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Fishing using poisonous plants in Campania, Italy. A brief historical survey

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Abstract

This article delves into the historical use of poisonous plants used for fishing in Campania, Italy, from the 16th to the 19th centuries, exploring both ancient practices and more recent practices found during the era of transition to the Italian Kingdom. It describes how various plants used as ichthyotoxins, including *Cyclamen* spp., *Euphorbia* spp., *Taxus baccata*, and *Strychnos nux-vomica*, underscoring their significance in traditional fishing methods in Campania across different times. The study also examines legal and regulatory responses to this practice, noting its persistence despite changing legal frameworks. This examination sheds light on the deep-rooted tradition of using natural toxins in fishing, contributing to our understanding of cultural practices in Southern Italy.

Keywords: fishing, *chiusarana*, poisonous plants, *Euphorbia*, *Taxus*, *Strychnos*, *Cyclamen*, Campania, XVI-XIX Centuries

Riassunto

Questo articolo approfondisce l'uso storico di piante velenose per la pesca in Campania, Italia, dal XVI al XIX secolo, esplorando sia le pratiche antiche sia la transizione all'epoca del Regno d'Italia. Si prendono in considerazione diverse piante utilizzate come ittiotossiche, tra cui *Cyclamen* spp., *Euphorbia* spp., *Taxus baccata* e *Strychnos nux-vomica*, sottolineando la loro importanza nei metodi di pesca tradizionali in Campania durante un arco temporale molto esteso. Lo studio esamina anche le risposte legali e normative a questa pratica, notando la sua persistenza nonostante l'evoluzione dei quadri

giuridici. Questo esame fa luce sulla radicata tradizione dell'uso di tossine naturali nella pesca, contribuendo alla comprensione delle pratiche culturali nell'Italia meridionale.

Keywords: pesca, *chiusarana*, piante velenose, *Euphorbia*, *Taxus*, *Strychnos*, *Cyclamen*, Campania, XVI-XIX Secolo**.**

Introduction

Fishing by poisonous plants is a technique largely used throughout the world. In one of the first syntheses on this topic Greshoff (1900) recorded about 500 species, including fungi, that were used as ichthyotoxins. The seed plants represented the largest part of this list and were distributed among approximately 210 different plant families. Building on this work, Heizer (1953) showed that the use of piscicides encompassed a large geographical area, from Persia to North China and Asia extending to Indonesia, Malaysia, Japan, and Australia indicating that their use was possibly spread by cultural contacts between different ethnic groups. Europe was another large geographical area where there was an old tradition of plant piscicides, from eastern and central European countries, as Poland, Hungary, and Bosnia, to France, the British Isles, and Ireland (Svanberg & Locker, 2020). Fish poisoning was also reported from the Mediterranean region. Álvarez Arias (2003) listed 32 ichthyotoxic plants used in Spain, where this practice was already spread throughout the region in Middle Ages. The use of stunning or killing fish by plants has been also reported in Portugal (Van De Putte, 2005), Italy (Guarrera, 2005; Leto et al., 2013), and Greece (Kamen-Kaye, 1977). Regarding Greece, Heizer (1953) suggested that a report on ichthyotoxic plants could be found in the writings of Aristotle. Indeed, in *Historia animalium*, he reported the practice of using plant piscicides: "Fishes are poisoned with the plant called mullein for which reason some persons capture them by poisoning the waters of rivers and ponds […]" (Aristotle, 2002, Hist. An. VIII, XX). Quigley (1956) suggested that the entire Old World was a single diffusion area of fish poisoning knowledge, coming from Southern or Southeastern Asia, probably the focus area of this trait, whence moved to the rest of the world.

The origins of fish drugging are thought as being very remote: Béarez (1998) reported evidence of this practice from an archeological site of Ecuador dated in the first millennium. Howes (1930) described in detail the usual method in which this practice was conducted in most parts of the world: the organs of the plants containing most of piscicide substances are collected and finely crushed. Then the fragments are thrown in a part of a water body with a slow water flow and, acting on respiratory systems of the fish, produced a stupefying effect, followed by death. Less frequent is the alternative strategy, in which the toxic plant is consumed by the fish after being mixed with food. Heizer (1953) mentioned also other two strategies, (i) putting plant material in a basket that is soused deep and down in the water, or (ii) burning the plants in close vicinity to water, so that the toxic smoke spreads over the water. Plants can also be fermented or cooked before being used, or they can be thrown in the water and subsequently beaten with a stick, to allow the releasing of the toxic substances (Acevedo-Rodrìguez, 1990).

The number of plants used is so high and the species are so diverse, that many chemical constituents can be considered as responsible for the toxic effects on fish metabolism. The active ingredients range from tannins to other phenolic compounds such as isoflavonoids, alkaloids or hydrocyanic acid. Only the latter compound requires a mild heat treatment to separate it from the bark of some plants, while the others are active immediately after

crushing the leaves, rhizomes or roots. The aforementioned substances can also be toxic to humans, so the choice of plant is often linked to this crucial aspect. For example, Van Andel (2000) emphasizes that most ichthyotoxic plants used by Amerindians of Northeast Guyana contains rotenone, an isoflavone causing respiratory failure of fish, that can be safely digested by humans and is unstable in light and heat.

Fishing with ichthyotoxic plant material is also reported from Italy by Savo et al. (2013), who refers that "the use of ichthyotoxic plants for illegal fishing is frequently reported in freshwater basins, while it is rare in coastal areas". However, modern studies concerning this practice seems to be mainly focused on the Northern regions of Italy (Cornara et al., 2009), although the use of poisonous plants in fishing activities has also been noted in Southern Italy and dates to Antiquity. Here we report information on poaching with poisonous plants in Southern Italy across the centuries, focusing our research on Centuries XVI-XIX, also including the first decades of the newborn Kingdom of Italy.

Methodology

Different sources were used for drawing a picture of poaching with poisonous plants in Campania. An examination of the decrees issued in Southern Italy against this illegal activity over the centuries was also carried out. The main sources consulted were Savelli (1681), Dentice (1853), Dorotea (1863) and the *Gazzetta Ufficiale del Regno* after the unification of Italy in 1861. In this report we have devoted special attention on the fundamental contribution to the knowledge of this practice, due to Achille Costa, zoologist and director of the Museum of Zoology of the University of Naples from 1860 to 1880, who wrote *Delle chiusarane e della pesca colla melaterragna e col totumaglio nel Golfo di Napoli* (1870), subsequently summarized in the Italian *Annali del Ministero di Agricoltura, Industria e Commercio*, curated by A. Targioni Tozzetti (1871).

Results and Discussion

There was various evidence of poaching with poisonous plants in Campania from XVI to XIX century according to the decrees issued on this topic within the Kingdom of Naples. On 16th of April, 1543 the Regia Camera della Sommaria (an administrative, jurisdictional and consultative Institution operating during the Angevin and Aragonese regimes in the Kingdom of Naples) forbade the throwing of yew or other poisonous herb into the rivers by which fish die ("è proibito di gettare il tasso o altra erba venefica ne' fiumi per cui muoiono i pesci" – De Vincentiis, 1878). The *Prammatica XIX De nautis et portubus*, was a law ratified on 1784 that regulated in the Kingdom of Naples the entire spectrum of activities related to sea and freshwater, included fishing, subsequently reinforced by the decree enacted by Ferdinando II King of Naples on 1834, which explicitly referred to fishing with poisonous plants: "for fishing with *pomo terragno*, titimol, vomitic nut, yew or other substance that makes the fish's food harmful, the first degree of imprisonment will be applied for the mere fact of having made use of these substances, in addition to the fine of 3 to 12 ducats" ("Per la pesca col pomo terragno, col titimolo, colla noce vomica, col tasso o con altra sostanza che renda nocivo il cibo de' pesci, si applicherà pel solo fatto di essersi valuto di tali sostanze, oltre l'ammenda di 3 a 12 ducati, il primo grado di prigionia" – Suppl. Cod., 1850). But even after the establishment of the Kingdom of Italy (1861) the practice of using poisonous plants in fishing was still alive, becoming the target of laws aiming to ban it in all Italian regions (Gazzetta Ufficiale, 1883).

Chiusarane was a fishing system based on aggregating nets, and the use of poisonous plants to stun fish, traditionally practiced by the Neapolitan fishermen of Santa Lucia, the Lucians, who possessed the necessary capital to organize such a fishing system on the islands of Capri and Procida (Sirago, 2009), causing protests among fishermen on those islands who were strongly opposed to this fishing technique (Armiero, 1998). The term *chiusarane* was already known in the time of Giambattista Basile (1583-1632) who used it in a fairy tale of *Lo Cunto de li cunti*: "And so, after sending a hundred fishermen out to sea, they set up many skewers, chiusarane (space enclosed by nets where fish can enter but not leave), palangrese (fishing tools consisting of a long hemp rope to which thinner strings are attached, each ending in a hook.), buoli (drift net also called bolentino or ledger rig), pots, lines and wires" ("E cossí, mannato ciento pescature a maro, apararo tante spedune, chiusarane, parangrase, buole, nasse, lenza e felacciune" – Basile, 2013, Cunto I, 9).

Recent ethnobotany research indicates that some of the plants included in XVIII century Prammatica regulating fishing in Southern Italy, as *titimallo* and *pomo terragno* were still used by Italian fishermen till the last century, whereas neither *noce vomica* or *tasso* were reported in the studies carried out during the XIX century. *Strychnos nux-vomica*, native to tropical and sub-tropical Asian and Australian (Agarwal & Gupta, 2023) is a renowned medicinal plant, used in oriental medicine for curing different diseases, ranging from pains, acute inflammatory issues, headaches (Behera, 2019). Nux vomica (*noce vomica* in Italian) is a drug consisting of the dried, ripe seeds of this plant and was known in Europe in the XVI century. It was reported as a new drug in the epistolary between Calzolari and Aldrovandi (Pugliano, 2017) and was already sold in England in the middle XVII century and in Germany in the late XVII century, mainly for poisoning animals (Evans, 2009; Ujváry, 2010). Already known as a potent poison in the Dioscorides *Materia Medica*, *Taxus baccata* (European yew) is a relict tree species, today reduced in the Mediterranean region to small populations (Linares, 2013). All the parts of the tree, except the arilli, are toxic and animal poisoning due to ingestion of part of the tree, prevalently leaves, was extensively reported (Poudel et al., 2021). The mention of yew both in the 1543 decree of *Regia Camera della Sommaria* and in that by 1835 it became widely known, points to a persistent use of *T. baccata* as an ichtyotoxin in illegal fishing, at least in the Kingdom of Naples. This represents novel information, to the best of our knowledge, and no recent ethnobotanical reference about this use of yew has been reported in Italy.

The name *titimollo* or *titumallo* refers to *Euphorbia lathyris* (Penzig, 1974). As far as concerns Southern Italy, different *Euphorbia* species have been employed as a fish poison. The latex of *E. dendroides* was used for ichthyotoxic activity in Basilicata and Calabria (Guarrera & Leporatti, 2007), in Aegadian islands (La Rosa et al., 2021) and in Pantelleria island, where also *E. segetalis* is recognized as a fish poison (Quave & Saitta, 2016). In Sicily, the latex from *E. characias* and *E. rigida* has been used to 'poison' the river in order to flush out eels, making them easier to catch (Leto et al., 2013; Savo et al., 2013).

Pomo terragno deserves a more detailed account. According to Pliny, the plant called *malum terrae* by the Latins was actually a species of *Aristolochia*, a genus that includes several species used in traditional medicine in the Americas, Asia and Europe, despite the reported renal toxicity (Heinrich et al., 2009). Birthwort (*Aristolochia* spp.) was frequently included in Greek and Roman recipes for treating a variety of ailments, from gout to bladder stones and kidney disorders, and was also highly recommended against snake bites (Scarborough, 2011). The *Aristolochia* called *venenum terrae* by the fishermen of

Campania, had a rounded root and could possibly be identified as *A. rotunda*. Pliny mentions that he was present when "they pounded it with lime and threw it into the sea; immediately the fish flew towards it with surprising greed, and being struck dead in an instant, they floated to the surface" ("contusam mixta calce in mare sparsere. Advolant pisces cupiditate mira statimque exanimati fluitant" – Pliny, 1983, NH XXV, 54).

Pliny elsewhere reports that a variety of cyclamen called *chamaecissos*, which has a single leaf and a branched root, was also used for fishing (Pliny, 1983, NH XXV, 67–69). For Pliny, therefore, *Aristolochia* and cyclamen had the same uses, and the reputation of members of the latter genus as ichthyotoxic is also found in Dioscorides, who named cyclamen as ἰχθῦοθήρα (ἰχθῦς = fish + θήρα = hunting – https://stephanus.tlg.uci.edu/lsj/#eid=52959 – Dioscorides, 1958, 2, 164), from which we can deduce that even the Greeks used this plant to catch fish. Apparently, the two genera (*Aristolochia* and *Cyclamen*) have overlapped in popular usage over time, and the name *Aristolochia* with a round root has also been used to identify cyclamen species, as *C. europaeum* (Stirling, 1995–1998).

In the second half of XIX Century, about two thousand years after Pliny, another naturalist described in detail the use of species belonging to the genus *Cyclamen* by Campanian fishermen. Trying to harmonize the existing legislation in the ancient pre-unitary Kingdom of Naples and legislation of the Kingdom of Italy, old decrees and laws were subjected to a scrutiny. Concerning fishing, Achille Costa, chair of Zoology at the University of Naples, and director of the Museum of Zoology, was asked to ascertain if the use in fisheries of ichthyotoxic plants, and in particular of the so called *mela terragna*, had to be banned, according to the previous legislation. A few decades before Tenore and Pasquale, describing the species of *Cyclamen* found in the Kingdom of Naples, reported that all *Cyclamen* species were used by the local fishermen to poison fish: "to do this they pound the said tubers, place them in a closed bag, and this they infuse into the water; after a short time the fish are dead afloat" ("a far questo essi pestano i detti tuberi, li ripongono in un sacco chiuso, e questo infondono nell'acqua; dopo breve tempo i pesci vengono morti a galla." – Tenore & Pasquale, 1847).

Achille Costa (1870) identified the phytonym *mela terragna* with *Cyclamen neapolitanum*. Presently, *C. neapolitanum* and *C. poli* are considered as synonyms of *C. hederifolium* (https://www.gbif.org/species/4008204; www.gbif.org/species/4008056). As a result of molecular studies, the genus *Cyclamen* has recently been placed in the family Myrsinaceae, which includes trees or shrubs of tropical floras (Pignatti, 2018).

Costa had the chance of observing fishermen in action with the plant. The preparations of *mela terragna* tubers followed these steps: 1. Tubers were cut into small pieces; 2. The pieces were grated, producing a juicy paste; 3. The paste was transferred to small bags of coarse cloth, suspended from the end of a long pole. Then, fishermen pushed the pole into seawater and rubbed the bag between the rocks of the seabed, causing the release of the juice from *C. neapolitanum* tuber paste. Notably Costa stressed that the purpose of fishermen in using land-apple was to snare fish from places in which nets could not be used. But let now consider how fish reacted to the contact with the juice of the plant. "As the *mela-terragna* paste begins to be rubbed between the reefs the fish that was hiding among them moves away taking the opposite direction to them" ("Come comincia a fregarsi la pasta di *mela-terragna* tra gli scogli il pesce che tra essi annidavasi si allontana prendendo direzione opposta a' medesimi" – Costa, 1870). Then, fish escaping from *mela terragna* juice can be captured by the circular belt of vertical nets prepared by fishermen.

Starting from these preliminary notes, Costa planned a series of field observations: "only in this way one can study what naturally occurs in such cases. The experiments that are made in the laboratory by changing many of the conditions, do not have for us the same importance for application to fishing" ("poiché in tal modo soltanto può studiarsi ciò che naturalmente avviene in tali casi. Gli esperimenti che si fanno nel gabinetto mutando molte delle condizioni, non hanno per noi la stessa importanza per l'applicazione alla pesca" – Costa, 1870). The results contradicted what was generally reported by fishermen, in particular: 1. Fish returned after only three days to the place where *mela terragna* juice was released into seawater, and not after two weeks, and 2. Fish could be eaten and did not acquire any unpleasant taste.

Costa, afterwards hypothesized that only temporary effects could be attributed to *mela terragna*, and in the lab confirmed his field observations after carrying out histo-anatomical observations. The main effects observed were blood congestion, mainly of the gills, and an acceleration of respiratory rates, whereas no relevant alteration of abdominal organs was found (Costa, 1870), leading to the conclusion that the action of *C. europaeum* on fish was prominently irritant and short lasting. Finally, fish caught in this way, if placed immediately in containers with pure seawater, remained alive only a little less than the one caught alive without the use of the *mela terragna*. These observations led Costa (1870) to declare that the plant should not be considered as capable of producing poisoning, and that fishing with *C. europaeum* and allied species could, and indeed, should, be permitted rather than prohibited, since it did not result in any long-term toxic effects.

In the same year Adolfo Targioni Tozzetti was appointed chairman of the Advisory Commission for Fisheries, by the Italian Ministry of Agriculture, Industry and Commerce, making several trips to Italy to study fish fauna and the related economic network. In recounting his survey, published in the *Annali del Ministero di Agricoltura, Industria e Commercio*, Targioni Tozzetti (1871) reported Achille Costa's opinion on the subject that confirmed his positive opinion about *chiusarane*, using *Cyclamen europaeum*, or *Euphorbia lathyris* (*tutumaglia*). Interestingly, in another document reported in Targioni Tozzetti (1871), that was edited by the *Società per l'allevamento dei pesci e per la pesca razionale nel golfo di Napoli*, there is a mention to *chiusarane*: "*Chiusurane* fishing, for which the fuligin and juice of acrid and poisonous plants, such as *Menispermum cocculus*, the euphorbiaceae, nux vomica, etc., are used, is equally, harmful" ("La pesca delle *Chiusurane*, per cui adoperansi la fuligine ed il succo di piante acri e velenose, come il *Menispermum cocculus*, l'euforbiacee, la noce vomica ecc. è altrettanto, dannevole"). Hence, another plant is referred to, *Menispermum cocculus*, not reported in other documents of that time, nor previously listed, to the best of our knowledge. *Anamirta cocculus* (syn. *Menispermum cocculus*) is a species belonging to the Tribe Coscinieae, Family Menispermaceae, found from India to West New Guinea in lowland and coastal forests, near riverbanks, but also in savannah hilly countries (Forman, 1978). The fruits have been imported in Europe via Alexandria and Middle East since the XVI Century (Flückiger & Hanbury, 1879) and were used to eliminate lice from human skin, but in England were also mixed to breadcrumbs and honey and used as a bite to stun fish (Forman, 1978). Their biological activity is due to the presence of picrotoxanes, a mixture of two alkaloids, picrotoxinin and picrotin that can cause nausea, muscle contractions, augmented respiratory rates, convulsions, also leading to death (Shi et al., 2022).

Notwithstanding the positive opinion of Achille Costa (1870) about fishing with *chiusarane*, this practice was never approved.

Some years later (1883), in the *Gazzetta Ufficiale del Regno d'Italia*, march, 14, n° 61 was published the decree n. 1223 (serie 3a) that enshrined the final prohibition for the use of toxic plants in fishing: "Art. 6. It is forbidden to use for fishing narcotic, suffocating, corrosive and poisonous materials, such as nux vomica, morphine, lime, phosphorus, black smoke or soot, and so on, or explosive materials, such as dynamite, gunpowder, etc. It is also forbidden to collect or sell fish taken by such means" ("È vietato di adoperare per la pesca materie stupefacenti, soffocanti, corrosive e velenose, come ad esempio la noce vomica, la morfina, la calce, il fosforo, il nero di fumo o fuliggine e via dicendo, oppure materie esplodenti, come la dinamite, la polvere pirica, ecc. È pure vietato di raccogliere o vendere i pesci presi con tali mezzi"). In the following years the use of *chiusarane* in the bay of Naples was permanently abandoned.

Author contributions

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