

Table S1. Sequences of PCR primers, PCR conditions, amplicon length, and accession numbers used in this study.

| Gene | Forward primer | Reverse primer | PCR conditions | Amplicon length | NCBI accession number | Reference |
|----------------------------|------------------------------------|-------------------------------------|--|-----------------|-----------------------|--|
| <i>RpS5</i> | 5'AATTATTTGGTCGCTG GAATTG | 5'TAACGTCCAGCAGAATG TGGTA | Denaturation and annealing: 10 cycles at 94°C 15 s, 61.8°C 30 s, 72°C 45 s; followed by 20 cycles at 94°C 15 s, 61°C 30 s, 72°C 50 s Extension: 72°C for 7 min | 115 bp | XM_006570237.3 | Hamiduzzman et al., 2010 |
| 16s rRNA <i>N. ceranae</i> | 5'CGGCGACGATGTGATA TGAAAATATTAA | 5'CCCGGTCATTCTCAAAC AAAAAACCG | | 218 bp | KX024757.1 | Hamiduzzman et al., 2010 |
| 16s rRNA <i>N. apis</i> | 5'GGGGGCATGTCTTTGA CGTACTATGTA | 5'GGGGGGCGTTTAAATG TGAAACAACTATG | | 321 bp | JQ639301.1 | Hamiduzzman et al., 2010 |
| DWV polyprotein | 5'ATCAGCGCTTAGTGGA GGAA | 5'CATAGATATCAGTCAAC GGAGC | Incubation: 94°C 3 min Denaturation and annealing: 35 cycles at 94°C 30 s, 58°C 60 s, 72°C 60 s Extension: 72°C for 10 min | 642 bp | AJ489744.2 | Chen et al., 2005; Guzman-Novoa et al., 2012 |
| BQCV polyprotein | 5'GGACGAAAGGAAGCCT AAAC | 5'GGTGCAAGTCTCTTCTTA GT | Incubation: 94°C 3 min Denaturation and annealing: 35 cycles at 94°C 30 s, 55°C 60 s, 72°C 60 s Extension: 72°C for 10 min | 424 | AF183905.1 | Tentcheva et al., 2004 |
| IAPV | 5'AGACACCAATCACGGA CCTCAC | 5'GAGATTGTTGAGAGGG GTGG | Incubation: 94°C 3 min Denaturation and annealing: 35 cycles at 94°C 30 s, 55°C 60 s, 72°C 60 s Extension: 72°C for 10 min | 138 bp | EF219380 | Maori et al., 2009 |
| CBPV | 5'CTCTAACGCCATTTGC GAGC | 5'CGGTGGTCTCGTTCTTGA CA | Incubation: 94°C 3 min Denaturation and annealing: 35 cycles at 94°C 30 s, 55°C 60 s, 72°C 60 s Extension: 72°C for 10 min | 456 bp | MF175173.1 | This lab |
| DWV helicase | 5'GCGCTTAGTGAGGAA ATGAA | 5'GCACCTACGCGATGTAA ATCTG | Incubation: 95°C for 10 min Denaturation and annealing: 40 cycles at 95°C 15s, 60°C 60 s Extension: 68°C for 7 min | 69 bp | AJ489744.2 | Di Prisco et al., 2013 |
| BQCV | 5'GGTGCGGGAGATGATA TGGA | 5'GCCGTCTGAGATGCATG AATAC | Incubation: 95°C for 10 min Denaturation and annealing: 40 cycles at 95°C 15s, 60°C 60 s Extension: 68°C for 7 min | 71 bp | AF183905.1 | Chantawannakul et al., 2006 |
| <i>Cytochrome b</i> | 5'TATGTACTACCATGAG GACAAATATC | 5'ATTACACCTCCTAATTTA TTAGGAAT | Incubation: 94°C for 3 min Denaturation and annealing: 30 cycles at 94°C 15 s, 50°C 15 s, 68°C 5 s Extension: 72°C for 10 min | 485 bp | OM203348.1 | Crozier et al., 1991 |

References cited in Table S1

- Chantawannakul, P., Ward, L., Boonham, N., Brown, M. (2006). A scientific note on the detection of honeybee viruses using real-time PCR (TaqMan) in *Varroa* mites collected from a Thai honeybee (*Apis mellifera*) apiary. *J. Invertebr. Pathol.*, 91(1), 69-73.
- Chen, Y. P., Higgins, J. A., Feldlaufer, M. F. (2005). Quantitative real-time reverse transcription-PCR analysis of deformed wing virus infection in the honeybee (*Apis mellifera* L.). *Appl. Environ. Microbiol.*, 71(1), 436-441.
- Crozier, Y. C., Koulianos, S., Crozier, R. H. (1991). An improved test for Africanized honeybee mitochondrial DNA. *Experientia*, 47(9), 968-969.
- Di Prisco, G., Cavaliere, V., Annoscia, D., Varricchio, P., Caprio, E., Nazzi, F., Gargiulo G., Pennacchio, F. (2013). Neonicotinoid clothianidin adversely affects insect immunity and promotes replication of a viral pathogen in honey bees. *Proc. Nat. Acad. Sci.*, 110(46), 18466-18471.

- Guzman-Novoa, E., Hamiduzzaman, M. M., Espinosa-Montaña, L. G., Correa-Benítez, A., Anguiano-Baez, R., Ponce-Vázquez, R. (2012). First detection of four viruses in honey bee (*Apis mellifera*) workers with and without deformed wings and *Varroa destructor* in Mexico. *J. Apic. Res.*, 51, 342-346.
- Hamiduzzaman, M. M., Guzman-Novoa, E., Goodwin, P. H. (2010). A multiplex PCR assay to diagnose and quantify *Nosema* infections in honey bees (*Apis mellifera*). *J. Invertebr. Pathol.*, 105(2), 151-155.
- Li, B., Deng, S., Yang, D., Hou, C., Diao, Q. (2017). Complete sequences of the RNA 1 and RNA 2 segments of chronic bee paralysis virus strain CBPV-BJ detected in China. *Arch. Virol.*, 162(8), 2451-2456.
- Maori, E., Paldi, N., Shafir, S., Kalev, H., Tsur, E., Glick, E., Sela, I. (2009). IAPV, a bee-affecting virus associated with Colony Collapse Disorder can be silenced by dsRNA ingestion. *Insect Mol. Biol.*, 18(1), 55-60.
- Morfin, N., Gashout, H. A., Macías-Macías, J. O., De la Mora, A., Tapia-Rivera, J. C., Tapia-González, J. M., Contreras-Escareño, F., Guzman-Novoa, E. (2020a). Detection, replication and quantification of deformed wing virus-A, deformed wing virus-B, and black queen cell virus in the endemic stingless bee, *Melipona colimana*, from Jalisco, Mexico. *Int. J. Tropic. Insect Sci.*, 1-8.
- Morfin, N., Given, K., Evans, M., Guzman-Novoa, E., Hunt, G. J. (2020b). Grooming behavior and gene expression of the Indiana “mite-biter” honey bee stock. *Apidologie*, 51(2), 267-275.
- Tentcheva, D., Gauthier, L., Zappulla, N., Dainat, B., Cousserans, F., Colin, M. E., Bergoin, M. (2004). Prevalence and seasonal variations of six bee viruses in *Apis mellifera* L. and *Varroa destructor* mite populations in France. *Appl. Environ. Microbiol.*, 70(12), 7185-7191.
- Thompson G. J., Yockey H, Lim J., Oldroyd B. P. (2007). Experimental manipulation of ovary activation and gene expression in honey bee (*Apis mellifera*) queens and workers: testing hypotheses of reproductive regulation. *J. Exp. Zool.*, 307A: 600-610.