The creeping jenny (*Lysimachia nummularia*) for use in aquaria

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Abstract. We propose in this work to present the method, advantages and disadvantages of using in the aquarium a plant brought from green spaces or gardens, *Lysimachia nummularia*. The species can live in the aquarium for up to two months. It can be used, among other things, to set up aquariums for decoration and for the reproduction of aquarium fish. Terrestrial plants transplanted into aquariums drastically change their shape, growing excessively in length, the growth of the stem in thickness, leaf development and flowering being inhibited. In the aquarium, adventitious roots appear at almost all stem nodes. The plants make a great effort to get out of the water and have permanent contact with the atmospheric air. *L. nummularia* is not a pretentious plant regarding temperature values or heat shocks. The disadvantage of using these plants in the aquarium is that the basal leaves die, fall and more or less pollute the water. The advantages are important: low price and efforts for their procurement, it does not carry pathogens, pleasant appearance.
Key Words: moneywort, aurea, herb twopence, twopenny grass, Primulaceae, aquarium.

Introduction. *Lysimachia nummularia* is a terrestrial, or sometimes aquatic, perennial plant that is part of the Primulaceae family. It is a plant that forms a dense carpet, full of leaves, and has a creeping appearance (gardenexpert.ro) (Figure 1). Its vernacular names in English include moneywort, aurea, herb twopence, creeping jenny, and twopenny grass (Wikipedia.org). The Latin specific epithet *nummularia* means "like a coin" (Harrison 2012), referring to the shape of the leaves; hence the common names, such as "moneywort", which also references coins (Wikipedia.org). It is a medicinal plant (Doğan 2018; Csepregi et al 2020; Karpavičienė 2022).

The propose of the current paper was to present the method, advantages and disadvantages of using in the aquarium a plant brought from green spaces or gardens, *L. nummularia*.

The leaves. The leaves of this species grow in pairs with a trifoliate appearance (gardenexpert.ro) (Figure 1). The leaves are opposite, round or elliptic, obtuse, with entire edges, very shortly petiolate, with red glandular dots (Mag-Mureșan & Pop 2004).

The stems. They are up to 1 meter long and bear small, rounded, heart-shaped, green or yellowish-green leaves on either side (Figure 1). The stem is glabrous, simple or weakly branched, in four edges, rooting at the nodes (Săvulescu 1960).

The flowers. They are small, cup-shaped, with a diameter of 2 cm, consisting of five yellow petals. In southeastern Europe, where we studied the plant, flowering occurs from June to August. The flowers are solitary and axillary (Săvulescu 1960; Mag-Mureșan & Pop 2004). They have floral pedicels as long as the leaves, or longer. The calyx is 7 mm long, with cordiform lacinides, separated to the base. The corolla is intense yellow, reddish glandular dotted on the inside, about 15 mm wide, twice as wide as the calyx, divided almost to the base into obovate, obtuse lacunia, with entire margins. The stamens are two to three times shorter than the corolla, with hairy glandular filaments,

concrested at the base (Săvulescu 1960; Mag-Mureșan & Pop 2004). The style is as long as the stamens. The capsule, rarely developed, is globular, 4-5 mm long, shorter than the calyx, whitish yellow, with small red secretory bags. The seeds are warty, have three edges and are warty and 1-1.5 mm long (Săvulescu 1960; Mag-Mureșan & Pop 2004).

Figure 1. *Lysimachia nummularia* (photo by Kurt Stüber for Wikipedia.org).

Intraspecific variability. There is intraspecific variability (Săvulescu 1960; Mag-Mureșan & Pop 2004), with this plant meeting several forms classified according to:

- Season and shape of the leaf:
  - *submersa* – submerged, sterile plant, with thin leaves, without a petiole; leaves primaries obovate, the following ones round and usually few
  - *cordifolia* – slightly cordate leaves at the base
  - *rotundifolia* – round leaves
  - *ovalifolia* – elliptic ovate leaves
  - *parvifolia* – elongated elliptic leaves, small.
- Floral pedicels:
  - *brevipedunculata* – pedicels shorter than the leaves or at least their length
  - *longipedunculata* – pedicels longer than the leaves.

Distribution. The species is native to Europe, but has been introduced to North America, where it is considered an invasive species in some areas (Miller et al 2021; Casterline 2020). It aggressively spreads in favorable conditions, such as low wet ground or near ponds. It is moderately difficult to remove by hand pulling. Any tiny piece left behind will regrow (Wikipedia.org; Săvulescu 1960).

Habitat. *L. nummularia* is a small perennial plant that at maturity grows to a height between 5 and 10 centimeters from the ground. It is very resistant, has an easy growth and develops very well in both sunny and semi-shaded areas (Săvulescu 1960). It prefers light, which is important for the growth and flowering of the plant. The flowering

period begins in June and lasts until the end of August (Săvulescu 1960). It prefers moist, well-drained soils and does not need special maintenance and care. It is hardy, surviving to temperature of −15°C (5°F) (rhs.org.uk).

Cultivation. *L. nummularia* is a decorative plant in appearance, leaves and flowers. It is planted as a decorative flower in landscape and decorative arrangements in gardens and parks, on walls, in pots, or in hanging baskets. It can be planted along borders or as a ground cover plant. For special decorations, *L. nummularia* can be planted in mixed arrangements, in combination with other decorative garden plants and herbs (gardenexpert.ro). Preferably, the soil in which the plant is grown should be well-drained, loose and sandy, rich in nutrients, with a neutral pH. Watering should be done regularly, with plenty of water. In the case of cultivation, propagation is done by cuttings, and then by separating the bush.

Use of the plant in aquariums. The plant was studied and proposed for aquarophilic destination for the first time by Mag-Mureșan & Pop (2004). Aquatic plants are generally necessary in the aquarium, both for fish reproduction and for the aesthetics of the aquarium. Due to their fragility, many plants are destroyed in the management of fish reproduction (Mag-Mureșan & Pop 2004). The price of aquarium plants is not always low. Procuring plants directly from nature (lakes, ponds) is not a very suitable solution because, together with them, some microbial pathogens, fungi, protozoa or parasitic invertebrates can be brought from lakes and ponds (Mag-Mureșan & Pop 2004). Conversely, non-fish-populated waters could be a good source of aquatic plants, but such plant-populated and non-fish-populated waters are very rare.

Aquarium fish from the families Cyprinidae, Characidae, Cyprinodontidae, Anabantidae, etc. almost all require plants in the breeding pools, either for nuptial dances or as a support for semi-adhesive spawn (Mag-Mureșan & Pop 2004). The so-called viviparous fish eat their fry in the absence of plants in which the fry can hide. The plants also serve as a place of refuge for threatened and frightened fish. The fish feel better and safer hidden among the plants in the aquarium (Mag-Mureșan & Pop 2004). Aquatic vegetation serves as food for some omnivorous fish. Plants are also important sources of oxygen dissolved in water, oxygen so necessary for aquatic organisms. They also absorb potentially toxic nitrogenous substances from water (Mag-Mureșan et al 2004).

Terrestrial plants of the *L. nummularia* species, brought from nature and grown in the aquarium as submerged plants, drastically change their morphology, closely resembling the above-mentioned *F. submersa*. Both plants planted in pots and those that stand free in the water mass, or on its surface, intensify their growth in length (Mag-Mureșan & Pop 2004). The plants elongate their stems, instead growth in thickness, leaf development and flowering are inhibited. The internodes become longer and longer, and long and thin adventitious roots appear at the nodes. The basal leaves degrade and fall, while the leaves appearing at the top of the stems are small and rare but attractive (Mag-Mureșan & Pop 2004). Plants tend to withdraw their cauline apex from the water table, at which point their leaves begin to widen and growth in length slows. Some sprouting is also observed in plants grown freely on the surface of the water, which is not observed in plants grown in pots in aquariums, at greater depths (Mag-Mureșan & Pop 2004). The latter have the highest growth rate in length, but show extremely degraded basal leaves. We deduced from what we observed, that the plants try to get out of the water, spending a lot of energy for this purpose, the plant even consuming its own tissues to reach atmospheric air and light. If the water is still enough that the plant can keep the terminal portions of its stems out of the water, this plant will live for about another two months. Otherwise, it will grow in length and thin to exhaustion, trying to partially emerge from the water. This contact with the air, we believe, is responsible for the proper development of gas exchanges between the plant organism and the atmospheric air (Mag-Mureșan & Pop 2004).

We infer from these observations that *L. nummularia* is not a true submerged plant. *L. nummularia* is not pretentious in terms of temperature and resists sudden temperature changes. A strong lighting helps it a lot, because it induces the

intensification of the photosynthesis process. The growth rate of the plant in length is more accentuated at high temperatures than at low ones. The young shoots that appear are extremely attractive.

The plant is not toxic to aquarium animals. We found that the fish feel good in their new shelters. Female *Betta* fish can easily hide and avoid aggressive males (Mag-Mureșan & Pop 2004). Due to the abundant vegetation, males of *Xiphophorus hellerii* Heckel, 1848 do not meet so often, therefore conflicts between them are rarer. The females of the so-called viviparous species hide in the plants, escaping from the grip of the tireless males (Petrescu & Mag 2006; Petrescu-Mag 2008). The newborn fry find their hiding place by escaping from the hungry parents (Mag-Mureșan & Pop 2004). Fish from the genera: *Trichopodus, Betta* and *Macropodus* choose floating plants, under which they build their foam nest for spawning (Pop & Mag-Mureșan 2004ab). The nuptial dances of fish such as *Puntigrus tetrazona* (Bleeker, 1855), *Danio rerio* (Hamilton, 1822), *Devario malabaricus* (Jerdon, 1849), *Pethia nigrofasciata* (Günther, 1868), *Puntius titteya* Deraniyagala, 1929*, Paracheirodon innesi* (Myers, 1936), *Hyphessobrycon rosaceus* Durbin, 1909, etc., take place absolutely normally under the conditions created by us with the help of tested plants (Mag-Mureșan & Pop 2004).

The disadvantages of using plants of this species are that they lose their basal leaves, which, degrading, can change some water quality parameters in the aquarium. The plants of this species are consumable and must be replaced when they are two months old (Mag-Mureșan & Pop 2004).

The advantages of using the species *L. nummularia* are important: the plants are free or easy to procure, they exist in abundance, they can be harvested without difficulty, they are not fragile, so they can be handled easily and quickly, they can be used as sacrificial plants in aquariums disinfected with toxic substances or with a lot of salt (Mag-Mureșan & Pop 2004). The most important advantage is that *L. nummularia* does not really grow in deep waters, such as those populated with fish, which reduces the danger of contaminating aquariums with pathogenic agents (Petrescu-Mag 2007). Carp lice (*Argulus* spp.), *Ichtyophtirius* spp., or *Oodinium* spp., are just a few examples of such uninvited guests in the aquarium (Mag-Mureșan & Pop 2004).

Conclusions. *L. nummularia* is a terrestrial, or sometimes aquatic, perennial plant that is part of the Primulaceae family. It is a plant native to Europe that forms a dense carpet, full of leaves, and has a creeping appearance. *L. nummularia* is a decorative plant in appearance, leaves and flowers. It is planted as a decorative flower in landscape and decorative arrangements in gardens and parks, on walls, in pots, or in hanging baskets. It can be planted along borders or as a ground cover plant. For special decorations, *L. nummularia* can be planted in mixed arrangements, in combination with other decorative garden plants and herbs.

The species has been tested for use in aquariums. *L. nummularia* can live in the aquarium for up to two months. It can be used, among other things, to set up aquariums for decoration and for the reproduction of aquarium fish. Terrestrial plants transplanted into aquariums drastically change their shape, growing excessively in length, the growth of the stem in thickness, leaf development and flowering being inhibited. In the aquarium, adventitious roots appear at almost all stem nodes. The plants make a great effort to get out of the water and have permanent contact with the atmospheric air. *L. nummularia* is not a pretentious plant regarding temperature values or heat shocks.

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Conflict of interest. The authors declare no conflict of interest.

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