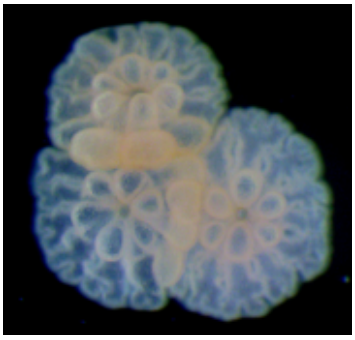
EATLAS DATA CATALOGUE (AIMS)



Toxicity of three insecticides and two fungicides to Acropora tenuis coral larvae (NESP 3.1.5, AIMS)

Metadata | Metadata (XML)
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Title	Toxicity of three insecticides and two fungicides to Acropora tenuis coral larvae (NESP 3.1.5, AIMS)
Date	2020-02-26
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Abstract	This dataset shows the effects of three insecticides (diazinon, fipronil, imidacloprid) and two fungicides (chlorothalonil, propiconazole) on larval metamorphosis in the coral Acropora tenuis. These five pesticides have been detected in the Great Barrier Reef lagoon and/or catchments. Settlement assays were conducted in Nov-Dec 2016 and Nov 2017. The aim of this research is to add toxicity data for inclusion into water quality guidelines. In order to improve water quality guidelines and subsequent risk assessments for pesticides in tropical marine ecosystems, the current study investigated the effects of three insecticides (diazinon, fipronil, imidacloprid) and two fungicides (chlorothalonil and propiconazole) on larval settlement and metamorphosis of the common reef-building coral Acropora tenuis larvae following 48 h exposures. Concentration-response curves were plotted to estimate no effect concentration (NEC) and effect concentration (ECx) values that inhibited larval settlement by 10% and 50% (EC10 and EC50, respectively). NEC is the concentration below which the pesticides are not expected to cause a reduction in larval metamorphosis. Methods: Gravid colonies (25-40 cm diameter) of the coral Acropora tenuis (Dana, 1846) were collected from 4 – 8 m depth in November 2016 from Trunk Reef (18°18.2’ S, 146°52.2’ E) and in November 2017 from Falcon Island (18°46’ S, 146°32’ E), GBR under Great Barrier Reef Marine Park Authority Permit G12/35236.1. Colonies were transported to the National Sea Simulator at the Australian Institute of Marine Science (AIMS) in Townsville and maintained in 1700 l flow-through holding tanks until spawning. Temperatures were held at 26-27°C, which was equivalent to the water temperature at the collection site. Gametes were collected from 8 parental colonies on each occasion, fertilised and symbiont-free larvae were cultured at approximately 500 larvae L-1 in 500 L flow-through tanks (Negri and Heyward, 2001, Nordborg et al., 2018). Larvae were competent to settle after 5 d and we used 7-10-day old A. tenuis larvae, each 800-1000 µm in length for consistency in the pesticide exposure experiments. The five pesticides in this study were > 98% pure and purchased from Sigma-Aldrich (NSW, Australia). Stock solutions (5 mg l-1) of all pesticides were dissolved in dimethyl sulfoxide (DMSO, final concentration < 0.01% (v/v) in exposures) and prepared in milli-Q water. A. tenuis larvae were exposed to diazinon (2.62 – 638 µg l-1), fipronil (1.57 – 1144 µg l-1), imidacloprid (3.88 – 947 µg l-1), chlorothalonil (0.69 – 507 µg l-1) and propiconazole (8.42 – 2053 µg l-1). Pesticide analyses were done by The University of Queensland, Queensland Alliance for Environmental Health Sciences (QAEHS), Woolloongabba, Australia.

Static exposures were conducted in 20 mL glass scintillation vials containing 12-14 larvae made up to 10 mL filtered seawater (0.5 µm) with 6-7 concentrations (per pesticide) and 6 replicate vials per concentration. All tests included solvent controls containing identical concentrations of DMSO carrier. Seawater and solvent carrier controls were run in 12-18 replicate vials. Copper ($CuCl_2$) was used as a reference toxicant at 6 concentrations between 1.12 – 36 µg L^{-1} and 6 replicate vials per concentration. Glass vials were transferred in random positions within a refrigerated shaking incubator (TLM-530, Thermoline Scientific) at 70 RPM to maintain gentle water movement which prevents larvae from attaching and undergoing metamorphosis in the containers (Negri et al., 2016). Larvae were exposed under a light intensity of approximately 60 µmol photons m^{-2} s^{-1} (12:12 h L:D cycle) and at 26.7 ± 0.7 °C (range). Vials were re-randomised at 24 h. After 48 h exposure larvae and treatment water were transferred into 6-well polystyrene culture plates (Nunc, NY, USA) and returned to the incubator but without water movement. Metamorphosis was initiated by the addition of crustose coralline algae (CCA) extract (10 µL) prepared from 4 g CCA Porolithon onkodes (Heyward and Negri, 1999, Negri et al., 2005). Metamorphosis was assessed after a further 24 h and larvae were considered normal and functional if larvae had changed from free swimming or casually attached pear-shaped forms to squat, firmly attached, disc-shaped structures with pronounced flattening of the oral–aboral axis and with septal mesenteries radiating from the central mouth region (Heyward and Negri, 1999). Average settlement success greater than or equal to 70% in controls was considered indicative of a standard response to settlement inducers based on several previous studies using CCA or extracts of CCA to initiate settlement (Negri and Heyward, 2000, Negri et al., 2011b, Negri et al., 2016).

Format:
Acropora tenuis pesticide settlement data_eAtlas.xlsx

Data Dictionary:

The dataset comprises of three tabs:

‘Settlement_2016’ denotes the settlement assay conducted in 2016 and consists of seawater and solvent controls, blanks, copper (reference toxicant), diazinon, fipronil, imidacloprid and chlorothalonil settlement data.
‘Propiconazole_2017’ denotes the settlement assay conducted in 2017 and consists of seawater and solvent controls, copper (reference toxicant) and propiconazole settlement data.
‘WQ’ denotes the measured water quality parameters at the initiation and finalisation of the test exposure.

SW control - seawater control; no herbicide and no solvent carrier; 12-18 scintillation vials (2-3 x 6-well plates: A/B/C); in well plates, crustose coralline algae (CCA) was added to initiate settlement
Solvent control = no herbicide and contains less than 0.01% v/v DMSO (dimethyl sulfoxide) solvent carrier as per the treatments; 12-18 scintillation vials (2-3 x 6-well plates: A/B/C); in well plates, CCA was added to initiate settlement
Blank = no herbicide and no solvent carrier and no CCA added; 12 scintillation vials (2 x 6-well plates: A, B)
Nominal conc (µg/L) = nominal pesticide concentrations used in the settlement assays
Measured conc (µg/L) = measured pesticide concentrations analysed by The University of Queensland
Rep = replicate vials 1-6
# Settled = number of coral larvae settled in the 6-well plates
# Total = number of total coral larvae counted in each well of a 6-well plate
# Failed = number of coral larvae that did not metamorphose: (# Total - # Settled) = # Failed
% Settled = percent of coral larvae that metamorphosed and settled: (# Settled/# Total) x 100

WQ = water quality parameters measured at start and end of exposure
DO = dissolved oxygen

References:
Dana, J.D. 1846. United States Exploring Expedition during the years 1838-1842. Zoophytes 7: 1-740. Lea and Blanchard, Philadelphia., available online at http://www.sil.si.edu/digitalcollections/usexex/navigation/ScientificText/USExEx19_08select.cfm

Negri, A.P. and Heyward, A.J. 2001. Inhibition of coral fertilisation and larval metamorphosis by tributyltin and copper. Marine Environmental Research 51(1): 17-27.

	Nordborg, M., Flores, F., Brinkman, D.L., Agusti, S., Negri, A.P. 2018. Phototoxic effects of two common marine fuels on the settlement success of the coral Acropora tenuis. Scientific Reports 8(1). https://doi.org/10.1038/s41598-018-26972-7 Negri, A.P., Brinkman, D.L., Flores, F., Botte, E.S., Jones, R.J., Webster, N.S. 2016. Acute ecotoxicology of natural oil and gas condensate to coral reef larvae. Scientific Reports 6. https://doi.org/10.1038/srep21153 Heyward, A.J. and Negri, A.P. 1999. Natural inducers for coral larval metamorphosis. Coral Reefs 18(3): 273 – 279. Negri, A.P., Vollhardt, C., Humphrey, C., Heyward, A.J., Jones, R., Eaglesham, G. and Fabricius, K. 2005. Effects of the herbicide diuron on the early life history stages of coral. Marine Pollution Bulletin 51(1-4); 370-383. Negri, A.P. and Heyward, A.J. 2000. Inhibition of fertilization and larval metamorphosis of the coral Acropora millepora (Ehrenberg, 1834) by petroleum products. Marine Pollution Bulletin 41(712): 420-427. Negri, A.P., Harford, A.J., Parry, D.L., van Dam, R.A. 2011. Effects of alumina refinery wastewater and signature metal constituents at the upper thermal tolerance of: 2. The early life stages of the coral Acropora tenuis. Marine Pollution Bulletin 62(3): 474-82. Data Location: This dataset is filed in the eAtlas enduring data repository at: data\nesp3\3.1.5_Pesticide-guidelines-GBR

Metadata language	eng
Character set	UTF8
Hierarchy level	Dataset

OnLine resource

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Linkage	https://nesptropical.edu.au/index.php/round-3-projects/project-3-1-5/
Protocol	WWW:LINK-1.0-http--related
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Protocol	WWW:LINK-1.0-http--related
Linkage	https://eatlas.org.au/nesp-twq-3/pesticide-guidelines-gbr-3-1-5
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Linkage	https://eatlas.org.au/pydio/public/au-nesp-twq-3-1-5-aims-pesticide-guidelines-gbr-acropora-tenuis-2020-02-26
Protocol	WWW:LINK-1.0-http--downloaddata

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Topic category	Biota

Extent

Description	Great Barrier Reef, Australia

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Metadata author

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Role	metadataContact
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