Device for supporting, growing and replanting aquatic plants from seeds

Abstract

The invention concerns a technique for seabed reforestation, specifically for the restoration of marine phanerogam beds compromised by anthropogenic impacts. The developed technique is based on the use of seedlings obtained from seed (with zero impact on the donor seagrass beds as it does not require the taking of cuttings from them) and uses *ad hoc* developed supports to maximise the anchorage rate and adhesion strength of the seedlings before their transfer to the sea, in the sites chosen for the repopulation interventions.

State of the art

Traditional marine phanerogam beds restoration techniques are based on the use of cuttings taken from donor beds and fixed to the substrate of the receiving site using cement, plastic or metal anchoring devices. These devices often fail to counteract the effect of wave motion and currents that uproot the cuttings, causing the dispersion of artificial materials into the environment and low survival of the transplants.

Invention Description

In the repopulation of marine phanerogam beds with seedlings developed from seed, it is crucial to increase the anchorage strength of the seedlings to the substrate during the first weeks of life, in order to increase the survival and adulting rates (Fig. 1). For this purpose, a support unit made of natural stone, compatible with the environmental characteristics of the transplantation sites, was devised. The invention exploits the adhesive properties of the root system possessed by some species of marine phanerogams in the initial phases of the life cycle and the knowledge of the root growth pattern. The support unit has the form of a parallelepiped on which a central cavity (Fig. 2) or a slit (Fig. 3) (cm scale) is made to house the plant in the seed stage. Secondary cavities are made on the sides of the parallelepiped to allow the development of the root system and its anchorage to the unit (mm scale). The surface of the support on which the roots grow has an "α"-inclination between 45° and 135° in relation to the parallel to the support plane of the parallelepiped. The support units can be assembled to form a multi-modular unit (Fig.1b and 2c). The growth and transplantation method involves 3 main phases: a) positioning of the seed and/or shoot in the cavity of the support (at the narrowest point); b) growth of the seedling in the enclosure; c) transfer of the support to the transplantation site. During the pilot trial the adhesion of the shoots to the support in the enclosure occurred in 100% of the cases. The in situ survival at 4 months after transplantation is 83%.

FIGURE 1 – Detail of a *P. oceanica* shoot in its support device after transfer to the sea

Industrial Property

European Patent Application n. 21170368.1 filed with priority on 26.04.2021

Italian Patent Application n. IT 102020000009046 filed on 27/04/2020

Applicant

Stazione Zoologica Anton Dohrn

Co-Applicant

Consiglio Nazionale delle Ricerche (National Research Council)

INVENTORS:

- Adriana Alagna
- Fabio Badalamenti
- Luigi Musco

TTO (Technology Transfer Office):

- Ornella Papaluca

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Advantages

The invention allows:

- maintained genetic variability of seagrass beds;
- increased adaptive capacity and resistance to stress and environmental conditions;
- reduced environmental impact;
- support modularity;
- reduced aesthetic impact of the substrate;
- quick installation (no anchoring);
- low replanting costs.

Applications

The invention finds application:

- in the restoration ecology of coastal waters;
- in the restoration of damaged *Posidonia oceanica* meadows;
- in the restoration of other marine phanerogamous species, with root system characteristics similar to those of *P. oceanica* such as those belonging to the genera Thalassia, Phyllospadix , Enhalus and Halophila.

Development stage

Current TRL: 3-4 . The technique was tested in its laboratory and field phases. Prototypes of the support units in the 2 versions were made and tested as a small-scale pilot project (25 units per support type).

Prospective TRL: 6-7. The technique is ready for large-scale use.

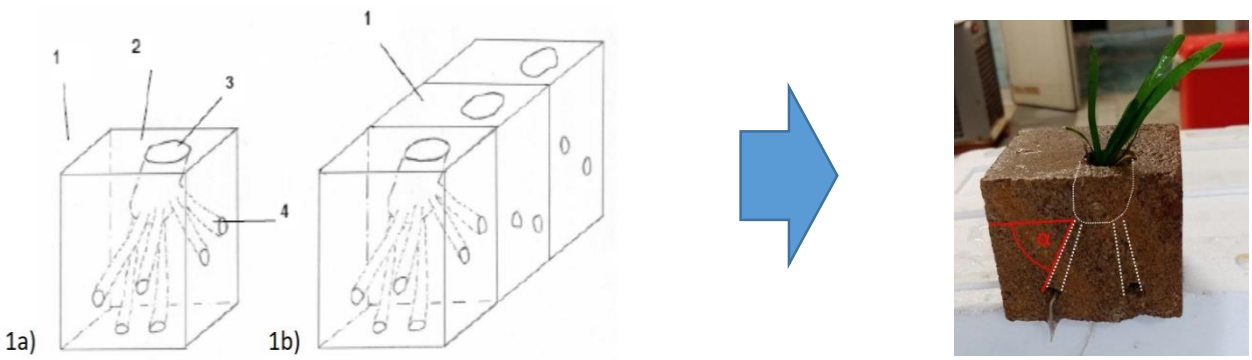

FIGURE 2 – Schematic detail and construction of one of the support devices with a shoot grown inside the main cavity (cm scale) and detail of the roots grown in the secondary cavities (mm scale)

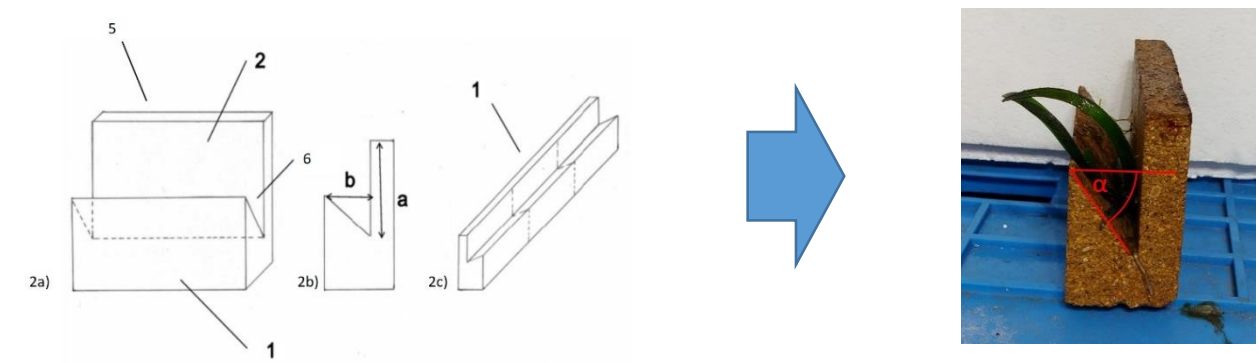

FIGURE 3 – Schematic detail and realisation of one of the support devices with a shoot grown inside the main cavity (cm scale) and detail of the roots

CONTACTS: Adriana Alagna (adriana.alagna@gmail.com), Fabio Badalamenti (fbadalam@yahoo.it); TTO Ornella Papaluca (tech.transfer@szn.it)