</i> var. <i>californica</i> | NRRL Y-17916 | U94944.1   |          |
| <i>Metschnikowia bicuspidata</i> var. <i>chathamia</i>   | NRRL Y-17917 | U84238.1   |          |
| <i>Metschnikowia caudata</i>                             | NRRL Y-63722 | KJ736788.1 |          |
| <i>Metschnikowia chrysomelidarum</i>                     | NRRL Y-27749 | AY520294.2 |          |
| <i>Metschnikowia chrysoperlae</i>                        | NRRL Y-27615 | AY452047.1 | KY104196 |
| <i>Metschnikowia corniflorae</i>                         | NRRL Y-27750 | AY611610.1 |          |
| <i>Metschnikowia danieliae</i>                           | NRRL Y-63945 | HM156539.1 |          |
| <i>Metschnikowia drosophilae</i>                         | NRRL Y-27458 | AF279303.1 |          |
| <i>Metschnikowia fructicola</i>                          | NRRL Y-27328 | AF360542.1 |          |
| <i>Metschnikowia gelsemii</i>                            | NRRL Y-48212 | DQ988046.1 |          |
| <i>Metschnikowia gruessii</i>                            | NRRL Y-17809 | U45737.1   |          |
| <i>Metschnikowia hainanensis</i>                         | NRRL Y-48715 | EU284103.1 |          |
| <i>Metschnikowia hawaiiiana</i>                          | NRRL Y-27473 | AF514293.1 |          |
| <i>Metschnikowia henanensis</i>                          | NRRL Y-63877 | JQ941874.1 |          |
| <i>Metschnikowia kofuensis</i>                           | NRRL Y-27226 | AF158019.1 |          |
| <i>Metschnikowia koreensis</i>                           | NRRL Y-48697 | AF257272.1 |          |
| <i>Metschnikowia krissii</i>                             | NRRL Y-5389  | U45735.1   |          |
| <i>Metschnikowia kunwiensis</i>                          | CBS 9679     | AJ716106.1 |          |
| <i>Metschnikowia lachancei</i>                           | NRRL Y-27242 | AY080995.1 |          |
| <i>Metschnikowia laotica</i>                             | NRRL Y-63934 | JX515978.2 |          |
| <i>Metschnikowia leonuri</i>                             | NRRL Y-6546  | MG050899.1 |          |
| <i>Metschnikowia lopburiensis</i>                        | NRRL Y-63946 | AB697756.1 |          |
| <i>Metschnikowia lunata</i>                              | NRRL Y-7131  | U45733.1   |          |
| <i>Metschnikowia noctiluminum</i>                        | NRRL Y-27753 | AY611609.1 |          |
| <i>Metschnikowia orientalis</i>                          | NRRL Y-27991 | AF313363.1 |          |
| <i>Metschnikowia peoriensis</i>                          | NRRL Y-5942  | MG050902.1 |          |

**Table S1** continued

| species name                      | strain No.   | 28S        | ITS      |
|-----------------------------------|--------------|------------|----------|
| <i>Metschnikowia picachoensis</i> | NRRL Y-27607 | AY452039.1 | AY494781 |
| <i>Metschnikowia pimensis</i>     | NRRL Y-27619 | AY452051.1 | KY102334 |
| <i>Metschnikowia pulcherrima</i>  | NRRL Y-7111  | U45736.1   | KY104205 |
| <i>Metschnikowia rancensis</i>    | NRRL Y-48702 | AJ508580.1 |          |
| <i>Metschnikowia reukaufii</i>    | NRRL Y-7112  | U44825.1   |          |
| <i>Metschnikowia rubicola</i>     | NRRL Y-6064  | MG050901.1 |          |
| <i>Metschnikowia saccharicola</i> | NRRL Y-63894 | AB697755.1 |          |
| <i>Metschnikowia shanxiensis</i>  | NRRL Y-48710 | DQ367883.1 | KY104210 |
| <i>Metschnikowia sinensis</i>     | CBS 10357    |            | KY104211 |
| <i>Metschnikowia torresii</i>     | NRRL Y-6699  | U45731.1   |          |
| <i>Metschnikowia vanudenii</i>    | NRRL Y-17036 | AF017404.1 |          |
| <i>Metschnikowia viticola</i>     | NRRL Y-48693 | AY626892.1 |          |
| <i>Metschnikowia ziziphicola</i>  | NRRL Y-48712 | DQ367882.1 | KY104214 |
| <i>Metschnikowia zobellii</i>     | NRRL Y-5387  | U44823.1   |          |
| <i>Metschnikowia shishimaru</i>   | NBRC 115075  | OQ442554   | OQ457535 |
| <i>Metschnikowia shishimaru</i>   | NBRC 115076  | OQ442550   |          |
| <i>Metschnikowia shishimaru</i>   | NBRC 115077  | OQ442551   |          |
| <i>Metschnikowia kenjo</i>        | NBRC 115071  | OQ442547   |          |
| <i>Metschnikowia kenjo</i>        | NBRC 115072  | OQ442546   |          |
| <i>Metschnikowia kenjo</i>        | NBRC 115073  | OQ442548   |          |
| <i>Metschnikowia seizan</i>       | NBRC 115074  | OQ442549   |          |
| <i>Metschnikowia seizan</i>       | NBRC 115078  | OQ442552   |          |
| <i>Metschnikowia seizan</i>       | NBRC 115079  | OQ442553   |          |
| <i>Metschnikowia seizan</i>       | NBRC 115080  | OQ442555   |          |
| <i>Metschnikowia</i> sp.          | NBRC 115081  | OQ442545   |          |

Table S2. Physiological traits of each strains

|                      | <i>Metschnikowia shishimaru</i> (Clade I) |             | <i>Metschnikowia kenjo</i> (Clade II A) |             |             | <i>Metschnikowia seizan</i> (Clade IIB) |             |             | <i>Metschnikowia</i> sp. (Clade III) |             |
|----------------------|-------------------------------------------|-------------|-----------------------------------------|-------------|-------------|-----------------------------------------|-------------|-------------|--------------------------------------|-------------|
|                      | NBRC 115076                               | NBRC 115077 | NBRC 115071                             | NBRC 115072 | NBRC 115073 | NBRC 115074                             | NBRC 115075 | NBRC 115080 | NBRC 115079                          | NBRC 115081 |
| <b>Carbon source</b> |                                           |             |                                         |             |             |                                         |             |             |                                      |             |
| D-Glucose            | +                                         | +           | +                                       | +           | +           | +                                       | +           | +           | +                                    | +           |
| Galactose            | -                                         | +           | -                                       | -           | -           | -                                       | -           | -           | -                                    | +           |
| L-Sorbose            | -                                         | -           | -                                       | -           | -           | -                                       | -           | +           | -                                    | +           |
| Sucrose              | +                                         | +           | +                                       | +           | +           | +                                       | +           | +           | +                                    | +           |
| Maltose              | +                                         | -           | +                                       | +           | +           | +                                       | +           | +           | +                                    | +           |
| Cellobiose           | -                                         | -           | -                                       | -           | -           | -                                       | -           | -           | -                                    | +           |
| Trehalose            | +                                         | v           | +                                       | +           | +           | +                                       | +           | +           | +                                    | +           |
| Lactose              | -                                         | -           | -                                       | -           | -           | -                                       | -           | -           | -                                    | -           |
| Melibiose            | -                                         | -           | -                                       | -           | -           | -                                       | -           | -           | -                                    | -           |
| Raffinose            | -                                         | -           | -                                       | -           | -           | -                                       | -           | -           | -                                    | -           |
| Melezitose           | +                                         | +           | +                                       | +           | +           | +                                       | +           | +           | +                                    | +           |
| Inulin               | -                                         | -           | -                                       | -           | -           | -                                       | -           | -           | -                                    | -           |
| Soluble starch       | -                                         | -           | -                                       | -           | -           | -                                       | -           | -           | -                                    | w           |
| D-Xylose             | -                                         | -           | -                                       | -           | -           | -                                       | -           | -           | -                                    | +           |
| L-Arabinose          | -                                         | -           | -                                       | -           | -           | -                                       | -           | -           | -                                    | -           |
| D-Arabinose          | -                                         | -           | -                                       | -           | -           | -                                       | -           | -           | -                                    | -           |
| D-Ribose             | +                                         | +           | L                                       | L           | L           | +                                       | +           | +           | v                                    | +           |
| L-Rhamnose           | +                                         | -           | -                                       | -           | -           | -                                       | -           | -           | -                                    | -           |
| Ethanol              | -                                         | -           | -                                       | -           | -           | -                                       | -           | L           | -                                    | L           |
| Glycerol             | +                                         | +           | -                                       | -           | -           | -                                       | w           | +           | -                                    | +           |
| Erythritol           | w                                         | -           | -                                       | -           | -           | -                                       | -           | -           | -                                    | -           |
| Ribitol              | -                                         | +           | -                                       | -           | -           | -                                       | -           | -           | -                                    | L           |
| D-Mannitol           | +                                         | +           | L                                       | L           | +           | +                                       | +           | +           | +                                    | +           |

+: positive; -: negative; w: weak (negative); L: lately positive; na: Not available

Table S2. continued

|                          | <i>Metschnikowia shishimaru</i> (Clade I) |             | <i>Metschnikowia kenjo</i> (Clade II A) |             |             | <i>Metschnikowia seizan</i> (Clade IIB) |             |             | <i>Metschnikowia</i> sp. (Clade III) |             |
|--------------------------|-------------------------------------------|-------------|-----------------------------------------|-------------|-------------|-----------------------------------------|-------------|-------------|--------------------------------------|-------------|
|                          | NBRC 115076                               | NBRC 115077 | NBRC 115071                             | NBRC 115072 | NBRC 115073 | NBRC 115074                             | NBRC 115075 | NBRC 115080 | NBRC 115079                          | NBRC 115081 |
| D-Glucitol/D-Sorbitol    | +                                         | +           | L                                       | L           | +           | +                                       | L           | +           | +                                    | +           |
| Methyl-alpha-D-glucoside | +                                         | +           | +                                       | +           | +           | +                                       | +           | +           | +                                    | +           |
| Salicin                  | -                                         | w           | -                                       | -           | -           | -                                       | -           | +           | -                                    | +           |
| DL-Lactic acid           | -                                         | -           | -                                       | -           | -           | w                                       | -           | -           | w                                    | -           |
| Succinic acid            | -                                         | +           | L                                       | L           | +           | +                                       | +           | +           | +                                    | +           |
| Citric acid              | -                                         | +           | L                                       | +           | +           | +                                       | -           | w           | +                                    | +           |
| myo-Inositol             | w                                         | -           | -                                       | -           | -           | -                                       | -           | +           | -                                    | -           |
| D-Glucosamine            | -                                         | -           | -                                       | -           | -           | -                                       | w           | w           | -                                    | -           |
| Xylitol                  | +                                         | +           | -                                       | -           | -           | w                                       | w           | +           | -                                    | L           |
| n-Hexadecane             | -                                         | -           | -                                       | -           | -           | -                                       | -           | -           | -                                    | L           |
| <b>Nitrogen source</b>   |                                           |             |                                         |             |             |                                         |             |             |                                      |             |
| Ammonium sul fate        | +                                         | +           | +                                       | +           | +           | +                                       | +           | +           | +                                    | +           |
| Potassium nitrate        | -                                         | -           | -                                       | -           | -           | -                                       | -           | -           | -                                    | -           |
| Sodium nitrite           | -                                         | -           | -                                       | -           | -           | -                                       | -           | -           | -                                    | -           |
| Lysine hydrochloride     | -                                         | -           | -                                       | -           | -           | -                                       | -           | +           | -                                    | -           |
| Creatine                 | -                                         | -           | -                                       | -           | -           | -                                       | -           | -           | -                                    | -           |
| Creatinine               | -                                         | -           | -                                       | -           | -           | -                                       | -           | -           | -                                    | -           |
| D-glucosamine            | -                                         | -           | -                                       | -           | -           | -                                       | -           | -           | -                                    | -           |
| <b>Additional tests</b>  |                                           |             |                                         |             |             |                                         |             |             |                                      |             |
| Cycloheximide 0.01%      | -                                         | -           | -                                       | -           | -           | -                                       | -           | -           | -                                    | -           |
| Cycloheximide 0.1%       | -                                         | -           | -                                       | -           | -           | -                                       | -           | -           | -                                    | -           |
| 10% NaCl                 | +                                         | -           | -                                       | -           | -           | -                                       | -           | -           | -                                    | -           |
| Starch formation         | -                                         | -           | -                                       | -           | -           | -                                       | -           | na          | -                                    | -           |
| Fermentation (D-Glucose) |                                           |             |                                         |             |             |                                         |             |             |                                      |             |

+: positive; -: negative; w: weak (negative); L: lately positive; na: Not available;

Table S2 continued

|                      | <i>M. picachoensis</i> <sup>1</sup> | <i>M. pimensis</i> <sup>1</sup> | <i>M. corniflorae</i> <sup>2</sup> |
|----------------------|-------------------------------------|---------------------------------|------------------------------------|
| <b>Carbon source</b> |                                     |                                 |                                    |
| D-Glucose            | +                                   | +                               | +                                  |
| Galactose            | +                                   | +                               | +                                  |
| L-Sorbose            | -                                   | -                               | +                                  |
| Sucrose              | +                                   | +                               | +                                  |
| Maltose              | +                                   | +                               | +                                  |
| Cellobiose           | -                                   | -                               | +                                  |
| Trehalose            | +                                   | +                               | +                                  |
| Lactose              | -                                   | -                               | +                                  |
| Melibiose            | +                                   | -                               | -                                  |
| Raffinose            | -                                   | -                               | +                                  |
| Melezitose           | +                                   | +                               | +                                  |
| Inulin               | -                                   | -                               | -                                  |
| Soluble starch       | -                                   | -                               | -                                  |
| D-Xylose             | -                                   | -                               | +                                  |
| L-Arabinose          | -                                   | -                               | +                                  |
| D-Arabinose          | -                                   | -                               | +                                  |
| D-Ribose             | +                                   | +                               | +                                  |
| L-Rhamnose           | -                                   | -                               | -                                  |
| Ethanol              | -                                   | -                               | +                                  |
| Glycerol             | +                                   | +                               | +                                  |
| Erythritol           | -                                   | -                               | -                                  |
| Ribitol              | +                                   | +                               | +                                  |
| D-Mannitol           | +                                   | +                               | +                                  |

|                          | <i>M. picachoensis</i> <sup>1</sup> | <i>M. pimensis</i> <sup>1</sup> | <i>M. corniflorae</i> <sup>2</sup> |
|--------------------------|-------------------------------------|---------------------------------|------------------------------------|
| D-Glucitol/D-Sorbitol    | +                                   | +                               | +                                  |
| Methyl-alpha-D-glucoside | +                                   | +                               | +                                  |
| Salicin                  | +                                   | +                               | +                                  |
| DL-Lactic acid           | -                                   | -                               | +                                  |
| Succinic acid            | +                                   | +                               | +                                  |
| Citric acid              | V                                   | +                               | +                                  |
| myo-Inositol             | -                                   | -                               | -                                  |
| D-Glucosamine            | +                                   | +                               | +                                  |
| Xylitol                  | +                                   | +                               | na                                 |
| n-Hexadecane             | na                                  | na                              | na                                 |
| <b>Nitrogen source</b>   |                                     |                                 |                                    |
| Ammonium sulfate         | na                                  | na                              | na                                 |
| Potassium nitrate        | -                                   | -                               | -                                  |
| Sodium nitrite           | -                                   | -                               | -                                  |
| Lysine hydrochloride     | -                                   | -                               | +                                  |
| Creatine                 | -                                   | -                               | -                                  |
| Creatinine               | -                                   | -                               | -                                  |
| D-glucosamine            | -                                   | -                               | w                                  |
| <b>Additional tests</b>  |                                     |                                 |                                    |
| Cycloheximide 0.01%      | -                                   | -                               | -                                  |
| Cycloheximide 0.1%       | -                                   | -                               | -                                  |
| 10% NaCl                 | na                                  | na                              | +                                  |
| Starch formation         | -                                   | -                               | -                                  |
| Fermentation (D-Glucose) | +                                   | +                               | +                                  |

+: positive; -: negative; w: weak (negative); L: lately positive; na: Not available; <sup>1</sup>Suh et al. (2004), <sup>2</sup>Nguyen et al. (2006)