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## ***Anredera cordifolia (Basellaceae) invasive in the river vegetation of North-Eastern Sicily***

### **Abstract**

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The occurrence of *Anredera cordifolia* as invasive element of the vegetation of the watercourses of the Tyrrhenian East coast of Sicily is reported. The species - indicated in Sicily as alien and then as a rapidly spreading plant in the Western sector of the island - had already been reported for some generic localities in the province of Messina. Here it is reported its abundant presence, within hygrophilous forest phytocoenoses where the species ends up physiognomizing the woody vegetation of a stream. In this vegetation, *A. cordifolia* exerts an indisputable synecological role and, at the same time, has an impact that deserves to be monitored.

**Key words:** alien flora, *Salici-Populetea nigrae*, *Nerio-Tamaricetea*, synecological impact.

### **Introduction**

*Anredera cordifolia* (Ten.) Steenis (= *Boussingaultia cordifolia* Ten.), native to South America, is reported to Italy as a naturalized alien (Celesti Grapow 2009). In the last 20 years, its diffusion has affected many coastal areas of various regions, from north to south (Pasta & al. 2016). This species had been reported as a casual alien in Sardinia (Galasso & al. 2018) and in a few years became naturalized (Manca & Brundu 2020). This latter status is also recognized in Calabria, the extreme region of the Peninsula close to Sicily (Musarella & al. 2020).

*A. cordifolia* is therefore an alien species now widespread in almost all the Italian regions including, as mentioned, also Sicily (Galasso & al. 2018). For this island, recent data demonstrate its widespread occurrence in the Western part (Pasta & al. 2016), as well as in the Aeolian Islands and in the Messina area, along the coastal stretch between Milazzo and S. Agata di Militello (Rossitto & Ilardi 1998). Recently, the species has landed even further south, on the small island of Linosa (Pasta & al. 2017). On the other hand, there are recent reports for Calabria (Musarella & al. 2020) and - outside the Italian territory - in the nearby North African coast, specifically in Algeria (Sakhraoui & al. 2019).

In the Messina area the species was reported very generically. Recent observations on the vegetation of the watercourses of the Tyrrhenian side of the Nebrodi Mountains, have allowed us to observe a widespread occurrence along the Naso stream, downstream of the homonymous inhabited center in the province of Messina, near the most famous town of Capo d'Orlando.

The site in question – as it is located between Milazzo and S. Agata di Militello – therefore falls within the coastal stretch reported by Rossitto & Ilardi (1998), but more than the coastal strip it concerns the fluvial branch of the aforementioned stream, in North-South direction, or from the valley towards the mountain, up to the inhabited area of Sinagra, a small town of the Nebrodi at 260 m (a.s.l.) [latitude 38°5'0"N - longitude 14°51'0"E].

The object of this contribution is therefore reporting the particular Sicilian settlement of *Aredera cordifolia*, a plant with a marked invasive character on the native river vegetation. It has evident environmental and synecological as well as landscape effects (Fig. 1).



Fig. 1. *Aredera cordifolia* in the riverbed of the Naso stream (NE-Sicily): the impact on woody vegetation and the landscape is evident.

For these aspects, its further diffusion in Sicily and in the fluvial habitats deserves to be controlled and monitored over time.

## Materials and Methods

The presence along the Naso stream, in the province of Messina, of the alien *Anredera cordifolia* is examined with reference to its impact on the vegetation of the watercourse. The population of this species is located along the riverbed of the Naso stream, falling within the territory of the Province of Messina, between Capo d'Orlando and Brolo (Fig. 2). The torrential course examined flows between 50-250 m (a.s.l.), for a length of about 3 km, involving the potential space pertaining to the associations referable to the class *Quercetea Ilicis* Br.-Bl. ex A. & O. Bolos 1950. The phytocoenosis in which the species occurs was analyzed on the basis of 5 surveys carried out in October 2020, following the phytosociological method of the Zurich-Montpellier School, limited to the coverage index only. The relevés carried out at 50, 100, 150, 200 and 250 m (a.s.l.) are reported in Table 1. The nomenclature of taxa listed therein follows Bartolucci & al. (2018) for the native taxa; Galasso & al. (2018) for the alien ones.



Fig. 2. a) The lianosus character of *Arendera cordifolia* in the Nebrodi site ensures that the plant covers the entire canopy of the trees that support it; b) Aspect of vegetation physiognomized by *Tamarix gallica* invaded by *Arendera cordifolia*.

Table 1. Aspects of hygrophilous woody vegetation with *Anredera cordifolia* along the Naso stream (N-E Sicily).

| Biological form                          | Relevé (n°)                                       | 1   | 2   | 3   | 4   | 5   | FREQUENCY |
|--|---|-----|-----|-----|-----|-----|-----------|
|  | Altitude (m a.s.l.)                               | 50  | 100 | 150 | 200 | 250 |           |
|  | Exposure  | N   | N   | N   | N   | N   |           |
|  | Slope (°)   | 3   | 5   | 3   | 4   | 5   |           |
|  | Total cover (%)                                   | 90  | 95  | 100 | 95  | 100 |           |
|  | Woody layer average height (m)                    | 5,0 | 5,5 | 6,0 | 6,0 | 6,5 |           |
|  | Area (m <sup>2</sup> )                            | 70  | 90  | 80  | 80  | 70  |           |
| <b>Invasive species</b>                  |   |     |     |     |     |     |           |
| NP                                       | <i>Anredera cordifolia</i>                        | 1   | 3   | 5   | 4   | 1.  | V         |
| <i>Salici-Populeta nigrae</i> Contingent |   |     |     |     |     |     |           |
| P  | <i>Salix alba</i>                                 | 1   | 1   | 2   | 2   | 2   | V         |
| P  | <i>Salix pedicellata</i>                          | 1   | 2   | 1   | 2   | 2   | V         |
| P  | <i>Populus nigrae</i>                             |     | 2   | 2   | 2   | 2   | IV        |
| P  | <i>Salix purpurea</i> ssp. <i>lambertiana</i>     | 1   | 1   | 1   | 2   | 2   | IV        |
| P  | <i>Ulmus canescens</i>                            |     | 1   | 1   | 1   | 1   | IV        |
| P  | <i>Alnus glutinosa</i>                            |     |     | 1   | 1   | 1   | III       |
| P  | <i>Fraxinus angustifolia</i>                      | 1   | 1   |     | 1   |     | III       |
| P  | <i>Salix ×rubens</i>                              |     |     | 1   | 1   | 1   | III       |
| P  | <i>Sambucus nigra</i>                             |     |     | 1   | 1   | 1   | III       |
| H  | <i>Carex pendula</i>                              |     | 1   | 1   |     | 1   | III       |
| NP                                       | <i>Hypericum hircinum</i> ssp. <i>majus</i>       |     |     |     | 1   | 1   | II        |
| NP                                       | <i>Solanum dulcamara</i>                          |     |     |     | 1   | 1   | II        |
| H  | <i>Saponaria officinalis</i>                      |     | 1   | 1   |     |     | II        |
| H  | <i>Angelica arcangelica</i>                       |     |     |     | 1   |     | I         |
| <i>Nerio Tamaricetea</i> Contingent      |   |     |     |     |     |     |           |
| NP                                       | <i>Rubus ulmifolius</i>                           | 1   | 1   | 1   |     | 1   | IV        |
| P  | <i>Tamarix gallica</i>                            | 1   | 1   | 1   |     |     | III       |
| P  | <i>Spartium junceum</i>                           | 1   | 1   |     | 1   |     | III       |
| P  | <i>Tamarix africana</i>                           | 1   | 1   |     |     |     | II        |
| P  | <i>Nerium oleander</i>                            |     | 1   |     |     |     | I         |
| <b>Other species</b>                     |   |     |     |     |     |     |           |
| NP                                       | <i>Rubus ulmifolius</i>                           | 1   | 1.  | 1   | 1   | 1   | V         |
| H  | <i>Juncus inflexus</i> ssp. <i>inflexus</i>       | 1   | 1   | 1   | 1   |     | IV        |
| H  | <i>Mentha pulegium</i> ssp. <i>pulegium</i>       | 1   | 1   | 2   |     | 1   | IV        |
| P  | <i>Pyrus spinosa</i>                              |     | 1   | 1   |     | 1   | III       |
| P  | <i>Prunus spinosa</i> ssp. <i>spinosa</i>         |     |     | 1   | 1   | 1   | III       |
| H  | <i>Prunella vulgaris</i> ssp. <i>vulgaris</i>     | 1   |     |     | 1   | 1   | III       |
| H  | <i>Cirsium creticum</i> ssp. <i>triumfettii</i>   | 1   | 1   |     |     | 1   | III       |
| H  | <i>Typha latifolia</i>                            | 1   | 1   |     | 1   |     | III       |
| P  | <i>Crataegus monogyna</i>                         |     |     |     | 1   | 1   | II        |
| P  | <i>Ricinus communis</i>                           | 1   | 1   |     |     |     | II        |
| P  | <i>Clematis vitalba</i>                           |     |     |     | 1   | 1   | II        |
| NP                                       | <i>Smilax aspera</i>                              | 1   |     | 1   |     |     | II        |
| H  | <i>Juncus articulatus</i> ssp. <i>articulatus</i> |     |     |     | 1   | 1   | II        |
| H  | <i>Rumex conglomeratus</i>                        | 1   |     |     | 1   |     | II        |
| G  | <i>Equisetum telmateia</i>                        |     |     |     | 1   | 1   | II        |
| H  | <i>Juncus conglomeratus</i>                       |     |     | 1   |     | 1   | II        |
| Ch                                       | <i>Dittrichia viscosa</i>                         | 1   | 1   |     |     |     | II        |
| G  | <i>Tussilago farfara</i>                          |     | 1   |     | 1   |     | II        |
| H  | <i>Mentha aquatica</i> s.l.                       |     |     |     | 1   | 1   | II        |
| H  | <i>Heracleum sphondylium</i> ssp. <i>elegans</i>  |     |     |     | 1   | 1   | II        |
| H  | <i>Mentha spicata</i>                             |     |     |     | 1   | 1   | II        |
| H  | <i>Calystegia sepium</i>                          |     |     |     | 1   | 1   | II        |

Table 1. continued.

|    |                                 |   |   |   |   |   |    |
|----|---------------------------------|---|---|---|---|---|----|
| G  | <i>Phragmites australis</i>     | 1 |   |   | I |   | II |
| G  | <i>Arundo plinii</i>            | 1 | 1 |   |   |   | II |
| H  | <i>Scirpoides holoschoenus</i>  | 1 | 1 |   |   |   | II |
| H  | <i>Urtica dioica</i>            |   |   |   | 1 | 1 | II |
| H  | <i>Hyparrhenia hirta</i>        | 1 | 1 |   |   |   | II |
| T  | <i>Symphyotrichum squamatum</i> | 1 | 1 |   |   |   | II |
| H  | <i>Oloptum miliaceum</i> s.l.   | 1 |   | 1 |   |   | II |
| H  | <i>Cyperus alternifolius</i>    |   | 1 |   | 1 |   | II |
| T  | <i>Xanthium italicum</i>        | 1 |   | 1 |   |   | II |
| P  | <i>Malus sylvestris</i>         |   |   |   | 1 |   | I  |
| P  | <i>Rhamnus alaternus</i>        |   | 1 |   |   |   | I  |
| Ch | <i>Dorycnium rectum</i>         | 1 | 1 |   |   |   | I  |
| H  | <i>Plantago major</i>           | 1 |   |   |   |   | I  |
| H  | <i>Lolium arundinaceum</i>      | 1 |   |   |   |   | I  |
| T  | <i>Persicaria lapathifolia</i>  |   | 1 |   |   |   | I  |
| H  | <i>Epilobium montanum</i>       |   |   |   | 1 |   | I  |
| H  | <i>Carex distans</i>            |   |   |   |   | 1 | I  |
| G  | <i>Arundo donax</i>             | 1 |   |   |   |   | I  |
| H  | <i>Epilobium hirsutum</i>       |   |   |   | 1 |   | I  |
| T  | <i>Datura stramonium</i>        |   | 1 |   |   |   | I  |

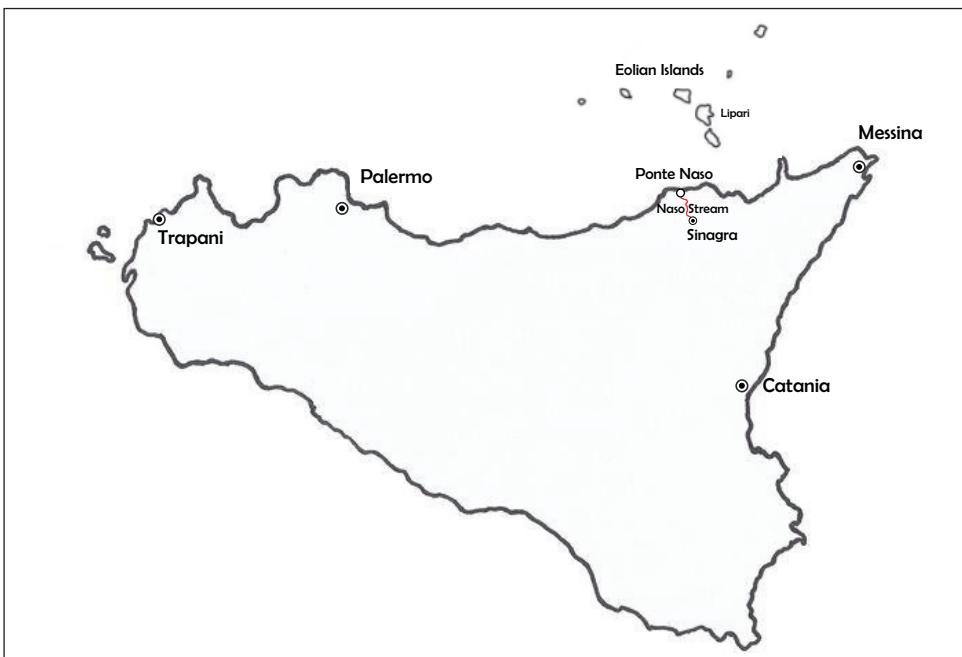
## Results and Conclusion

The Sicilian site examined falls along the river course of the Naso stream, on the northern side of the Nebrodi area, of which unpublished mesophilic aspects of woody vegetation have also been presented (Raimondo & al. 2021). The greatest diffusion of *Anredera cordifolia* is observed along a significant part of the Naso Torrent, a watercourse descending from the northern slopes of the wooded mountain system of the province of Messina, with seasonal variable flows, but nevertheless sufficient even in summer to feed in addition to the woody phytocoenoses hygrophilous of the class *Salici purpureae-Populetalia nigrae* Rivas Mart. & Canto ex Rivas Mart. & al. 1991, and hydrophilic herbaceous phytocenoses of the *Nasturtio officinalis-Glycerietalia fluitantis* Pignatti 1953.

The South American alien is a fickle suffruticosa; due to this character it climbs both shrubs and trees, forming a characteristic facies, particularly evident during the flowering period with creamy-white tones, spectacular for the recurrence of the plant on the vegetal landscape of the watercourse (Fig. 3).

From the phytosociological point of view – as can be seen from Table 1 – it is an unusual facies of natural hygrophilous forest vegetation, to refer to both mesophilic aspects of the class *Salici-Populetea nigrae*, and more thermophilic aspects of the class *Nerio-Tamaricetea* Br.-Bl. & O. Bolos 1958.

In relation to its diffusion and known data in Sicily, the Messina province site represents the area of largest diffusion of the species in Sicily, affecting a long stretch of the bed of a watercourse. Due to the density and extent that the population of the Messina area has so far assumed, today it is not possible to hypothesize the impact that the species may have on the occupied phytocoenosis. Probably – at least in the examined site – it already constitutes a differential element of the plant communities of the two classes mentioned above.



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