

The Improvement of Floral Assortment with *Ardisia* Genus and the Development of Multiplication Technology by Cuttings

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Abstract. *Ardisia* genus includes 250 small trees, shrubs and subshrubs distributed in tropical and subtropical regions of the world. It used and sold in the horticulture industry as an ornamental plant – often called Christmas berry or Coral Berry, Marlberrry. It is native to China, Japan and northern India, take part of the family *Myrsinaceae*. 65 species are in China including 14 native species in Hong Kong. *Ardisia* beginning cultivation in 1982, spreading into wooded areas. Currently *Ardisia* is found in many counties used in the landscape or indoor design for its persistent red berries, glossy foliage and low maintenance. The study involves *Ardisia* species *A. crenata* Sims. and *A. pusilla* A. DC. , are two species cultivated in South Korea and were brought in our country during an exchange of biological material between RDA Suwon - Korea and University of Agricultural Sciences and Veterinary Medicine Cluj in a frame of bilateral agreement. The multiplication of these species were made by cuttings and during the experience was studied the influence of rooting substrate on root system formation. Some soil mixtures were tested: I. perlite + peat + garden soil, with a ratio of 3:1:1, II. peat + sand + mature manure 2:1:1, III. peat + perlite 1:1, IV. perlite (control of experience). The best results for *Ardisia crenata* were obtained in mixture of peat + perlite + garden soil in 3:1:1 ratio, rooting occurred in 37 days. The process of rooting of *Ardisia pusilla* was finished in 58 days, and the best result was obtained in the mixture consist in of peat + sand + mature manure 2:1:1 ratio.

Keywords: indoor plants, multiplication, cuttings, rooting media, shrubs

INTRODUCTION

Ardisia crenata Sims. (*A. crenulata* Vent.) is a shrub with 60-80 cm high, persistent leaves, grown for decorative foliage and attractive fruit. Leaves alternate, dark green above, waxy, glabrous, with crenate (scalloped) margins and calluses in the margin notches. The flowers are white to pink, fragrant, small, bisexual, with petaloid parts pinkish white and anthers yellow. It is followed by red globose berries that persist on the plant several months to a year (Şelaru, 2006; Marinelli, 2004; Jantra, 2000).

This species grows as indoor plant, with rather slow development. They prefer bright spaces, but do not support direct rays of sun, tolerate well the shade (Jantra, 2000). During the growing season requires moderate temperatures of 18 °C, winter must be provided with a temperature of 10 °C. It can be grown also as outdoor plant.

During the growing season requires high humidity, wet substrate, Growing media preferably should be composed of peat, leaf mold and other components (Şelaru, 2006). Species multiplication can be done by cuttings or seeds. Seeds have a pretty good germination (Marinelli, 2004) and are able to germinate in a range of soil pH, from pH 4 (acid) to pH 10 (alkaline).

Some of researches show that the seed germination of *A. japonica* and *A. pusilla* was higher in dark than in light, whereas *A. crenata* in the light. Although *A. japonica* and *A. crenata* seeds germinated well at 25°C, *A. pusilla* germinated well at 30 °C. Seed germination

of three *Ardisia* species was higher when the seeds are stored in moist condition at 23 °C (Lee *et al.*, 2000).

Best result concerning the *Ardisia* species multiplication it is obtained *in vitro*. Explants of *Ardisia pusilla* A. DC. and *Ardisia japonica* (Thunb.) were established *in vitro* from greenhouse grown plants in primary cultures. The primary cultures tested lateral buds, shoot tips, and rhizomes as sources for micropropagation materials as influenced by plant growth regulators benzyl adenine (BA), indoleacetic acid (IAA) and naphthalene acetic acid (NAA) and the number of nodes per explant.

In *A. pusilla*, lateral buds were the best primary culture source and 59% of explants produced shoots in 17 days. Shoot tips produced shoots in 30 days from 6% of explants. The results for *A. japonica* were similar to *A. pusilla* for primary culture; 27 days and 15%, respectively, for shoot formation from the lateral buds and 42 days and 12% from the shoot tip explants (Doo *et al.*, 2008).

Ardisia crenata is a species resistant to pests and diseases (Zachos, 2005), requires minimal maintaining works. It is recommended to make annually rejuvenation pruning. This species is invasive in Central and North Florida (Llamas, 2003).



Fig. 1. *Ardisia pusilla* and *Ardisia crenata*

It is recommended for winter color in a forest grove, planting under trees or in a shade garden. Where freezes are severe, ardisia should be placed in a protected area or covered.

Ardisia pusilla is uncommon but quite widespread in Hong Kong that you may find it on Hong Kong Island, Lantau Island and in the New Territories. It is a compact, stoloniferous evergreen shrub or conservatory plant with glossy, pale green leaves and creamy-white flowers in spring followed by red berries. It is considered a good groundcover plant.

Ardisia pusilla is cultivated as indoor or outdoor, in many countries, but in some places is cultivated for this chemical compounds. Two new saponins were isolated from this plant and proved to have marked immunological function and antitumor activity (Zhang QH *et al.*, 1993).

It grows mainly along stream banks under evergreen forests. Canopy cover should be complete enough to avoid too much sunlight reaching the place where they grow as a moist and shaded environment is required. It can be found in native regions on hilly areas, roadsides, along streams, shady damp places.

Other cultivated species from *Ardisia* genus are: *A. elliptica*, *A. escallonioides*, *A. nigrescens*, *A. revoluta* (Llamas, 2003).

MATERIALS AND METHODS

Experiences regarding the improvement of floral assortment with *Ardisia* genus and the development of multiplication technology by cuttings were placed in the greenhouse belonging to the Floriculture Department of UASVM - Cluj-Napoca. The greenhouse is old, flat glass, with semi-automatic equipment. Rooting was carried out on tables in substrate and growing trays.

The experiment was carried out during 2010 and was organized an experience with two factors and the analyzed factors were *Ardisia* species and rooting substrate.

Factor A: a₁ *Ardisia crenata*; a₂ *Ardisia pusilla* and **Factor B:** b₁ perlite + peat + garden soil 3:1:1; b₂ peat + sand + mature manure 2:1:1; b₃ peat + perlite 1:1; b₄ perlite



Fig. 1. *Ardisia crenata* and *Ardisia pusilla* cuttings

Through the combination of those two factors were obtained 8 experimental variants, which were placed in randomized blocks, in three repetitions. The control of experience was the rooting media with perlite. For the propagation of *Ardisia* species, on 17.06.2010 were collected 10 cuttings for each variant from the healthy mother plants, vigorous and free from diseases and pests. Cuttings were made from the middle-aged healthy stems. The prepared cuttings were treated with Radistim 1 for a better rooting (Fig.1).



Fig. 2. *Ardisia crenata* and *Ardisia pusilla* rooted cuttings

Biological material prepared before had been planted in four rooting substrates, as follows: perlite +peat + garden soil 3:1:1, peat + sand + mature manure 2:1:1, peat + perlite 1:1 and perlite, the cuttings being introduced in the substrate with at thickness of 8-10 cm.

In the Figure 2 are presented the rooted cuttings in perlite +peat + garden soil 3:1:1and peat + sand + mature manure 2:1:1.

The data were statistically interpreted by LSD test (Least Significant Difference) to illustrate the significance of differences.

RESULTS AND DISCUSSION

Regarding the development of rooting system can conclude that this process devolved different, depending to the rooted substrate (Tab. 1).

Tab. 1

Centralized table concerning the situation of rooting of *Ardisia* cuttings

Experimental variants		Data of cuttings preparation	Data of cuttings rooting	No. of days of rooting
V1	<i>Ardisia crenata</i> + perlite + peat + garden soil 3:1:1	17.06.2010	23.07.2010	37
V2	<i>Ardisia crenata</i> + peat + sand + mature manure 2:1:1	17.06.2010	25.07.2010	39
V3	<i>Ardisia crenata</i> + peat + perlite 1:1	17.06.2010	24.07.2010	38
V4	<i>Ardisia crenata</i> + perlite (Control)	17.06.2010	27.07.2010	41
V5	<i>Ardisia pusilla</i> + perlite + peat + garden soil 3:1:1	17.06.2010	16.08.2010	61
V6	<i>Ardisia pusilla</i> + peat + sand + mature manure 2:1:1	17.06.2010	13.08.2010	58
V7	<i>Ardisia pusilla</i> + peat + perlite 1:1	17.06.2010	18.08.2010	63
V8	<i>Ardisia pusilla</i> + perlite (Control)	17.06.2010	21.08.2010	66

The data from the upper table show that *Ardisia crenata* species rooted at the earliest (37 days) in the rooting media compound by perlite + peat + garden soil 3:1:1. In the substrates consist in peat + perlite the same species rooted in 38 days.

Ardisia pusilla cuttings rooted in perlite in 66 days, in the peat – perlite combination the cutting were rooted in 63 days. At this species the best rooting media was the mix of peat + sand + mature manure 2:1:1 (rooted in 58 days). In the second table are presents data concerning the influence of rooting media on the development of length and number of leaves at *Ardisia crenata* cuttings. Significant difference comparing with the control were registered at the substrates consist in perlite + peat + garden soil 3:1:1 (V1) and peat + perlite 1:1 (V3).

Tab. 2

The influence of rooting media on the length of *Ardisia crenata* cuttings and the number of leaves

Rooting media	The length of cuttings		The number of leaves	
	Absolute (cm)	±D (cm)	Absolute	±D
V1	6.60	0.85*	9.5	1.50*
V2	5.75	0.00	8.5	0.50
V3	6.45	0.70*	10.0	2.00 *
V4 (control)	5.75	0.00	8.0	0.00
DL (p 5%)		0.53		1.30
DL (p 1%)		0.98		2.38
DL (p 0.1%)		2.16		5.28

Concerning the influence of rooting media upon the diameter of leaves rosette, length of roots and number of roots on *Ardisia crenata* cuttings can conclude that the best substrata was the mix of peat + sand + mature manure 2:1:1, which has generated distinct and respectively significant differences (Tab. 3).

In the case of *Ardisia pusilla*, the best results regarding the length of cuttings and the number of leaves was registered when was used the mix of perlite + peat + garden soil 3:1:1 and peat + sand + mature manure 2:1:1 (Tab. 4).

Tab. 3

The influence of rooting media on diameter of leaves rosette, length of roots and number of roots on *Ardisia crenata* cuttings

Rooting media	Diameter of leaves rosette		The length of roots		Number of roots	
	Absolute (cm)	±D (cm)	Absolute (cm)	±D (cm)	Absolute	±D
V1	9.55	-0.95	3.55	0.20	13.00	2.50
V2	11.50	1.00	4.60	1.25**	14.50	4.00*
V3	9.50	-1.00	3.40	0.05	12.50	2.00
V4 (control)	10.50	0.00	3.35	0.00	10.50	0.00
DL (p 5%)		2.24		0.54		2.83
DL (p 1%)		4.11		0.98		5.20
DL (p 0.1%)		9.10		2.18		11.51

Tab. 4

The influence of rooting media on the length of *Ardisia pusilla* cuttings and the number of leaves

Rooting media	The length of cuttings		The number of leaves	
	Absolute (cm)	±D (cm)	Absolute	±D
V5	6.93	1.33**	15.50	5.00**
V6	6.38	0.77*	13.50	3.00*
V7	5.68	0.07	11.75	1.25
V8 (control)	5.60	0.00	10.50	0.00
DL (p 5%)		0.60		2.49
DL (p 1%)		1.11		4.58
DL (p 0.1%)		2.46		10.14

Tab. 5

The influence of rooting media on diameter of leaves rosette, length of roots and number of roots on *Ardisia pusilla* cuttings

Rooting media	Diameter of leaves rosette		The length of roots		Number of roots	
	Absolute (cm)	±D (cm)	Absolute (cm)	±D (cm)	Absolute	±D
V5	14.20	3.80*	4.40	0.00	8.70	0.00
V6	9.75	-0.65	5.50	1.10*	12.80	4.10***
V7	12.55	2.15	3.50	-0.90°	10.50	1.80**
V8 (control)	10.40	0.00	4.90	0.50	9.35	0.65
DL (p 5%)		2.85		0.77		0.96
DL (p 1%)		5.23		1.43		1.76
DL (p 0.1%)		11.59		3.13		3.91

Statistical data shows that in the substrate composed of peat + sand + mature manure 2:1:1 the length of roots was longer, accounting differences of 1.10 cm which significant compared with the control (perlite). In the same rooting media the number of roots was higher than the control, achieved very significant positive differences. It was registered positive and significant differences in the second rooting media at the length of roots (Tab. 5).

CONCLUSIONS AND RECOMMENDATION

Analyzing the results concerning the improvement of floral assortment with *Ardisia* genus and the development of multiplication technology by cuttings we can conclude the following:

The rooting process of *Ardisia crenata* took between 37-41 days according to the

rooting substrate. Fastest rooted in the mix of perlite + peat + garden soil 3:1:1 and latest in perlite.

Analyzing the second species (*Ardisia pusilla*) and the influence of substrata on the development of rooting we can observe that in the mix of peat + sand + mature manure 2:1:1 the cuttings rooted in 58 days. The rooting process was slower than the first species (*A. crenata*).

Concerning the influence of rooting media on the development of length and number of leaves at *Ardisia crenata* cuttings we can show a significant difference comparing with the control registered at the substrates consist in perlite + peat + garden soil 3:1:1 (V1) and peat + perlite 1:1 (V3).

Studying the influence of rooting media upon the diameter of leaves rosette, length of roots and number of roots on *Ardisia crenata* cuttings can conclude that the best substrata was the mix of peat + sand + mature manure 2:1:1, which has generated distinct and respectively significant differences. In the case of *Ardisia pusilla*, the best results regarding the length of cuttings and the number of leaves was registered when was used the mix of perlite + peat + garden soil 3:1:1 and peat + sand + mature manure 2:1:1.

Statistical data shows that in the substrate composed of peat + sand + mature manure 2:1:1 the length of roots was longer, comparing with the control (perlite). In the same rooting media the number of roots was higher than the control, achieved very significant positive differences.

Based on these results obtained in the researches and the conclusions we can make the following **recommendations**:

Cultivation of studied species further because they have good resistance to pests and diseases and are characterized by a high rate of multiplication.

Use especially for multiplication the mix consist in perlite + peat + garden soil 3:1:1 and peat + sand + mature manure 2:1:1 because they led to the highest percentage of rooting.

Ardisia species can be introduced into commercial crops for diversify the assortment of indoor plants in our country.

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