**Supplementary File, FIGURE S1.** Map of sampling locations for *Pyropia vietnamensis* in the Konkan region, India.



**Supplementary File, TABLE S1.** Collection sites, ecological variables, specimen collection number and GenBank accessions.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Collection site | Geomorphology of collection sites | Latitude and longitude | Specimen collection number | GenBank Accessions for *cox1* gene | Salinity (psu) | Temp.(°C) |
| Dona Paula | Rock laterite intermixed with columnar basalt, surface is even and porous but at places interrupted by water pools and huge boulders | 15° 27.135’ N73° 48.191’ E | ARC-P-183 | KM977740 | 28.4 | 25.9±0.44 |
| Anjuna | Rock laterite as well as basaltic and porous, many eroded boulders, water pools are scattered here and there along the rock surface surface is uneven due to crevices | 15° 35.083’ N73° 44.213’ E | ARC-P-192 | KM977741 | 29.1 | 28.1±0.86 |
| Vagator | Basaltic rock covered with coarse sand, uneven surface due to several cracks and crevices,  | 15° 36.083’ N73° 44.213’ E | ARC-P-196 | KM977744 | 28.4 | 28.4±0.98 |
| Redi | Rock laterite and porous with cracks, crevices and water pools, sand deposition is found all along the beach | 15° 45.078’ N73° 39.671’ E | ARC-P-73 | KM977739 | 19.1 | 26.1±0.79 |
| Malvan | laterite and porous rock in northern part, vertically cut, columnar basaltic rock at sloppy region of western part , steep slope and sandy region in southern part | 16° 03.663’ N73° 27.373’ E | ARC-P-48 | KM977736 | 30.2 | 26±0.35 |
| ARC-P-69 | KM977738 |  |
| Purnagad | soft as well as hard basaltic rock, unevenly eroded with cracks and numerous water pools  | 16° 48.439’ N73 18.709’ E | ARC-P-21 | KM977742 | 19.9 | 28.9±0.55 |
| ARC-P-22 | KM977750 |  |
| Hedavi | Basaltic rock with more or less even surface  | 17° 22.016’ N73° 13.591’ E | ARC-P-20 | KM977749 | 19.18 | 28.6±0.70 |
| ARC-P-12 | KM977747 |  |
| Velaneshwar | Basaltic rock with some laterite formations, collapsed overhanging cliff of the rocky headland, relatively large sized water pools, small and large boulders are eroded down on the rocky headlands | 17° 23.239’ N73° 13.146’ E | ARC-P-8 | KM977745 | 19.25 | 30±0.02 |
| Palshet | Rock laterite as well as basaltic, numerous cracks, crevices and water pools, huge laterite boulders are eroded down on the rock surface | 17° 26.504’ N73° 11.490’ E | ARC-P-3 | KM977746 | 14.4 | 26.5±0.6 |
| Kolthare | Rock laterite and porous, numerous eroded boulders and water pools  | 17° 39.427’ N73° 07.826’ E | ARC-P-23 | KM977748 | 18.2 | 28.4±0.27 |
| Harihareshwar | Basaltic wave cut platform with overhanging cliffs, numerous huge boulders and water pools | 17° 59.558’ N73° 01.115’ E  | ARC-P-31 | KM977737 | 16.5 | 27.1±0.1 |
| Shekhadi | Laterite rock, steep slope and large boulders | 18° 06.103’ N72° 59.318’ E | ARC-P-80 | KM977743 | 11 | 27.4±0.23 |

**Supplementary File, TABLE S2.** Morphological and ecological characters used in morphometric analysis of *P. vietnamensis*.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Dona Paula | Anjuna | Vagathor | Redi | MalvanI | MalvanII | Purnagad I | Purnagad II | Velaneshwar | HedaviII | Hedavi I | Palshet | Kolthare | Shekhadi | Harihareshwar  |
| Specimen Voucher | ARC-P-183 | ARC-P-192 | ARC-P-196 | ARC-P-73 | ARC-P-48 | ARC-P-69 | ARC-P-21 | ARC-P-22 | ARC-P-8 | ARC-P-12 | ARC-P-20 | ARC-P-3 | ARC-P-23 | ARC-P-80 | ARC-P-31 |
| Zone | Middle-Upper intertidalregion | Lower intertidalregion | Lower intertidalregion | Middle-Upper intertidalregion | Middle-Upper intertidalregion | Lower intertidalregion | Middle-Upper intertidalregion | Lower intertidalregion | Lower intertidalregion | Lower intertidalregion | Middle-Upper intertidalregion | Middle-Upper intertidalregion | Middle-Upper intertidalregion | Middle-Upperintertidalregion | Middle-Upper intertidalregion |
| Habitat | Wave shelter | Wave exposed | Wave exposed | Wave shelter | Wave shelter | Wave exposed | Wave shelter | Wave exposed | Wave exposed | Wave exposed | Wave shelter | Wave shelter | Wave shelter | Wave shelter | Wave shelter |
| Shape | lanceolate | Linear-lanceolate | Linear-lanceolate | lanceolate | Lanceolate | Linear-lanceolate | Linear-lanceolate | Linear-lanceolate | Linear-lanceolate | Linear-lanceolate | Ovate to irregular | Lanceolate | Linear-Lanceolate | Linear-lanceolate | Broadly lanceolate |
| Surface and Margin | Less ruffled with smooth margin | Ruffled with smooth margin | Ruffled with smooth margin | Less ruffled with smooth margin  |  Ruffled with smooth margin | Less Ruffled with undulate margin | Less ruffled with smooth margin  | Ruffled with smooth margin  | Ruffled with smooth margin  | Ruffled with smooth margin  | Ruffled with smooth margin | Less ruffled with smooth margin  | Less ruffled with smooth margin | Ruffled with smooth margin | Ruffled with smooth margin |
| Color |  brown | brown |  brown | Purple Pink | Purple Pink | Purple Pink | purpleBrown | Purple Brown | Purple Brown | Purple Brown | Purple Brown | Purple Brown | Brown | Purple brown | Brown |
| Height(cm) | Up to 16  | Up to 30  | Up to 30  | Up to 10  | Up to 30  | Up to 30  | Up to 30  | Up to 30  | Up to 30  | Up to 30  | Up to 10  | Up to 10  | Up to 6  | Up to 15  | Up to 16  |
| Width(cm) | Up to 6  | Up to 3  | Up to 3  | Up to 6  | Up to 5  | Up to 1  | Up to 3  | Up to 3  | Up to 4  | Up to3  | Up to 15  | Up to 6  | Up to 3  | Up to 3  | Up to 15  |
| Spines  | moderate | abundant | abundant | moderate | moderate | abundant | moderate | abundant | abundant | abundant | moderate | moderate | moderate | abundant | moderate |
| Thickness of thallus (cm) | 26.4 – 36.3 | 26.4 – 39.6 | 26.4 – 36.3 | 33 – 49.5 | 33 36.3 | 33 – 36.3 | 23.1 – 39.6 | 26.4 – 36.3 | 26.4 – 36.3 | 26.4 – 36.3 | 33 – 49.5 | 29.7 – 46.2 | 26.4 -  ­­36.3 | 29.7– 36.3 | 26.4 –  46.2 |
| Thickness of thallus in reproductive area (cm) | 29.7 – 42.2 | 29.7 – 39.6 | 29.7 – 42.2 | 42.2 – 52.8 | 33 36.3 | 33 – 39.6 | 26.4 – 39.6 | 29.7 – 39.6 | 26.4 – 39.6 | 29.7 – 39.6 | 29.7 – 39.6 | 33 – 49.5 | 33 – 39.6 | 29.7 – 39.6 | 33 – 39.6 |
| Thickness of mucilage (cm) | Up to 13.2 | Up. To 9.9 | Up. To 9.9 | Up to 13.2 | Up to 13.2 | Up. To 9.9 | Up. To 9.9 | Up. To 9.9 | Up. To 9.9 | Up to 13.2 | Up. To 9.9 | Up to 13.2 | Up. To 9.9 | Up. To 9.9 | Up to 13.2 |
|  |