**Supplementary material for : Functional redundancy dampens precipitation change impacts on species-rich invertebrate communities across the Neotropics**

**This PDF file includes:**

**Table S1**

**Table S2**

**Figure S1**

Table S1. Functional traits under consideration and their modalities, and proposed interpretations in the context of precipitation change (after Dézerald et al., 2015; Aspin et al., 2019). Abbreviations as in Fig. 2.

|  |  |  |  |
| --- | --- | --- | --- |
| Trait | Modality | abbreviation | Interpretation |
| Maximum body size | ≤0 .25 cm | BS1 | Smaller taxa have lower energetic demands and access more easily to refuge microhabitats in stressful hydrological conditions (e.g., water depletion, flushing, rapid fluctuations) |
|  | 0.25-0.5 cm | BS2 |
|  | 0.5-1 cm | BS3 |
|  | 1-2 cm | BS4 |
|  | >2-4 cm | BS5 |
| Aquatic stage | Egg | AS1 | Cross ecosystem life cycles enable regular recolonization of disturbed habitats |
|  | Larva | AS2 |
|  | nymph | AS3 |
|  | Adult | AS4 |
| Reproduction | ovoviviparity | RE1 | Egg survival in stressful environments depends on the degree of parental care (e.g., isolated eggs < egg clutches < ovoviviparity); stable environments promote asexual reproduction |
|  | isolated eggs, free | RE2 |
|  | isolated eggs, cemented | RE3 |
|  | clutches, cemented or fixed | RE4 |
|  | clutches, free | RE5 |
|  | clutches in vegetation | RE6 |
|  | clutches, terrestrial | RE7 |
|  | asexual reproduction | RE8 |
| Dispersal mode | Passive | DM1 | Active dispersal promotes migration to more favorable environments and regular recolonization of disturbed habitats |
|  | Active | DM2 |
| Resistance form | eggs, statoblasts | RF1 | Resting stages allow populations to persist during the drought spell |
|  | cocoons | RF2 |
|  | diapause or dormancy | RF3 |
|  | none | RF4 |
| Respiration mode | tegument | RM1 | Dissolved oxygen concentrations decline in shrinking water bodies to the detriment of aquatic respiration modes, relative to aerial respiration modes |
|  | gill | RM2 |
|  | plastron | RM3 |
|  | siphon/spiracle | RM4 |
|  | hydrostatic vesicle | RM5 |
| Locomotion | flier | LO1 | Life in wet organic deposits or constructions, or ability to move to moist refuges allow to resist drought events |
|  | surface swimmer | LO2 |
|  | full water swimmer | LO3 |
|  | crawler | LO4 |
|  | burrower | LO5 |
|  | interstitial | LO6 |
|  | tube builder | LO7 |
| Food | microorganisms | FD1 | Generalist diets confer ecological adaptation to resource loss/variability in shrinking pools or hydrologically variable environments |
|  | detritus (< 1mm) | FD2 |
|  | dead plant (litter) | FD3 |
|  | living microphytes | FD4 |
|  | living leaf tissue | FD5 |
|  | dead animal (>= 1mm) | FD6 |
|  | living microinvertebrates | FD7 |
|  | living macroinvertebrates | FD8 |
| Feeding group | deposit feeder | FG1 | Water shrinkage is detrimental to suspension feeders |
|  | shredder | FG2 |
|  | scraper | FG3 |
|  | filter-feeder | FG4 |
|  | piercer | FG5 |
|  | predator | FG6 |
| Cohort production interval | <21 days | CP1 | Fast life cycles increase population success in variable or unpredictable environments |
|  | 21-60 days | CP2 |
|  | >60 days | CP3 |
| Morphological defence | none | MD1 | Body armoring is a barrier against desiccation favoring *in situ* resistance |
|  | elongate tubercle | MD2 |
|  | hairs | MD3 |
|  | sclerotized spines | MD4 |
|  | dorsal plates | MD5 |
|  | sclerotized exoskeleton | MD6 |
|  | shell | MD7 |
|  | case or tube | MD8 |
| Body form | flat elongate | BF1 | Surface area: volume ratios determine desiccation resistance; rounded-spherical bodies are less prone to water loss during droughts relative to flattened bodies |
|  | flat ovoid | BF2 |
|  | circular elongate | BF3 |
|  | circular ovoid | BF4 |

Table S2. Correlation coefficients for the relationships between environmental variables and trait categories with the first RLQ axis in Puerto Rico, French Guiana and Argentina. Only environmental variables and trait modalities showing correlations at *P*< 0.1 are listed. $*P*< 0.1, \**P*<0.05, \*\**P*< 0.01. Trait abbreviations as in Table 2.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Puerto Rico | French Guiana | Argentina |
| *Environmental variables* |  |  |  |
| driedout days | 0.165\* | 0.100$ | 0.235\*\* |
| overflow days | - | -0.09$ | - |
| water volume | -0.123\* | -0.139\*\* | -0.181\* |
| mean depth | -0.148\* | -0.130\*\* | -0.208\* |
| cv depth | 0.166\* | 0.129\*\* | 0.179\*\* |
| wetness | -0.164\* | -0.130\* | -0.221\*\* |
| *Traits* |  |  |  |
| AS1 | 1.403\* | - | 0.181$ |
| AS3 | - | - | -0.166$ |
| BS4 | 0.138$ | - | 0.191\* |
| FD1 | - | -0.116$ | - |
| FD2 | -0.109\* | - | - |
| FD3 | 0.156\* | - | 0.191\* |
| FD4 | -0.135\* | - | -0.175$ |
| FD5 | 0.126\* | - | - |
| FD6 | -0.126\* | - | - |
| FD7 | - | - | -0.119\* |
| FG2 | 0.159\* | - | - |
| FG4 | -0.122\* | - | -0.206\* |
| RE6 | -0.117$ | - | - |
| RF3 | -0.136\* | - | -0.233\* |
| LO2 | -0.157\* | - | -0.203\* |
| LO3 | -0.166\* | - | -0.195\* |
| LO4 | - | - | - |
| LO5 | 0.133\* | -0.105$ | - |
| RM2 | 0.129\* | - | - |
| CP1 | -0.138\* | - | -0.184$ |
| CP2 | 0.131\* | - | - |
| MD3 | - | -0.130$ | - |
| BF3 | - | - | - |

Fig. S1. Left panels: ordination of environmental variables and functional traits along the first two RLQ axes for Costa Rica, Colombia, and Brazil. Percentages are the variance explained by RLQ axes 1 and 2. See Table 3 for summary statistics. Trait abbreviations as in Table 2. Environmental variables are represented as vectors: directions show the gradients, arrow length represents the strengths of the variables on the ordination space. Right panels: niche position (weighted average) and niche breath (variance) of invertebrate species along the gradient of bromeliad hydrology represented by the first RLQ axis for Costa Rica, Colombia, and Brazil.

