Table S1. Averages and standard errors at each site in each year for relative areas (arcsine square root transformed) of each colour category (carotenoid, structural, melanic, and green). Also shown is the relative area of all colour categories combined (total).

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Year | Site | Predation | N | Carotenoid | Structural | Melanic | Green | Total |
| 2005 | M14 | HP | 20 | 21.270 ± 0.768 | 17.197 ± 0.861 | 23.282 ± 0.98 | 9.397 ± 1.032 | 40.195 ± 1.117 |
|  | M16 | LP | 20 | 23.000 ± 0.779 | 16.308 ± 0.751 | 21.066 ± 1.162 | 15.938 ± 0.971 | 42.227 ± 0.422 |
|  | M4 | LP | 20 | 25.321 ± 1.038 | 10.368 ± 0.570 | 22.953 ± 0.657 | 9.547 ± 1.187 | 39.749 ± 0.990 |
|  | M7 | HP | 18 | 18.214 ± 1.652 | 14.702 ± 0.938 | 21.620 ± 1.003 | 10.77 ± 0.873 | 36.490 ± 1.285 |
|  | P4 | LP | 20 | 27.848 ± 1.067 | 12.683 ± 0.905 | 23.767 ± 0.625 | 8.538 ± 1.07 | 43.078 ± 0.976 |
|  | P7 | LP | 20 | 26.246 ± 0.792 | 18.772 ± 1.033 | 21.355 ± 0.687 | 6.211 ± 1.156 | 42.642 ± 1.072 |
| 2006 | M14 | HP | 20 | 19.326 ± 0.869 | 13.569 ± 1.109 | 24.526 ± 0.755 | 8.075 ± 0.955 | 37.613 ± 0.902 |
|  | M16 | LP | 19 | 19.684 ± 0.784 | 17.986 ± 0.732 | 21.496 ± 0.969 | 15.884 ± 0.972 | 40.979 ± 0.952 |
|  | M4 | LP | 19 | 26.443 ± 0.631 | 8.0830 ± 0.404 | 23.832 ± 0.739 | 8.205 ± 1.17 | 39.967 ± 0.762 |
|  | M7 | HP | 20 | 23.068 ± 1.500 | 11.952 ± 1.009 | 21.255 ± 1.384 | 10.721 ± 0.817 | 38.447 ± 1.214 |
|  | P4 | LP | 20 | 26.071 ± 0.995 | 11.551 ± 0.629 | 26.653 ± 0.997 | 5.561 ± 0.879 | 42.536 ± 0.657 |
|  | P7 | LP | 20 | 27.631 ± 0.679 | 11.899 ± 0.473 | 23.768 ± 0.605 | 6.072 ± 0.887 | 41.532 ± 0.530 |
| 2007 | M14 | HP | 16 | 21.029 ± 1.059 | 15.016 ± 0.829 | 27.140 ± 0.946 | 5.726 ± 1 | 40.779 ± 0.948 |
|  | M16 | LP | 20 | 22.411 ± 1.239 | 13.662 ± 1.054 | 26.292 ± 0.747 | 14.113 ± 1.213 | 43.713 ± 1.129 |
|  | M4 | LP | 20 | 26.449 ± 0.786 | 8.703 ± 0.475 | 25.201 ± 0.763 | 10.522 ± 0.972 | 41.922 ± 0.547 |
|  | M7 | HP | 19 | 23.972 ± 1.122 | 11.057 ± 1.105 | 26.114 ± 0.748 | 6.151 ± 1.22 | 40.814 ± 0.831 |
|  | P4 | LP | 20 | 28.144 ± 0.666 | 8.992 ± 0.581 | 28.996 ± 0.938 | 6.926 ± 1.019 | 45.481 ± 0.803 |
|  | P7 | LP | 20 | 27.841 ± 0.820 | 10.66 ± 0.707 | 29.091 ± 0.490 | 3.443 ± 0.952 | 45.183 ± 0.760 |
| 2008 | M14 | HP | 20 | 21.352 ± 0.833 | 18.718 ± 1.061 | 24.275 ± 0.645 | 8.21 ± 1.228 | 41.671 ± 0.919 |
|  | M16 | LP | 20 | 21.720 ± 0.874 | 21.821 ± 0.814 | 22.997 ± 0.784 | 11.907 ± 1.575 | 44.543 ± 0.610 |
|  | M4 | LP | 20 | 28.659 ± 0.614 | 11.073 ± 0.660 | 25.798 ± 0.534 | 2.624 ± 0.71 | 43.029 ± 0.587 |
|  | M7 | HP | 19 | 23.96 ± 0.850 | 15.864 ± 0.877 | 22.709 ± 0.904 | 6.307 ± 1.148 | 40.210 ± 0.740 |
|  | P4 | LP | 20 | 27.688 ± 0.654 | 14.959 ± 0.799 | 25.678 ± 0.802 | 4.198 ± 0.82 | 44.220 ± 0.682 |
|  | P7 | LP | 20 | 29.483 ± 0.736 | 12.751 ± 0.936 | 24.219 ± 0.713 | 6.018 ± 0.79 | 43.958 ± 0.696 |
| 2009 | M14 | HP | 20 | 25.46 ± 0.723 | 12.092 ± 0.899 | 26.468 ± 0.653 | 1.929 ± 0.689 | 41.473 ± 0.662 |
|  | M16 | LP | 20 | 25.702 ± 0.902 | 11.609 ± 0.856 | 28.950 ± 0.837 | 5.559 ± 1.018 | 44.243 ± 1.072 |
|  | M4 | LP | 20 | 29.615 ± 0.486 | 9.079 ± 0.601 | 26.923 ± 0.650 | 5.429 ± 0.897 | 44.526 ± 0.556 |
|  | M7 | HP | 6 | 23.449 ± 1.692 | 11.668 ± 1.353 | 27.360 ± 0.669 | 3.385 ± 1.518 | 40.576 ± 1.177 |
|  | P4 | LP | 20 | 26.68 ± 0.911 | 9.952 ± 0.845 | 27.719 ± 0.761 | 2.721 ± 0.757 | 42.820 ± 0.376 |
|  | P7 | LP | 20 | 29.263 ± 0.692 | 9.195 ± 0.703 | 28.075 ± 0.603 | 1.604 ± 0.712 | 44.722 ± 0.491 |
| 2010 | M14 | HP | 19 | 22.772 ± 0.766 | 13.524 ± 0.617 | 29.911 ± 0.692 | 6.38 ± 0.946 | 43.603 ± 0.511 |
|  | M16 | LP | 20 | 24.432 ± 0.716 | 14.832 ± 0.746 | 29.461 ± 0.713 | 6.908 ± 1.198 | 45.415 ± 0.632 |
|  | M4 | LP | 21 | 28.360 ± 0.505 | 9.384 ± 0.557 | 26.584 ± 0.577 | 3.114 ± 0.939 | 42.964 ± 0.442 |
|  | M7 | HP | 20 | 24.854 ± 0.937 | 11.042 ± 1.022 | 25.332 ± 1.265 | 3.092 ± 0.917 | 40.230 ± 1.037 |
|  | P4 | LP | 20 | 27.453 ± 0.841 | 11.226 ± 0.753 | 27.918 ± 0.791 | 2.892 ± 0.957 | 44.126 ± 0.624 |
|  | P7 | LP | 20 | 28.568 ± 0.808 | 11.521 ± 0.688 | 28.181 ± 0.469 | 4.755 ± 0.979 | 45.536 ± 0.659 |

Table S2. Averages and standard errors at each site in each year for number of coloured spots of each colour category (carotenoid, structural, melanic, and green). Also shown is the average number of spots of all colour categories combined (total).

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Year | Site | Predation | N | Carotenoid | Structural | Melanic | Green | Total |
| 2005 | M14 | HP | 20 | 3.800 ± 0.321 | 5.350 ± 0.327 | 3.750 ± 0.289 | 1.250 ± 0.190 | 14.150 ± 0.599 |
|  | M16 | LP | 20 | 5.150 ± 0.372 | 5.950 ± 0.596 | 5.300 ± 0.385 | 1.850 ± 0.233 | 18.250 ± 1.073 |
|  | M4 | LP | 20 | 3.850 ± 0.284 | 2.450 ± 0.256 | 4.450 ± 0.276 | 1.150 ± 0.131 | 11.900 ± 0.598 |
|  | M7 | HP | 18 | 2.611 ± 0.293 | 3.500 ± 0.355 | 4.222 ± 0.298 | 1.389 ± 0.183 | 11.722 ± 0.836 |
|  | P4 | LP | 20 | 3.350 ± 0.221 | 2.500 ± 0.256 | 3.850 ± 0.196 | 0.900 ± 0.100 | 10.600 ± 0.380 |
|  | P7 | LP | 20 | 4.400 ± 0.320 | 4.250 ± 0.280 | 4.800 ± 0.329 | 0.850 ± 0.150 | 14.300 ± 0.645 |
| 2006 | M14 | HP | 20 | 3.100 ± 0.289 | 4.250 ± 0.428 | 4.250 ± 0.331 | 1.050 ± 0.114 | 12.650 ± 0.856 |
|  | M16 | LP | 19 | 4.737 ± 0.365 | 6.684 ± 0.359 | 5.105 ± 0.305 | 1.368 ± 0.137 | 17.895 ± 0.830 |
|  | M4 | LP | 19 | 4.316 ± 0.342 | 1.789 ± 0.211 | 4.737 ± 0.240 | 0.947 ± 0.143 | 11.789 ± 0.469 |
|  | M7 | HP | 20 | 3.300 ± 0.317 | 2.800 ± 0.321 | 3.750 ± 0.260 | 1.300 ± 0.105 | 11.150 ± 0.642 |
|  | P4 | LP | 20 | 3.200 ± 0.186 | 2.050 ± 0.223 | 4.200 ± 0.236 | 0.700 ± 0.105 | 10.150 ± 0.519 |
|  | P7 | LP | 20 | 4.350 ± 0.254 | 3.200 ± 0.287 | 4.500 ± 0.450 | 1.000 ± 0.145 | 13.050 ± 0.776 |
| 2007 | M14 | HP | 16 | 3.562 ± 0.341 | 4.438 ± 0.408 | 4.375 ± 0.417 | 1.000 ± 0.204 | 13.375 ± 1.052 |
|  | M16 | LP | 20 | 4.250 ± 0.561 | 4.050 ± 0.400 | 5.650 ± 0.483 | 1.550 ± 0.170 | 15.500 ± 1.111 |
|  | M4 | LP | 20 | 4.250 ± 0.298 | 1.850 ± 0.221 | 5.250 ± 0.383 | 1.300 ± 0.128 | 12.650 ± 0.514 |
|  | M7 | HP | 19 | 3.895 ± 0.374 | 3.000 ± 0.530 | 4.684 ± 0.297 | 0.684 ± 0.134 | 12.263 ± 0.861 |
|  | P4 | LP | 20 | 3.850 ± 0.264 | 2.400 ± 0.222 | 4.050 ± 0.320 | 0.800 ± 0.117 | 11.100 ± 0.661 |
|  | P7 | LP | 20 | 4.550 ± 0.387 | 2.200 ± 0.186 | 4.300 ± 0.378 | 0.550 ± 0.153 | 11.600 ± 0.697 |
| 2008 | M14 | HP | 20 | 3.700 ± 0.300 | 4.950 ± 0.373 | 4.200 ± 0.408 | 1.050 ± 0.185 | 13.900 ± 0.736 |
|  | M16 | LP | 20 | 5.100 ± 0.416 | 8.400 ± 0.564 | 5.750 ± 0.422 | 1.500 ± 0.224 | 20.750 ± 1.203 |
|  | M4 | LP | 20 | 4.800 ± 0.321 | 3.400 ± 0.393 | 5.350 ± 0.221 | 0.500 ± 0.136 | 14.050 ± 0.731 |
|  | M7 | HP | 19 | 4.368 ± 0.232 | 4.316 ± 0.478 | 4.158 ± 0.279 | 0.789 ± 0.123 | 13.632 ± 0.714 |
|  | P4 | LP | 20 | 3.600 ± 0.222 | 3.400 ± 0.393 | 3.900 ± 0.250 | 0.850 ± 0.150 | 11.750 ± 0.652 |
|  | P7 | LP | 20 | 4.750 ± 0.339 | 3.600 ± 0.400 | 5.000 ± 0.391 | 0.950 ± 0.135 | 14.300 ± 0.715 |
| 2009 | M14 | HP | 20 | 6.350 ± 0.530 | 4.450 ± 0.535 | 5.100 ± 0.270 | 0.350 ± 0.109 | 16.250 ± 1.222 |
|  | M16 | LP | 20 | 5.350 ± 0.599 | 3.800 ± 0.468 | 6.050 ± 0.380 | 1.000 ± 0.205 | 16.200 ± 1.341 |
|  | M4 | LP | 20 | 5.050 ± 0.211 | 2.200 ± 0.200 | 6.150 ± 0.393 | 0.850 ± 0.150 | 14.250 ± 0.648 |
|  | M7 | HP | 6 | 4.833 ± 0.601 | 4.667 ± 1.085 | 5.167 ± 0.703 | 0.500 ± 0.224 | 15.167 ± 2.272 |
|  | P4 | LP | 20 | 3.800 ± 0.313 | 2.350 ± 0.379 | 4.600 ± 0.275 | 0.600 ± 0.184 | 11.350 ± 0.685 |
|  | P7 | LP | 20 | 4.950 ± 0.394 | 2.150 ± 0.327 | 5.450 ± 0.359 | 0.350 ± 0.150 | 12.900 ± 0.739 |
| 2010 | M14 | HP | 19 | 5.053 ± 0.310 | 5.105 ± 0.489 | 6.000 ± 0.350 | 1.000 ± 0.171 | 17.158 ± 0.766 |
|  | M16 | LP | 20 | 6.100 ± 0.324 | 6.000 ± 0.513 | 5.900 ± 0.315 | 0.900 ± 0.143 | 18.900 ± 0.912 |
|  | M4 | LP | 21 | 5.048 ± 0.288 | 1.810 ± 0.178 | 5.143 ± 0.380 | 0.476 ± 0.148 | 12.476 ± 0.476 |
|  | M7 | HP | 20 | 4.632 ± 0.406 | 3.526 ± 0.498 | 4.368 ± 0.335 | 0.526 ± 0.160 | 13.053 ± 0.990 |
|  | P4 | LP | 20 | 3.700 ± 0.231 | 2.100 ± 0.240 | 4.850 ± 0.357 | 0.550 ± 0.170 | 11.200 ± 0.631 |
|  | P7 | LP | 20 | 3.800 ± 0.321 | 5.350 ± 0.327 | 3.750 ± 0.289 | 1.250 ± 0.190 | 14.150 ± 0.599 |

Table S3. Adjusted p values for post-hoc Tukey HSD test results on pair-wise comparisons between sites for carotenoid colouration. Top right is for relative area, and lower left is for spot number. Bold indicates P < 0.05.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | M14 (HP) | M7 (HP) | M4 (LP) | M16 (LP) | P4 (LP) | P7 (LP) |
| M14 (HP) |  | 0.203 | **0.022** | 0.907 | **<0.001** | **0.005** |
| M7 (HP) | **0.044** |  | **<0.001** | **0.019** | **<0.001** | **<0.001** |
| M4 (LP) | 1.000 | 0.054 |  | 0.304 | 0.318 | 0.995 |
| M16 (LP) | 0.249 | **<0.001** | 0.213 |  | **<0.001** | 0.095 |
| P4 (LP) | 0.890 | 0.442 | 0.908 | **0.014** |  | 0.661 |
| P7 (LP) | 0.970 | **0.005** | 0.958 | 0.712 | 0.424 |  |

Table S4. Adjusted p values for post-hoc Tukey HSD test results on pair-wise comparisons between sites for structural colouration. Top right is for relative area, and lower left is for spot number. Bold indicates P < 0.05.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | M14 (HP) | M7 (HP) | M4 (LP) | M16 (LP) | P4 (LP) | P7 (LP) |
| M14 (HP) |  | 0.513 | **<0.001** | 0.219 | **<0.001** | 1.000 |
| M7 (HP) | 0.054 |  | **<0.001** | 0.997 | 0.071 | 0.592 |
| M4 (LP) | **<0.001** | **0.023** |  | **<0.001** | 0.264 | **<0.001** |
| M16 (LP) | 0.952 | 0.408 | **<0.001** |  | 0.199 | 0.223 |
| P4 (LP) | **<0.001** | **0.033** | 1.000 | **<0.001** |  | **<0.001** |
| P7 (LP) | **0.010** | 0.996 | 0.082 | 0.108 | 0.112 |  |

Table S5. Results from MANCOVAs using Wilk’s lambda test statistic with site fitted before year as fixed effects and body size (mm2, log transformed) as the covariate for sites within the Marianne river. Estimates of variance were calculated as multivariate partial η2 also utilizing Wilk’s Lambda. The dependent variables were relative area (arcsine square root transformed) and spot number (square root transformed) for all colour categories (carotenoid colour, structural colour, melanic colour, and green). Bold indicates p < 0.05.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | F | d.f. | p value | Wilk’s partial η2 |
| Relative Area Colour |  |  |  |  |
| Site | 38.905 | 12, 1130 | **<0.001** | 0.190 |
| Year | 21.770 | 20, 1417 | **<0.001** | 0.186 |
| Year-by-Site | 2.760 | 60, 1669 | **<0.001** | 0.088 |
| Body Size | 16.549 | 4, 427 | **<0.001** | 0.111 |
| Spot Number |  |  |  |  |
| Site | 30.073 | 12, 1130 | **<0.001** | 0.160 |
| Year | 12.647 | 20, 1417 | **<0.001** | 0.120 |
| Year-by-Site | 2.697 | 60, 1669 | **<0.001** | 0.086 |
| Body Size | 9.417 | 4, 427 | **<0.001** | 0.095 |

Table S6. Results from MANCOVAs using Wilk’s lambda test statistic with site fitted before year as fixed effects and body size (mm2, log transformed) as the covariate for sites within the Paria river. Estimates of variance were calculated as multivariate partial η2 also utilizing Wilk’s Lambda. The dependent variables were relative area (arcsine square root transformed) and spot number (square root transformed) for all colour categories (carotenoid colour, structural colour, melanic colour, and green). Bold indicates p < 0.05.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | F | d.f. | p value | Wilk’s partial η2 |
| Relative Area Colour |  |  |  |  |
| Site | 2.772 | 4, 224 | **0.030** | 0.028 |
| Year | 10.201 | 20, 734 | **<0.001** | 0.173 |
| Year-by-Site | 3.392 | 20, 744 | **<0.001** | 0.070 |
| Body Size | 3.094 | 4, 224 | **0.017** | 0.049 |
| Spot Number |  |  |  |  |
| Site | 12.071 | 4, 224 | **<0.001** | 0.158 |
| Year | 4.534 | 20, 734 | **<0.001** | 0.083 |
| Year-by-Site | 1.416 | 20, 744 | **<0.001** | 0.031 |
| Body Size | 4.486 | 4, 224 | **<0.001** | 0.072 |

Table S7. Pearson-product moment correlation test results comparing the relative area of blue and orange colour for individual years. Bold indicates P < 0.05.

|  |  |  |
| --- | --- | --- |
| Year | r | P |
| 2005 | -0.332 | 0.520 |
| 2006 | -0.563 | 0.244 |
| 2007 | -0.904 | **0.013** |
| 2008 | -0.891 | **0.017** |
| 2009 | -0.909 | **0.012** |
| 2010 | -0.799 | 0.057 |

Table S8. Results from MANCOVAs using Wilk’s lambda test statistic with year as a randomized block, site as a fixed effect, the year-by-site interaction, and body size (mm2, log transformed) as the covariate. All MANCOVAs were done in the R working environment utilizing the car package. The dependent variables were relative area (arcsine square root transformed) and spot number (square root transformed) for all colour categories (carotenoid, structural, melanic, and green). Bold indicates p < 0.05.

|  |  |  |  |
| --- | --- | --- | --- |
|  | F | d.f. | p value |
| Relative Area Colour |  |  |  |
| Site | 9.622 | 20, 2173 | **<0.0001** |
| Year | 6.882 | 20, 2173 | **<0.0001** |
| Year-by-Site | 2.892 | 100, 2600 | **<0.0001** |
| Body Size | 14.928 | 4, 655 | **<0.0001** |
| Spot Number |  |  |  |
| Site | 6.132 | 20, 2173 | **<0.0001** |
| Year | 5.686 | 20, 2173 | **<0.0001** |
| Year-by-Site | 2.362 | 100, 2600 | **<0.0001** |
| Body Size | 14.414 | 4, 655 | **<0.0001** |

**Supplemental Figure Legend**

**Supplemental Figure 1.** Map of the Marianne and Paria rivers on the northern slope of the Trinidadian mountain range.

**Supplemental Figure 2.** Spot numbers of colour category by year and site