About onions and squids - the elusive *Allium calamarophilon* is revealed

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As a researcher of the Greek flora, I have always been excited by the challenge of searching for and locating rare plant species with minimal records: these are plants I personally call "ghost species", meaning they are usually only known from their initial description and then not observed for years or even decades. A characteristic case of such a species is *Allium calamarophilon*: it was discovered in 1980 by Professor D. Phitos on the coastal rocks of a small cove in the area of Kymi, one of the numerous coves that form along the extensive and steep rocky coast. The initially collected specimens of the species were in fruiting stage, which, combined with the limited clarity and available information about the locus classicus and the general difficulty of accessing the area, has resulted in no photograph of the species in its habitat existing to this day (there is only one published photograph of individuals in bloom, originating from laboratory cultivation) and overall no information about its population size and conservation status – nor, of course, in the IUCN edition for the top 50 plants of the Mediterranean islands (2005 & 2017), which includes *Allium calamarophilon*, where the species' status appears as "Data Deficient". In short, it seems that no one has succeeded to observe it in nature since 1980!

For the history of the species' discovery, we consulted Mr. Dimitrios Phitos, Emeritus Professor of the Department of Biology at the University of Patras, who also served as President (1980-2) of the Hellenic Society for the Protection of Nature and is currently its Honorary President. Mr. Phitos kindly provided us with topographical and other information related to the “locus classicus” of *Allium calamarophilon* Phitos & Tzanoud. Here is his narrative:

«It is natural to wonder how it is possible for the name of a terrestrial plant to be associated with the name of a marine organism, as is the case here with the 'calamari / squid' (Allium calamarophilon Phitos & Tzanoud.). The reason is as follows: due to my parents' origin from the broader area of Kymi (east Euboea Island) and specifically from the coastal village of Platana, I had the opportunity in the past to spend my summer vacations there. During the summer months, European flying squids (Todarodes sagittatus), commonly known in Greek as ‘thrapsala’, migrate to the sea shores, from Cape Kymi (Kavos) towards the northwest, along a coastal length of several kilometers. Fishing them has been and still is a traditional but mainly enjoyable occupation for the inhabitants of the aforementioned area! Under the vertical steep cliffs of the coast and the fantastic starry sky, 'squid fishing' begins when night falls. Upon arriving from our base (Platana) at the fishing area and before the fishing started, we used to make a stop at a small cove with a sandy beach, about 20 meters wide, from which a small ravine, about 50 meters deep, begins. At the back, vertical limestone cliffs, over 50 meters high, rise. This ravine is called 'Apokleistis'. During one of these stops (July 9, 1980), we arrived at the area earlier than usual, so, perhaps driven by an instinct for research, I proceeded to the back of

the ravine and climbed the steep limestone cliffs to a height of about 15 meters, where I collected, among other things, a few specimens of the Allium in question. It was a new species, which we believe rightly bears the name Allium calamarophilon! The specimens collected then constitute the 'HOLOTYPUS' of this species. "The pleasant with the useful...!" as a Greek saying goes.»

Among those who attempted in the past to locate the species, without success obviously, was myself: it was in 2007, as part of the SEMCLIMED project (Impact of Climatic Change on the Mediterranean Flora and Conservation Actions), in which the Seed Bank of the National and Kapodistrian University of Athens (NKUA) participated. Along with my colleague, biologist Katerina Koutsovoulou, and having only some vague information from the initial publication, we approached, starting from the settlement of Hili and walking along the rocky coast, the bay where the "Apokleistis" stream ends (without knowing then, of course, that this is where the species' locus classicus is located). However, it was impossible to reach the coast from the point we arrived on foot, as there was a completely vertical rock face falling into the sea.

Ultimately, my 'encounter' with this rare species took place many years later, in the afternoon of June 13, 2022, when I was conducting botanical research north of the town of Kymi - without, however, having *A. calamarophilon* in mind at all when I started. My goal was to explore a rocky outcrop in the wider area of the Castle of Saint George, at an elevation of about 350 meters, which had piqued my interest for locating certain species. These species were targets of the project "Conserving the Flora of the Balkans: Native Plants of Greece" (scientifically overseen by Professor Emeritus Costas A. Thanos, in collaboration with and funded by the Royal Botanic Gardens, Kew, UK), aimed at collecting and preserving seeds of native Greek plants in the Seed Bank of NKUA. Wanting to focus on the chasmophytic flora, I began the ascent from relatively low and moved up a steep but fairly safe rocky face of the hill. Initially, this choice had a very negative outcome: having neglected to close the camera case, during a maneuver, the camera first fell into the void and then struck the rocks forcefully, detaching the lens and tumbling down several dozen meters. Having identified where it landed so I could retrieve it on the way back, I furiously decided to continue towards the top of the hill, at least to complete the work I had started.

A few meters above and a little before the summit, I stopped to rest on a relatively flat rocky surface when a few low, blooming wild onions caught my attention, peeking out from the edges of the cliffs. It didn't take long for the purple lines along the white crowns of their flowers to evoke the proper associations and refer me to the unique known image of *Allium calamarophilon*. And just the possibility of having rediscovered such a rare find made the coincidence of my malfunctioning camera seem unbelievable! With the rather limited capabilities of its - far from state-of-the-art - smart phone camera that I had with me, I took some photos; while wandering on top of the hill, I located several dozens of individuals of the species, gathered in two main areas. Of course, I also collected two intact individuals with their bulbs for taxonomic identification.

From the macroscopic examination of its characters I subsequently carried out, with the help of the species description, I had the initial impression that I had indeed likely identified *Allium calamarophilon*. Naturally, we immediately consulted a specialist in Systematic Botany, the project collaborator Katerina Goula, who examined the live samples and identified them as *Allium calamarophilon*: the satisfaction I gained from this confirmation is not easily described in words, as it seemed that I was the first researcher since 1980 to observe the species in Nature and the first to photographically capture it in its habitat!

Finding *A. calamarophilon* in the broader area significantly contributes to what was already known about this extremely rare species: the main flowering month is June (not July), the altitude of presence reaches 350 m, the habitat is not exclusively coastal cliffs, but also open rocky locations and rock clefts inland. Although we did not yet have a precise location for the locus classicus, less than 800 meters away in a straight line is the very cove where the stream "Apokleistis" ends: indeed, after communication with Professor Phitos, it was confirmed that the shore of this exact cove is the site where the species was first collected. It is noted that accessing the locus classicus is extremely difficult even via the (steep and rocky) stream - in which, furthermore, the effluents of the biological purification of the town of Kymi flow...

Approximately 40 days after locating the plant in the new site, we revisited the area to collect mature seeds of the species, but it turned out to be too late as their dispersal had already taken place. Therefore, we decided to visit the area in a more organised way the following year. Indeed, on June 12, 2023, we visited the area again with colleagues, the fellow biologists Spyros Oikonomidis and Sofoklis Mouratidis, in order to conduct a more thorough investigation of the area regarding the population size, which was estimated to number just over 1000 individuals, and to photograph the plant in flowering phase and its habitat. As for the collection of mature seeds, one month later, the plants of the species were in full fruiting: ensuring not to exceed the upper limit of 10% of the mature seeds of the population (as always), a collection of approximately 1500 seeds of this extremely rare endemic species of Euboea is now preserved in the Seed Bank of the University of Athens.

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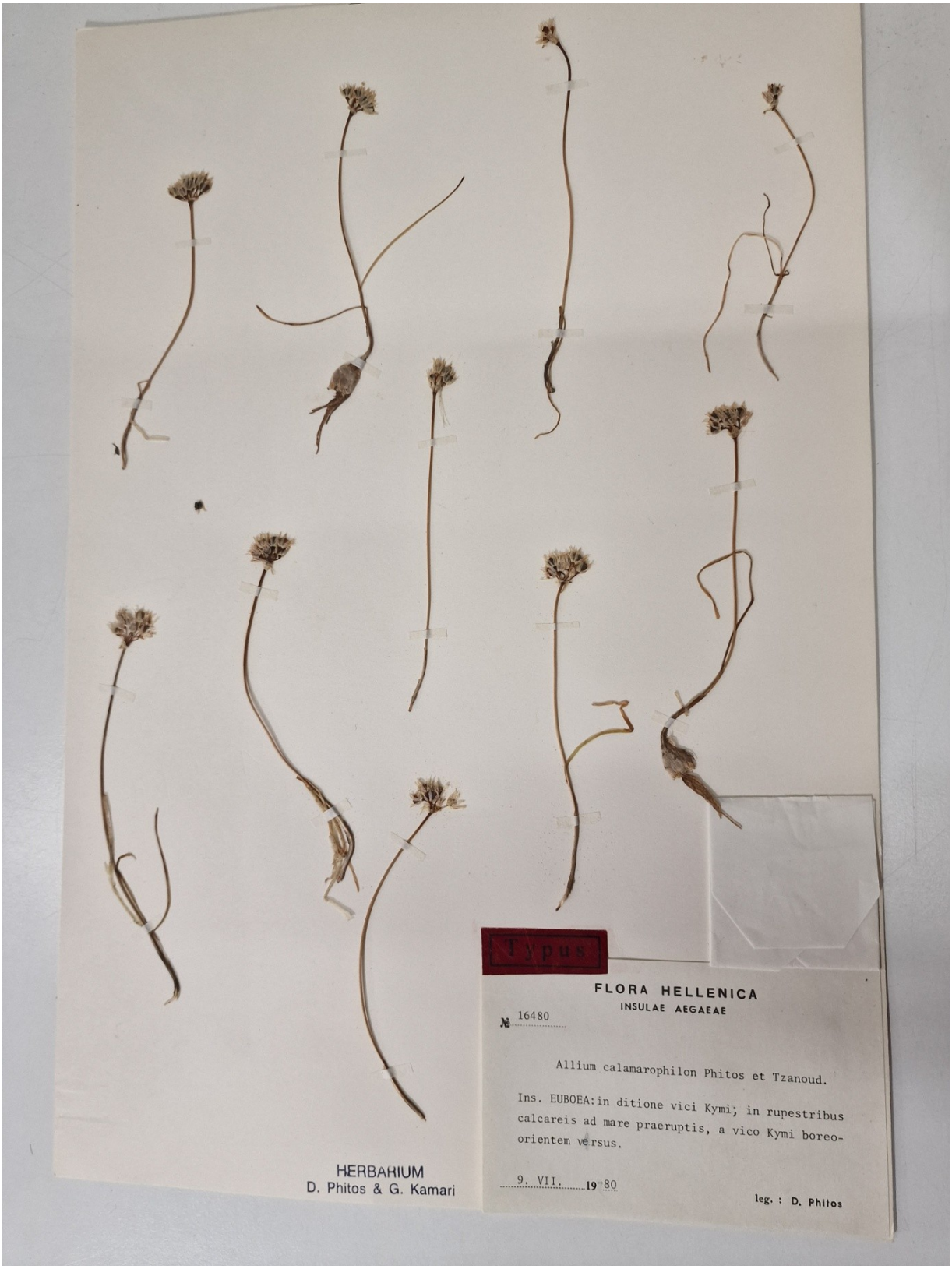

The holotype of *Allium calamarophilon* preserved at the "Herbarium Phitos & Kamari" in the Botanical Museum of the University of Patras (photo: G. Kamari)

The coast of the cove where the stream "Apokleistis" ends, which constitutes the 'locus classicus' of *Allium calamarophilon* (photo: A. Kaltsis)

Allium calamarophilon at the beginning of its flowering, on 13.6.2023 (photo: A. Kaltsis)

Individuals of *Allium calamarophilon* in their rocky habitat at the newly discovered location, north of the town of Kymi (photo: A. Kaltsis)