

Article

Selectivity of Entomopathogenic Fungi to *Chrysoperla externa* (Neuroptera: Chrysopidae)

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Figure S1: Mortality of entomopathogens bioassay on the larval stage of *Chrysoperla externa*. (A) first instar of *Chrysoperla externa*; (B) second instar of *Chrysoperla externa*; (C) third instar of *Chrysoperla externa*. (Images recorded with 13 Mpx camera. Surfboard (A, B and C), with the aid of a stereoscopic microscope with a magnification of 20×).



Figure S2: Mortality Confirmed. (A) Larva of *Chrysoperla externa* dead after 120 h, treatment with *B. bassiana*; (B) larvae after the surface disinfection process; (C) Larvae over humid chamber containing sterile cotton moistened with distilled water to provide mycelial growth; (D) Storage of humid chambers in B.O.D. at 25 ± 1 °C, (RH) $70 \pm 10\%$ and 12 hour photoperiod (L:D). (Images recorded with 13 Mpx camera. With the aid of a stereoscopic microscope with a magnification of 20 \times).

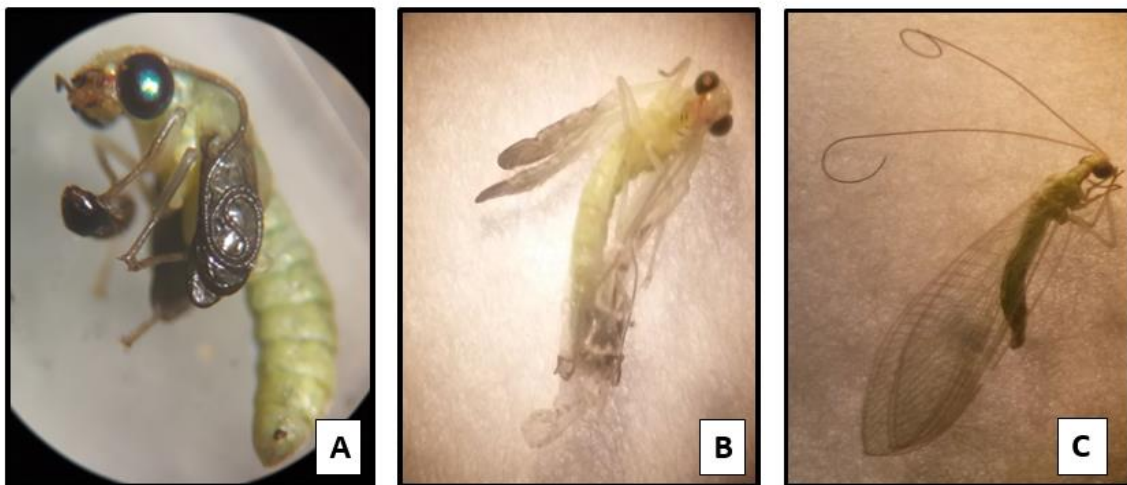


Figure S3: Visual scale for viability or deformity of *Chrysoperla externa*. (A and B) Insects with wing and antenna deformity patterns; (C) Viable insect. (Images recorded with 13 Mpx camera. With the aid of a stereoscopic microscope with a magnification of 20 \times).

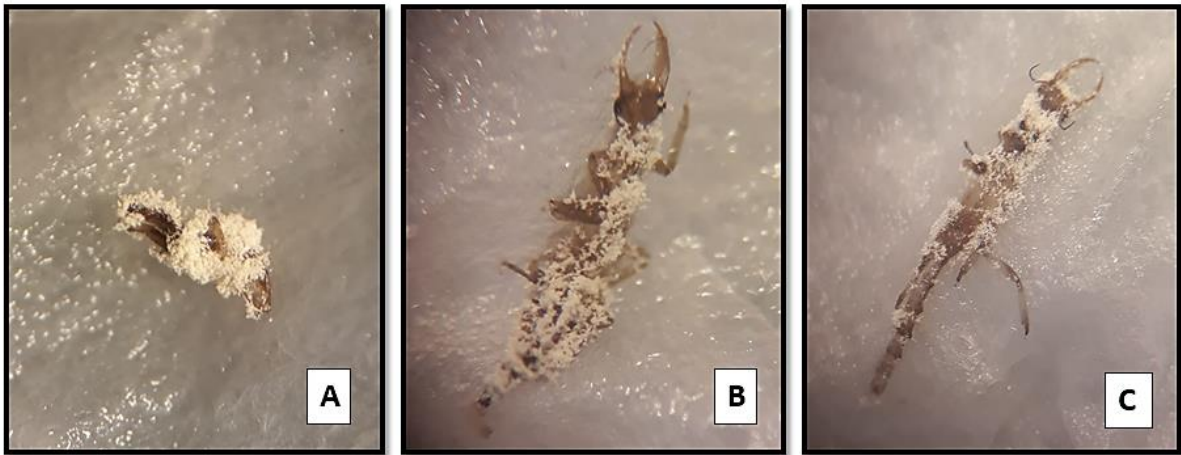


Figure S4: Conidiogenesis of *Beauveria bassiana* (ESALQ PL63 strain), on cadavers of *Chrysoperla externa* with mortality at 120 hours after application. (A) confirmed mortality by the fungus *Beauveria bassiana* (1×10^7 con.mL⁻¹), (D.A.), on dead bodies of second instar of *Chrysoperla externa*, 5 days after mortality; (B) Conidiogenesis on third instar larvae, 3 days after the death (1×10^8 con.mL⁻¹), (D.O.); (C) conidiogenesis of *Beauveria bassiana* (1×10^9 con.mL⁻¹), (D.A.), on dead bodies of third instar, 3 days after death. (Images recorded with 13 Mpx camera. With the aid of a stereoscopic microscope with a magnification of 20×).



Figure S5: Emergence of *Chrysoperla externa* after application of treatments on third instar larvae. (A) The emergence of *C. externa*, treatment with *B. bassiana* (1×10^9 conidia mL⁻¹) (D.F.); (B) Imago of *C. externa*, treatment with *M. anisopliae* (1×10^9 conidia.mL⁻¹) (D.F.), highlighted the antennae and the golden eyes, characteristic of the group green lacewing; (C) adults of *C. externa*, regular size, control treatment (D.A.). (Images recorded with 13 Mpx camera. With the aid of a stereoscopic microscope with a magnification of 20×).

3.1. Mortality of *C. externa* Larvae

Table S1: Summary of ANOVA (values of mean square) of the mortality of first instar larvae of *C. externa* after application of entomopathogenic fungi *B. bassiana*, *M. anisopliae* and *M. rileyi* (T: 25 ± 1 °C, RH of 70 ± 10% and photoperiod of 12 hours (L:D)).

| SV | DF | 24 hours | 48 hours | 72 hours | 96 hours | 120 hours |
|-------------------|-----|--------------------|--------------------|--------------------|--------------------|--------------------|
| Product (P) | 3 | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 1.40* |
| Application (A) | 1 | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.08 ^{ns} |
| Concentration (C) | 3 | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.21 ^{ns} |
| PxA | 3 | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.03 ^{ns} |
| PxC | 9 | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.02 ^{ns} |
| AxC | 3 | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} |
| PxAxC | 9 | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.01 ^{ns} |
| Residue | 580 | 0.03 | 0.03 | 0.03 | 0.03 | 0.01 |

* significant at 5% probability by F-test; ns: not-significant at 5% probability by F-test. SV: source of variation; DF: degrees of freedom; Numbers are F-values.

Table S2: Summary of ANOVA (values of mean square) of the mortality of second instar larvae of *C. externa* after application of entomopathogenic fungi *B. bassiana*, *M. anisopliae* and *M. rileyi* (T: 25 ± 1 °C, RH of 70 ± 10% and photoperiod of 12 hours (L:D)).

| SV | DF | 24 hours | 48 hours | 72 hours | 96 hours | 120 hours |
|-------------------|-----|--------------------|--------------------|--------------------|--------------------|--------------------|
| Product (P) | 3 | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.80* |
| Application (A) | 1 | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.01 ^{ns} |
| Concentration (C) | 3 | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.01 ^{ns} |
| PxA | 3 | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} |
| PxC | 9 | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.01 ^{ns} |
| AxC | 3 | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.01 ^{ns} |
| PxAxC | 9 | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.06 ^{ns} |
| Residue | 580 | 0.03 | 0.03 | 0.03 | 0.03 | 0.07 |

* significant at 5% probability by F-test; ns: not-significant at 5% probability by F-test. SV: source of variation; DF: degrees of freedom; Numbers are F-values.

Table S3: Summary of ANOVA (values of mean square) of the mortality of third instar larvae of *C. externa* after application of entomopathogenic fungi *B. bassiana*, *M. anisopliae* and *M. rileyi* (T: 25 ± 1 °C, RH of 70 ± 10% and photoperiod of 12 hours (L:D)).

| SV | | 24 hours | 48 hours | 72 hours | 96 hours | 120 hours |
|--------------------------|-----|--------------------|--------------------|--------------------|--------------------|--------------------|
| Product (P) | 3 | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.15* |
| Application (A) | 1 | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.41 ^{ns} |
| Concentration (C) | 3 | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.46 ^{ns} |
| PxA | 3 | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.01 ^{ns} |
| PxC | 9 | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.03 ^{ns} |
| AxC | 3 | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} |
| PxAxC | 9 | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.00 ^{ns} | 0.18 ^{ns} |
| Residue | 580 | 0.03 | 0.03 | 0.03 | 0.03 | 0.05 |

* significant at 5% probability by F-test; ns not-significant at 5% probability by F-test. SV: source of variation; DF: degrees of freedom; Numbers are F-values.

3.2. Change of Stage of *C. externa* Larvae

Table S4: Summary of ANOVA (values of mean square) of the duration of first instar larvae of *C. externa* after application of the entomopathogenic fungi *B. bassiana*, *M. anisopliae* and *M. rileyi* (T: 25 ± 1 °C, RH of 70 ± 10% and photoperiod of 12 hours (L:D)).

| SV | DF | 24 hours | 48 hours | 72 hours | 96 hours | 120 hours |
|-------------------|-----|--------------------|--------------------|--------------------|--------------------|--------------------|
| Product (P) | 3 | 0.00 ^{ns} | 6.59* | 4.35* | 1.27* | 1.65* |
| Application (A) | 1 | 0.00 ^{ns} | 0.13 ^{ns} | 0.01 ^{ns} | 0.10 ^{ns} | 0.20 ^{ns} |
| Concentration (C) | 3 | 0.00 ^{ns} | 0.05 ^{ns} | 0.23 ^{ns} | 0.27 ^{ns} | 0.48* |
| PxA | 3 | 0.00 ^{ns} | 0.12 ^{ns} | 0.34 ^{ns} | 0.18 ^{ns} | 0.24 ^{ns} |
| PxC | 9 | 0.00 ^{ns} | 0.12 ^{ns} | 0.46 ^{ns} | 0.28 ^{ns} | 0.11 ^{ns} |
| AxC | 3 | 0.00 ^{ns} | 0.02 ^{ns} | 0.11 ^{ns} | 0.18 ^{ns} | 0.15 ^{ns} |
| PxAxC | 9 | 0.00 ^{ns} | 0.03 ^{ns} | 0.04 ^{ns} | 0.05 ^{ns} | 0.06 ^{ns} |
| Residue | 580 | 0.03 | 0.12 | 0.17 | 0.21 | 0.12 |

* significant at 5% probability by F-test; ns: not-significant at 5% probability by F-test. SV: source of variation; DF: degrees of freedom; Numbers are F-values.

Table S5: Summary of ANOVA (values of mean square) of the duration of second instar larvae of *C. externa* after application of the entomopathogenic fungi *B. bassiana*, *M. anisopliae*, and *M. rileyi* (T: 25 ± 1 °C, RH of 70 ± 10% and photoperiod of 12 hours (L:D)).

| SV | GL | 24 hours | 48 hours | 72 hours | 96 hours | 120 hours |
|-------------------|-----|--------------------|--------------------|--------------------|--------------------|--------------------|
| Product (P) | 3 | 0.00 ^{ns} | 0.26 ^{ns} | 0.71* | 0.63* | 0.00 ^{ns} |
| Application (A) | 1 | 0.00 ^{ns} | 0.02 ^{ns} | 0.00 ^{ns} | 0.02 ^{ns} | 0.00 ^{ns} |
| Concentration (C) | 3 | 0.00 ^{ns} | 0.06 ^{ns} | 0.21 ^{ns} | 0.24 ^{ns} | 0.00 ^{ns} |
| PxA | 3 | 0.00 ^{ns} | 0.25 ^{ns} | 0.39 ^{ns} | 0.24 ^{ns} | 0.00 ^{ns} |
| PxC | 9 | 0.00 ^{ns} | 0.10 ^{ns} | 0.09 ^{ns} | 0.04 ^{ns} | 0.00 ^{ns} |
| AxC | 3 | 0.00 ^{ns} | 0.11 ^{ns} | 0.01 ^{ns} | 0.15 ^{ns} | 0.00 ^{ns} |
| PxAxC | 9 | 0.00 ^{ns} | 0.07 ^{ns} | 0.10 ^{ns} | 0.07 ^{ns} | 0.00 ^{ns} |
| Residue | 580 | 0.03 | 0.14 | 0.23 | 0.23 | 0.03 |

* significant at 5% probability by F-test; ns: not-significant at 5% probability by F-test. SV: source of variation; DF: degrees of freedom; Numbers are F-values.

Table S6: Summary of ANOVA (values of mean square) of the duration of third instar larvae of *C. externa* after application of the entomopathogenic fungi *B. bassiana*, *M. anisopliae*, *M. rileyi* (T: 25 ± 1 °C, RH of 70 ± 10% and photoperiod of 12 hours (L:D)).

| SV | DF | 24 hours | 48 hours | 72 hours | 96 hours | 120 hours |
|-------------------|-----|--------------------|--------------------|--------------------|--------------------|--------------------|
| Product (P) | 3 | 0.00 ^{ns} | 0.00 ^{ns} | 1.21* | 2.97* | 4.12* |
| Application (A) | 1 | 0.00 ^{ns} | 0.00 ^{ns} | 0.32* | 0.02 ^{ns} | 1.50 ^{ns} |
| Concentration (C) | 3 | 0.00 ^{ns} | 0.00 ^{ns} | 0.72* | 3.68* | 1.54* |
| PxA | 3 | 0.00 ^{ns} | 0.00 ^{ns} | 0.20 ^{ns} | 0.00 ^{ns} | 1.07 ^{ns} |
| PxC | 9 | 0.00 ^{ns} | 0.00 ^{ns} | 0.12 ^{ns} | 1.07 ^{ns} | 0.47 ^{ns} |
| AxC | 3 | 0.00 ^{ns} | 0.00 ^{ns} | 0.06 ^{ns} | 0.12 ^{ns} | 1.43 ^{ns} |
| PxAxC | 9 | 0.00 ^{ns} | 0.00 ^{ns} | 0.03 ^{ns} | 0.19 ^{ns} | 0.42 ^{ns} |
| Residue | 580 | 0.03 | 0.03 | 0.07 | 0.20 | 0.64 |

* significant at 5% probability by F-test; ns: not-significant at 5% probability by F-test. SV: source of variation; DF: degrees of freedom; Numbers are F-values.

Table S7: Summary of ANOVA (values of mean square) of the duration of third instar larvae and pupae of *C. externa* after application of the entomopathogenic fungi *B. bassiana*, *M. anisopliae*, *M. rileyi* (T: 25 ± 1 °C, RH of $70 \pm 10\%$ and photoperiod of 12 hours (L:D)).

| SV | DF | 148 hours | 164 hours | Pupae |
|-------------------|-----|--------------------|--------------------|--------------------|
| Product (P) | 3 | 4.98* | 4.12* | 3.44 ^{ns} |
| Application (A) | 1 | 2.40 ^{ns} | 1.50 ^{ns} | 0,54 ^{ns} |
| Concentration (C) | 3 | 1.26 ^{ns} | 0.87 ^{ns} | 0.75 ^{ns} |
| PxA | 3 | 1.36 ^{ns} | 1.07 ^{ns} | 0.28 ^{ns} |
| PxC | 9 | 0.57 ^{ns} | 0.47 ^{ns} | 0.52 ^{ns} |
| AxC | 3 | 1.34 ^{ns} | 1.43 ^{ns} | 1.27 ^{ns} |
| PxAxC | 9 | 0.28 ^{ns} | 0.42 ^{ns} | 0.87 ^{ns} |
| Residue | 580 | 0.65 | 0.64 | 1.68 |

* significant at 5% probability by F-test; ns: not-significant at 5% probability by F-test. SV: source of variation; DF: degrees of freedom; Numbers are F-values.



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