**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’ N  73° 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’ N  73° 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’ N  73° 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’ N  73° 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’ N  73° 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’ N  73 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’ N  73° 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’ N  73° 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’ N  73° 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’ N  73° 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’ N  73° 01.115’ E | ARC-P-31 | KM977737 | 16.5 | 27.1±0.1 |
| Shekhadi | Laterite rock, steep slope and large boulders | 18° 06.103’ N  72° 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 | Malvan  I | Malvan  II | Purnagad  I | Purnagad  II | Velaneshwar | Hedavi  II | 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 intertidal  region | Lower  intertidal  region | Lower intertidal  region | Middle-Upper intertidal  region | Middle-Upper intertidal  region | Lower  intertidal  region | Middle-Upper intertidal  region | Lower  intertidal  region | Lower  intertidal  region | Lower  intertidal  region | Middle-Upper intertidal  region | Middle-Upper intertidal  region | Middle-Upper intertidal  region | Middle-Upper  intertidal  region | Middle-Upper intertidal  region | |
| 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 | purple  Brown | 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 to  3 | 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 | |
|  | | | | | | | | | | | | | | | |