# CARNIVOROUS PLANTS AND CONSERVATION – THE ROLE OF CARNIVOROUS PLANT ENTHUSIASTS

ANDREAS FLEISCHMANN • Botanische Staatssammlung München • GeoBio-Center LMU Ludwig-Maximilians-University of Munich • Menzinger Strasse 67 • 80638 Munich • Germany • fleischmann@bio.lmu.de

Keywords: poaching, illegal plant trade, wild collections, *in situ* conservation, *ex situ* conservation, species introductions, neophytes.

Received: 5 December 2022

https://doi.org/10.55360/cpn522.af323

Abstract: Carnivorous plants and their unique habitats face various threats, most of them being anthropogenic. About 25% of the known 860 carnivorous plant species are threatened or face extinction. Two of the threats are predominantly caused by "carnivorous plant lovers". The actions include 1) sale and trade of plants that have been illegally collected from the wild, a threat that has continuously increased in the past years and 2) planting of exotic carnivorous plant species into pristine habitats of native species. This article illustrates these problems and shows causal connections and the legal situation, which are apparently not known to everyone. A long-term solution can only be found if carnivorous plant lovers recognize and stop their misconduct. This article aims at closing knowledge gaps and to inform about the problem of threats to wild carnivorous plant populations by carnivorous plant lovers.

### Introduction

Of the 860 known species of carnivorous plants (CPs), more than a quarter are threatened with extinction in the wild: 69 carnivorous plant species (8%) are currently classified as Critically Endangered (that is, facing extinction), 47 species (6%) as Endangered (that is, likely facing extinction if their current decline continues) according to the IUCN Red List (= the global Red List of categories of threat to all living beings), 104 species (12%) as Vulnerable, and 23 (3%) as Near Threatened (Cross *et al.* 2020). At least 89 species of CPs are known from only a single locality worldwide (so-called microendemics). If the localities get destroyed, these species will become globally extinct (Cross *et al.* 2020). Threat categories to CPs in their natural habitats are diverse (Fig. 1), but nearly all causes of threat are purely anthropogenic (Jennings & Rohr 2011; Clarke *et al.* 2018; Cross *et al.* 2020) – just as generally the survival of nearly all organisms in the Anthropocene era is influenced by the vast human impacts on global ecosystems.

This article focuses on two threats to CPs that come from "carnivorous plant lovers", and which sadly are the main threats to the survival of certain CP species in the wild! At least 126 CP species worldwide are threatened by human disturbance of their habitat (i.e., land use, development, pollution, agriculture, forestry, mining, but also including poaching and invasive species), and at least 98 CP species are threatened mainly by having their populations plundered for the illegal plant trade for "CP lovers" (Cross *et al.* 2020; Fleischmann 2021). These are, of all things, species that would otherwise be relatively safe in their habitat because they are located in protected areas, where they would actually be largely spared from other negative human impacts.

This article is adopted and updated from an article written for the German CP society magazine "Das Taublatt" in 2021 (Fleischmann 2021). Sadly, many more reports of man-made habitat loss,



Figure 1: (left and right): Main categories of threat for each CP genus in the wild. The length of the bars corresponds to the number (in %) of species from the genus that are endangered by the respective cause. For example, more than a quarter of all known *Nepenthes* species are threatened by poaching and illegal plant trade! Below each photo, the total number of species for each genus, as well as the number of species under an IUCN Red List category of threat (CR = Critically Endangered; EN = Endangered; VU = Vulnerable; NT = Near Threatened; LC =Least Concern). Data basis from Cross *et al.* 2020; graphics and photos: A. Fleischmann.



 $\begin{array}{c|cccc} Darlingtonia (1 sp., LC) & Brocchinia (2 spp., LC) & Catopsis (1 sp., LC) \\ \hline \\ & &$ 

poaching, illegal plant trade and CP habitat spoiling by naturalized non-locally native species have become evident to the author since the 2021 article.

### Threats to carnivorous plants due to illegal collection from the wild

Carnivorous plants, along with orchids, cacti, bromeliads, and cycads, suffer very concrete threats to individual species due to a high horticultural interest in growing these interesting plants (Simpson 1995; Clarke et al. 2018; Cross et al. 2020). There is hobbyist interest especially when it comes to spectacular, rare, or "new" species. Illegal collecting activities, sometimes on a commercial scale, continue to bring some populations or even species to extinction. This happens both by an increasing number of individual private collectors or plant hunters, and also on a large scale by illegal poaching for commercial sale by plant dealers. These dealers offer the illegally wildcollected plants or seeds on online marketplaces such as Facebook, eBay, and Etsy (eBay claims to control and ban the offer of wildlife and wild-collected plants for trade; eBay 2021). Particularly endangered by this are Nepenthes species (Figs. 2-4; Simpson 1995; Clarke 1997, 2001; Clarke et al. 2018; Cross et al. 2020; McPherson 2022a; Carnivorous Plant Poachers 2023), especially in Borneo, Sumatra, the Philippines, and Indochina. But also tuberous Drosera and "location forms" of Cephalotus, Sarracenia and Dionaea are illegally taken from the wild on a large scale to be sold (Clarke et al. 2018; see Fig. 5). The customers are CP growers all over the world who are probably aware where their "goods" come from. Practically all commercial trade of wild collected CPs is illegal in spite of what the sellers so often claim! In Australia, for example, the commercial export of Australian plants (which includes CPs) taken from the wild has been prohibited for 20 years (EPBC Act 1999), despite many of them appearing on well-known sales lists or internet sites. In most countries, the acquisition of illegal wild collections is treated the same as the purchase of stolen goods: a) the customers should carefully inform themselves about the legality of the source before buying, b) ignorance is no excuse c) a buyer can never acquire legal ownership of illegally poached species which are subject to confiscation by legal authorities. If illegal plants are seized, the consumer's money is lost and fines, and other penalties, or even imprisonment can result.

The following are the most commonly brought up arguments or excuses by growers for the purchase of illegal wild collections. These excuses are mostly to convince themselves of a good conscience for their action. None of these arguments are defensible...

## False argument 1: "Their natural sites will get destroyed anyway by habitat destruction and climate change, so it's good if the plants will be saved."

In principle, this would make up the most sensible argument, but it just doesn't stand scrutiny. Almost all illegal collections of CPs that have become evident in the past years were made in protected areas (such as nature reserves) and/or in very inaccessible regions, such as remote mountain tops in SE Asia or wilderness areas of Western Australia, i.e., in areas that are largely safe from habitat destruction. These protected or remote sites are where the long-term survival of these plants in the wild would be ensured, and this is exactly where many CPs are getting poached for the illegal trade—often done on a large scale. On an alarmingly large commercial scale this is affecting *Nepenthes* in the protected areas of Borneo, Sulawesi, in Indochina, or in the Philippines. Unfortunately, species like *N. edwardsiana* or *N. clipeata* in the wild are not endangered because their habitats are being destroyed—it is because there are certain people out there (call them "plant enthusiasts", "plant collectors", "CP lovers", or by the words of Barry Rice: "CLODS", see Meyers-Rice 1996)



Figure 2: (Left): This large *Nepenthes* × *kinabaluensis*, illegally plundered from site on Mt. Kinabalu, Borneo, was offered for several hundred dollars on Facebook by a professional poacher in 2022 – together with a long and sad sales list of many more illegal wild collections of many other rare *Nepenthes* species from Borneo, the Philippines and Papua. Any CP grower purchasing such plants should be aware that they are obtaining illegal material and are involved in criminal actions that violate international biodiversity laws, endangered species protection laws (CITES) and national customs regulations. High fines and confiscation of such purchased illegal material (including the rest of the private CP collection, as customs officers might not be able to tell apart legally obtained material from illegal internet buys) can await the customer of such offers. Photo: screenshot from Facebook. (Right): Bundles of *Nepenthes ephippiata* adult vines cut into pieces by the poachers in Borneo, ready for being shipped to unscrupulous overseas customers of this illegal business. In this case, the mass poaching of hundreds of plants was ordered and collectively paid by a Chinese commercial nursery from Tianjin Province (see McPherson 2022b). Photo provided by Stewart McPherson.







Figure 3: (this and previous pages): Some examples of the unfortunately very prosperous illegal trade with poached *Nepenthes*, which document that there is not only an increasing offer of such illegally collected plants by poachers, but also a high demand for these by some CP growers, who specifically ask for these wild collections. Compilation of screenshots from Facebook offers made in 2020 by various "plant dealers" and their customers. Shown here are illegally taken young and old plants of *Nepenthes rajah*, *N. edwardsiana*, *N. villosa* (these three Bornean species are all protected by law, trade of these wild-collections is prohibited by CITES, and moreover they were poached from a National Park!), *N. rigidifolia* and *N. ampullaria*.



Figure 4: Poached plants of the last remaining individuals of *Nepenthes clipeata* from Mount Kelam, Borneo, in 2020. This parcel was addressed to an illegal wild-trade customer in Taiwan, a notorious local nursery owner who specializes on selling wild-collected Southeast Asian plants. The shipment got confiscated by local police and conservationists tried to replant the plants (see McPherson 2022b). Photo provided by Stewart McPherson.



Figure 5: Examples of the sale of illegally excavated tuberous *Drosera* in Western Australia on an internet platform (screenshots), done professionally on commercial scale. This seller even explicitly stated in his sale description that these were wild collections and cited an alleged "official permit". By Australian law, any sale of wildlife removals is strictly prohibited. Despite – or perhaps rather because of? – the indication that these were wild collected specimens, specimens were purchased by CP growers all over the world – in the case of *Drosera collina* pictured above, at least 62 times.

who buy wild-collected *Nepenthes* stolen from their natural habitats, and by doing so create and support a market for these illegal activities.

Ironically, by their actions these self-termed "plant lovers" ensure that the plants they actually claim to admire so much will perish from the wild! To emphasize: some rare and endangered CP species, such as *Nepenthes aristolochioides*, *N. clipeata*, *N. diabolica*, *N. edwardsiana*, *N. erucoides*, *N. hamata*, *N. inermis*, *N. izumiae*, *N. jamban*, *N. jacquelineae*, *N. pitopangii*, *N. rigidifolia*, *N. tenuis*, *N. undulatifolia*, etc. (Cross *et al.* 2020; McPherson 2022a, b; A. Robinson, pers. com.) will become extinct in the wild only because there are people who desperately want to own them in their CP collections no matter what, and therefore do not hesitate to buy wild collected specimens!

For example, there is a high demand for wild-collected plants of *N. clipeata* among certain CP growers in Asia, the USA, and Europe, and the habitat of this Critically Endangered species, a single hill-top in Borneo, although a protected area, is comparatively easily reached, hence populations are under massive threat by illegal collections. The single known population of this species has undergone a massive decline by poaching, and by 2019 only 18 individuals of this unique species were left in the wild (Mansur *et al.* 2021). Nevertheless, illegal collection of these last reminders for the illegal commercial trade continued, with a big poaching event being documented in 2020 (McPherson 2022b; Fig. 4). *Nepenthes clipeata* most likely has to be declared extinct in the wild by now, and this loss has to be entirely attributed to certain CP growers or customers of such wildlife offers.

Paradoxically, in these cases it is undeniably the "CP lovers" who constitute the biggest threat to the survival of these species, and who are responsible for the decline and extinction of certain (rare)

species which they claim to love so much! In the case of *Nepenthes*, illegal trade of wild-collected plants represents the strongest threat and the main reason for the extinction of individual species in their natural habitat (see Fig. 1). More than a quarter (27%) of the known *Nepenthes* species today are endangered by poaching and illegal wild trade (Cross *et al.* 2020). It is us, the CP growers, who will be responsible for the loss of these species from the wild! Likewise, any so-called "location forms" of *Cephalotus*, as well as various tuberous *Drosera*, that are offered as exceptional "legal wild collections" from Australia are in fact illegally taken, in several cases even from protected areas. Any buyer should be aware that there is not an infinite number of plants of these species at each of their natural locations and that any removal of these species will bring them closer to extinction.

As mentioned earlier, the export of plants for the commercial trade is generally prohibited in Australia and also in almost any country that is home to *Nepenthes*. In response, some resourceful dealers relabelled their wild-collected material as "cultivars" or "cultivated hybrids", hoping to escape the legislation. Unfortunately, more and more imitators followed—in Western Australia recently an internet supplier of wild collected tuberous *Drosera* (who also exported them internationally) publicly boasted that he had "legal permits" and would also get them for Nature Reserves. This is a bald-faced lie, because in Western Australia any trade in wild-collected plants taken from conservation areas is prohibited, with fines of AU\$ 50,000 for non-protected species and AU\$ 500,000 for strictly protected species (Biodiversity Conservation Act 2016). Wild-collected plants of *Sarracenia*, *Dionaea*, and many *Drosera* offered for sale online also come almost exclusively from protected areas. Here, too, it must be clear to every buyer where these plants come from, and that by buying them they contribute to the loss of these species in the wild.

### False argument 2: "Now that the plants have already been dug up anyway, I've only bought them to save them, otherwise they would have died in vain in the seller's possession."

This excuse is also window dressing. As hard as it sounds, only if no one buys these wildcollected offers, will the dealer eventually stop plundering plants in their natural habitat—even if all poached plants must perish in the hands of the illegal dealer. Every purchase, no matter how well-intentioned, creates the market that will eventually kill-off our beloved CPs in their natural habitat. It's like the sad trade with baby turtles illegally poached from the wild that are offered for sale to tourists at weekly markets in parts of the Mediterranean. Some tourists buy some out of pity and release them back into the wild, believing they have done a good deed. Exactly the opposite is the case: for the seller this is an incentive to continue with the illegal taking of wild animals, because they are able to make a business out of it. It is the same with the illegal taking of CPs from the wild.

As long as there is someone to purchase the poached plants, there is an incentive for the poachers to continue. Culturally, this is quite understandable, since the often comparatively high sums paid for these plants are good reward for the local people who have a comparatively low income stream, e.g., in Indonesia.

### False argument 3: "I want to grow different location-forms/clones, because this way I can contribute to the conservation of this species, so that it will survive at least in cultivation."

The argument of "private *ex-situ* conservation" is also not tenable. *Ex-situ* conservation, i.e., the sole preservation of a species in horticultural cultivation, can only be the last option if survival of a species in the wild is no longer possible at all (IUCN/SSC 2014). *In-situ* conservation, i.e., the protection of a species in its natural habitat, should always be regarded as the first and ultimate conservation goal. Only *in-situ* can the whole ecosystem including all associated organisms (pollinators, mutual-

ists, symbionts, but also parasites, herbivores, etc.) be preserved along with the associated biota essential for the long-term survival of a species (Braverman 2014). No *ex-situ* approach can take this into account, and so most of them are doomed to fail in the long run. For example, what is the use of an *ex-situ* conservation program for threatened *Nepenthes* (see Cantley *et al.* 2005; Ziemer 2010; McPherson 2022b) if the required genetic diversity for the conservation cultures is partly created by resorting to removals from natural habitats, where this genetic diversity then is lacking?

Furthermore, not a single one of the "*ex-situ* conservation cultures" of *Nepenthes* (e.g., *N. clipeata* clones grown in German, Japanese, or American greenhouses) also breeds the species' pollinators or the symbionts and other organisms associated with this species that could also go extinct when the species goes extinct in the wild. And regarding possible herbivores and parasites specialized to this species (which are also part of and often have essential regulatory functions in the local ecosystems), the *Nepenthes* grower will likely want to get rid of with sprays rather than conserving them.

*Ex-situ* conservation might allow individual species to endure in cultivation, i.e., part of their gene pool will be "preserved" into the future, but the entire ecosystem and thus the long-term survival of the living organism and its biotic interactions at the natural sites cannot be preserved in this way. For nature conservation and the urgent aim of preserving global biodiversity, we should stop thinking of "preserving" single species (of horticultural interest, or because they are charismatic animals such as the panda bear), but we will have to turn to concepts to preserve and better protect their entire ecosystems.

In general, the success rate for reintroducing plants after *ex-situ* conservation is low (Braverman 2014). Cultivated plants that are replanted at the natural sites of origin after local extinction, or to support declining populations of endangered species, unfortunately often have a very low chance of survival. Seeds of cultivated plants that are replanted at the natural site often germinate poorly or not at all (Maschinski & Haskins 2012). One of the reasons for this is that propagation in cultivation always creates a so-called genetic bottleneck: in cultivation, it is usually not the same individuals that establish and survive from a given seed capsule as they would in the wild.

In cultivation, plants will grow under conditions that are optimal for them (and without competition from other species) in the so-called auto-ecological optimum. However, this is a purely artificial system that is not found anywhere in nature. In cultivation (no matter if seeds are going to be raised in pots or *in vitro*) those individuals (or clones) are automatically and unintentionally selected that grow best under our specific growing conditions—in the wild completely different genotypes might have prevailed. Seedlings that might be slow growing in culture (and therefore will not even be considered for *ex-situ* conservation because they are selected out by the breeder or die anyway), or seeds not germinating under these conditions at all, might have been the best adapted ones under the specific conditions of the natural site.

In consequence, in an *ex-situ* conservation program, the genotypes that grow best in cultivation are not necessarily the same that would grow best in the wild.

Also, the success of a conservation culture strongly depends on the long-term interest and cultivation success of the institutions/persons involved. It can never become a matter of the short-term interest CP grower like: "today I will participate in the *N. clipeata* project... tomorrow I am no longer interested in lowland *Nepenthes*, my focus now is *Sarracenia*". Even "professional", institutional *ex-situ* conservation cultures, e.g., of botanical gardens, which are based on legally taken material from a natural site, regularly fail (see e.g., Peruzzi *et al.* 2004; Peruzzi pers. comm.). This is not meant to be a general plea against *ex-situ* conservation (there are also a few success stories where this worked well, e.g., the conservation of *Aldrovanda* at the species' last remaining site in Japan; Kondo *et al.* 1997), one just has to be realistic. The conservation aspect certainly can never be an argument to justify the illegal removal of species from their natural habitats.

Unfortunately, poaching of CPs from the wild and their illegal trade is steadily increasing today (Clarke *et al.* 2018; Cross *et al.* 2020; McPherson 2022b; Carnivorous Plant Poachers 2023), mainly on a commercial scale, but also in the removal of individual plants by plant hunters. Poaching tourism—the search for natural sites specifically to dig up plants or to take seeds—has reached alarming numbers (Figs. 6 & 7). Photos of plants at their natural sites are often posted with pinpoint geo-coordinates on social media, photo databases, and platforms such as iNaturalist or ISpotNature, encouraging poaching from the last remaining sites of many rare CPs. Rice (2019) reports *Sarracenia* sites in the US that were poached just days or even hours after photos of them became public online. At least on iNaturalist, all uploaded *Sarracenia* observations are no longer accessible with exact geo-coordinates, the same applies to other CP species classified as endangered, especially some *Nepenthes* and Australian tuberous *Drosera*.

The great pressure by over-collecting and the threat by poaching also lead to the fact that for many of the newly discovered CP species, especially for spectacular species that might be of high horticultural demand, exact localities are no longer provided for conservation reasons in publications and species descriptions. This became necessary for a good deal of new CP species that have been published as new to science in the past decades, e.g., *Drosera buubugujin* (Mathieson & Thompson 2020), *D. atrata, D. hortiorum, D. koikyennuruff, D. macropetala, D. reflexa, D. rubricalyx* (Krueger *et al.* 2023), *Nepenthes berbulu* (Tan *et al.* 2023), *N. flava* (Wistuba *et al.* 2007), *N. holdenii* (Mey *et al.* 2008), *N. pudica* (Dančák *et al.* 2022), *N. undulatifolia* (Lee *et al.* 2011), and others (essentially, most new *Nepenthes* species described recently). All these species descriptions explicitly state that exact localities were withheld for conservation purposes to avoid exploitation of the sites for the horticultural demand. This translates into: if it would become publicly aware where these species grow, they would be poached by plant hunters and CP growers until nothing was left. Many people who have studied CPs in the wild (including myself) no longer provide any locality data to anyone. Obviously, long-term survival for some rare CPs on this planet today is only possible if no one knew exactly where they grow.

Even the attempt to make spectacular new species legally available to CP breeders with seeds taken legally by official collecting permits and thus to take the collecting pressure off the natural populations fails because of the "want to have" of some CP collectors. For example, in case of the microendemic, endangered *Drosera magnifica*, a few seeds were taken by the discoverers with collecting permits and distributed worldwide to experienced growers for propagation (also *in vitro*) and to share among CP collectors. As a result, the species was available to CP collectors shortly after its discovery. And yet, when we visited the natural site of this species in 2018, we were told by local conservationists that a "group of plant enthusiasts from Asia" had been on the mountain shortly before and had dug up some adult plants there.

Some CP collectors apparently care little about applicable laws, and these individuals apparently also do not care whether their actions cause long-term and irreparable harm to wild populations and thus to the survival of the plants they admire, or perhaps just want to own. Clarke *et al.* (2018) wrote that some CP collectors consider it their right to help themselves to wild populations at the natural site as a matter of course for their hobby, and that they consider this "right" to be more important than the right of these plants to exist undisturbed at their natural sites. Nature as a self-service store for the hobby of a few?

This doesn't have to be necessary at all. Pretty much all CP species that can be grown in cultivation are available for little money as well-established plants from registered, legal dealers (and there



Figure 6: Remains after poaching of a local population of *Cephalotus follicularis* in Western Australia. About 40 stocks and large mature individuals of this endangered species were still growing at this particular site, 30 of which were excavated in 2019 by an unknown perpetrator. This local population is now likely to become extinct solely due to the demand for *Cephalotus* location forms for cultivation by CP growers! Photos: Brian Quinn.



Figure 7: Poaching holes as leftovers of illegal excavation of tuberous *Drosera* (at this site: *Drosera stricticaulis*) in a National Park near Perth, Western Australia in 2019. Photos: Thilo Krueger.

are more and more on offer every year). The chances of survival of such plants are much higher than those of wild collected specimens, and you will get healthy, vigorous plants. What more could you want? Obviously, however, some people are not at all interested in enjoying healthy, beautifully grown plants in cultivation – they want to collect "location forms", "wild clones", or plants that are "seed grown". Without additional locality data, these plants seem to be worth nothing at all to these individuals (Meyers-Rice 1996, 2001). That is collecting of plants as a stamp collection. However, 20 new "location forms" of *Cephalotus follicularis* in cultivation also mean at least 20 times illegal wild removals of this strictly protected plant species, which is endangered in the wild. In such cases, the term "*Cephalotus* fans" only makes sense if you see fan as an abbreviation of fanatic, who apparently cares about the survival of this plant only in their own collection, but care quite little about the species' survival in the wild.

Why this increased interest in "wild origin material" in our hobby lately? To see who can buy the most beautiful poached Nepenthes edwardsiana? Surely that's not an accomplishment. Anyway, I pay my respect to anyone who manages to grow a Nepenthes edwardsiana (or any other CP species) from in vitro propagation obtained from a legal source (registered CP nursery) into a large, beautiful, flowering plant. That's how the grower proves their horticultural skills. For the owners of plants plundered at the natural locations, however, there is just contempt, and hopefully at least in some cases a complaint because of offence against international species protection laws. This also seems to be the only way to legally stop the illegal trade with wild collected plants: by prosecuting the buyers. Of course, local people involved in conservation have also tried to report the illegal suppliers/traders/sellers of wildlife (e.g., in the case of Nepenthes poaching at Mt. Kinabalu, to the relevant National Park authorities in Sabah). However, unfortunately, the prosecutions in the countries of origin usually come to nothing. In the case of other protected animal and plant species that are highly endangered by international illegal wildlife trade (e.g., cacti, many reptiles), it has proven to be quite effective to take action against the buyers, who are mostly located in countries with more effective law enforcement of biodiversity and customs crimes. It is hoped that this will also be effective in the case of CPs.

#### Threats to natural habitats by introduced alien carnivorous plants

Among the above-mentioned "hobbyist groups" of plants, the phenomenon that cultivated species are also naturalized, i.e., deliberately planted, at foreign natural sites, to my knowledge exists only in the case of CPs and orchids. This refers to the deliberate introduction, i.e., by sowing or planting, of alien plant species by humans for the supposed "enrichment" of the local flora. In most countries, such introductions to the wild are regulated by Nature Conservation Acts and any release of alien or native organisms are subject to approval by the respective local, federal, or national Nature Conservation Authority. Such are generally prohibited in nature reserves or other protected area (which include most CP habitats such as bogs and swamps in the Northern Hemisphere). From a nature conservation point of view, alien species introductions are just as problematic (and furthermore likewise illegal) as the poaching of species from their natural habitat. Invasive non-native species can have severe negative impacts on locally native species and are considered one of the major threats to global biodiversity (Pyšek *et al.* 2020). It is actually sad to have to report about this in the newsletter of a society like the ICPS that unites people who are passionate about CPs for various reasons, that the illegal activities of a few from this worldwide CP community are responsible for the threat to and the disappearance of some of our beloved CPs in the natural habitats.

The introductions of foreign plants to native CP habitats are not a "trivial offense", but an administrative offense according to most countries' Nature Conservation Acts, which can be prosecuted with high fines (in Germany, release of non-native species like *Sarracenia* into protected habitats such as bogs can be prosecuted with a fine of up to 10,000 Euro, see German Federal Nature Conservation Act §69). Under this category fall both the removal of protected species or their parts, including seeds, as well as the release of plants in protected areas, as well as any introduction of alien CPs in bogs or other natural CP sites. Conservationists and the people who are responsible for the care of the remaining native CP sites usually file a complaint with the responsible authorities if there are signs of poaching and illegal wild removals as well as species introductions in protected areas. I hope, this has already enough deterrent effect for some which had the thoughts: "there are so many plants of that one species out there, surely it won't harm if I took a few..." or: "that bog over there, now that looks like a good CP habitat, let's drop a few seeds there...".

Apart from the illegality aspect, the conservation status of the local CP habitat is done a disservice by the actions of plant introducers. In the worst case, a nature reserve or other protected area overgrown with invasive neophytes (and some alien CPs have proven to be invasive weeds!) can lose its protection status (and would then no longer be protected from possible agricultural or construction measures, for example). Technically, a raised bog in Europe overgrown with North American *Sarracenia* is no longer considered untouched nature worthy of legal protection. It becomes a "developed" area planted with alien plants. Such alien flora must then be painstakingly removed by the responsible nature conservation authorities, which are concerned with the preservation of these unique and last remaining species-rich natural habitats. Anyone who has ever taken part in a maintenance measure in a raised bog knows what an effort this means.

At the same time, criminal charges can be filed against the unknown introducers of these plants with the respective nature conservation authorities. Nevertheless, there are obviously still enough people among the CP enthusiasts who think that any native bog habitat would only become more interesting with the addition of some *Sarracenia, Darlingtonia, Dionaea*, or *Aldrovanda*, or that the species inventory of the naturally occurring native *Drosera* and *Utricularia* species needed to be "enriched" by further, exotic species. There are many examples of such species introductions from almost all countries with an active CP grower community.



Figure 8: Examples of deliberately introduced CPs as invasive species: *Drosera capensis* forms mass populations at Albion Bog, California, USA, threatening the unique ecosystem of Pygmy Forest. The locally native *D. rotundifolia* does not stand a chance against the vigorous superiority of the weedy *D. capensis* that occupies its habitat.

In addition to the bastardization of the flora aspect, some CP species do have the potential to emerge as invasive neophytes, e.g., weedy species such *Drosera capensis*, *D. tokaiensis*, *D. spatulata*, *D. aliciae*, *D. filiformis*, *Utricularia subulata*, and *U. bisquamata*. All of these species, among many other cultivated CPs, have been released into the unique and threatened habitat of the Pygmy Forest in the Albion Bog in California (Rice 2008; Cross et al. 2020; Fleischmann 2021). There these CP species, especially *D. capensis*, are now developing mass stands that are impossible to be removed (Fig. 8). The locally native *Drosera rotundifolia* has now been pushed back to a few patches by the much more vigorous introduced species (pers. obs.). Unfortunately, with ongoing global warming, more and more invasive exotic weeds are capable to establish and naturalize in areas where they were not able to survive previously (Hobbs 2000; Nobis *et al.* 2009). Among these climate change winners are also some weedy CPs, e.g., *Utricularia gibba*, which was not hardy in many European climates, but which was recently found to survive and become an invasive species at very high risk in some countries due to global warming (Piria *et al.* 2022).

The following examples of introduction and naturalization of CPs in intact, protected natural sites shall be listed concretely as acts of natural offences, all of them committed by thoughtless CP "lovers"! Please do not take them as a template for imitation. In some cases, the released CPs still could be removed more or less successfully, in none of the cases an "enrichment" of the native flora or the biotope by the released CPs was assumed.

In the US, alien CPs, in particular *Drosera*, *Sarracenia*, and *Dionaea*, have been introduced to a number of bog habitats outside and within their range. The infamous example of Albion Bog has been mentioned above already – in this pristine bog habitat, numerous CPs have been illegally introduced, including *Heliamphora*, various *Sarracenia* species and cultivars (Fig. 9), *Darlingtonia*, and even tuberous *Drosera* such as *D. gunniana* (pers. obs. 2018). In the protected Butterfly Valley, *Drosera* × *hybrida* has been recently introduced by CP enthusiasts (Brittnacher 2012). *Aldrovanda* has been released in 1999 into a pond in Orange County, New York by CP growers where it naturalized, spread into other water bodies, e.g., Lake Owassa, New Jersey, where today it forms populations of millions of plants (Lamont *et al.* 2013).



Figure 9: A wide variety of commonly cultivated CPs have been and apparently still are introduced into Albion Bog and the entire habitat is now occupied by invasive non-native CP. Sadly, this is also increasingly the case in other bogs and protected areas worldwide. This involves plantings of *Sarracenia* and other CPs (*Sarracenia* 'Adrian Slack' pictured here from Albion Bog in 2018, as well as the everywhere present *Drosera capensis*). Introducing non-native species is not a "peccadillo", but a legal offence. To make it clear: this picture was not taken in a private bog garden, but in an area protected by The Nature Conservancy. The last remaining natural sites should not become an "experimental garden" for a few individuals, which produces a bad reputation for the CP community.

Sarracenia purpurea subsp. purpurea has been deliberately introduced into intact peatlands at more than 100 sites in Europe, including the UK, Ireland, Sweden, Denmark, France, Germany, Austria, Switzerland, and the Czech Republic, and also to a few sites in Japan and New Zealand (Parisod *et al.* 2005; Adlassnig *et al.* 2010; Walker 2014). At many of these sites especially in England and Ireland, it has become an invasive species, self-reproducing and spreading by seeds (Parisod *et al.* 2005; Adlassnig *et al.* 2010; Walker 2014; pers. obs.), and with a repeatedly documented negative impact on the abundance and composition of native bog flora, including native CPs such as *Drosera rotundifolia* (Trippi 2006; Adlassnig *et al.* 2010; Walker 2014; Walker 2014; Walker 2014; Walker *et al.* 2016). Therefore, *S. purpurea* has recently been added to the blacklist of invasive species in a few European countries such as the UK, Switzerland, and Germany (Nehring *et al.* 2013; Walker *et al.* 2016) which includes the direction for its removal from bogs where it had been naturalized (Parisod *et al.* 2005; Walker *et al.* 2016; Chatters 2020). This species in particular has an additional negative effect on the biodiversity of raised bogs in Europe, as the non-native *Sarracenia purpurea* quite effectively captures locally native insects, including rare species and essential pollinators of other



Figure 10: *Sarraceniopus* mites observed in 2018 from the interior of a dissected pitcher of naturalized *Darlingtonia* at Albion Bog, California, USA.

plants (Sanderson 2012; Franklin *et al.* 2017; Chatters 2020). This species also captures juveniles of amphibians and reptiles as prey to a significant extent, at least at some sites in its natural habitat (Moldowan *et al.* 2019; pers. obs.) but also in Europe (pers. obs.). In some European raised bogs, their pitchers sometimes can be filled with juveniles of the protected Viviparous Lizard (*Zootoca vivipara*) (pers. obs. and communication from nature conservation wardens in the Bavarian Forest). Additionally, North American *Sarracenia* infauna, such as the pitcher inhabiting mite *Sarracenio-pus*, has been unintentionally introduced to European bogs as non-native animals together with planted *Sarracenia purpurea* (Goddard *et al.* 2022). By the presence of this obligate *Sarracenia* inhabitant in Europe one can even safely conclude that wild-collected, living pitcher plant stocks once had been planted in a given bog. *Sarraceniopus* mites have also been observed by the author of the present article in all *Sarracenia* and *Darlingtonia* pitchers in Albion Bog (Fig. 10), i.e., outside their native USA range. The effect on the established ecosystems caused by these additive alien species which will unnoticedly but inevitably come with such plantings, along with other organisms such as soil microbes including fungi, bacteria and other putative pathogens, cannot be foreseen.

Other hardy, non-native, mostly North American CP species have been introduced to various bog habitats in Europe, including *Sarracenia oreophila*, *Dionaea*, *Darlingtonia*, and *Utricularia* (Fleischmann 2016). In Switzerland, France, and the Czech Republic, *Pinguicula hirtiflora* has been introduced at some of the sensitive limestone dripping wall habitats and seepages, where this species reproduces well and, at one site in France, even threatens the naturally occurring, highly endangered *P. reichenbachiana* there by overgrowth (Fleischmann & Roccia 2018; Cross *et al.* 2020).

In the Azores, the South African species *Drosera aliciae* and *D. capensis* have been introduced deliberately from cultivated material and since naturalized at some seepage habitats (Borges *et al.* 

2010; Costa *et al.* 2013). In Brazil, plantings of *D. capensis* and *D. binata* into pristine CP habitats have fortunately been detected in time and could be removed completely (P. Gonella, pers. comm.).

Seven alien *Drosera* species have so far been introduced into native CP habitats in Japan by carnivorous plant enthusiasts (*D. aliciae*, *D. binata*, *D. capensis*, *D. capillaris*, *D. filiformis*, *D. × hybrida*, *D. intermedia*, *D. pygmaea*), several of which naturalized and threaten local native CP species, and which are removed by local conservationists and volunteers (Kataoka & Nishimoto 2012; Kagawa 2015). Additionally, *Dionaea*, *Sarracenia* spp., aquatic *Utricularia* spp., as well as the SE-USA species *Pinguicula primuliflora* have been deliberately planted to and naturalized in wetland habitats in Japan (Kadono *et al.* 2019; Shimai 2021).

In New Zealand, European *Pinguicula grandiflora* was planted in a nature reserve ("Rogue carnivorous plant-lovers sabotage national park": www.nzflora.info), and in Australia, South African *Utricularia sandersonii* was introduced by CP lovers in a protected area in the Blue Mountains (Conn *et al.* 2004). Unfortunately, there are quite a few more such examples, especially from Europe and the USA.

It is precisely the nutrient-poor CP habitats (such as raised bogs and seeps) that are one of the last biotopes that have been largely spared from being spoilt by neophytes and flora adulteration. It is precisely this gap that some CP lovers are now ingloriously and completely unnecessarily trying to fill. It is quite clear that this is due to the ill-considered actions of individual black sheep, but ultimately this falls back on the entire CP community. Personally, I would rather see the global CP community (such as the ICPS) as a player in conservation than as part of the problem. Whether this will remain the case in the public perception due to these negative individual actions is unfortunately impossible to foresee.

### Conclusion

I hope that I have succeeded at least a little bit in pointing out the negative correlations regarding CP growing and conservation with this article, some of which may not have been clear to some at first, and perhaps to move one or the other to critically reconsider their attitude and actions with regard to wild origins and species introductions. Many of our beloved CP species are critically endangered or even threatened with extinction in the wild. Their future survival depends not only on global politics and economics, but for many species often very specifically on our very own behavior and attitudes regarding our hobby. We should act in a way that future generations will still be able to enjoy these species in intact natural habitats. Endangered CP species are best kept in their natural habitats. It is of course okay for the CP enthusiast to grow *S. oreophila* and other endangered CP species, if obtained from a trustworthy, legal source and as long as location information is not the reason for collecting plants.

Acknowledgments: For information on illegal "poaching rings" and the illegal trade with wild collected CPs, especially of *Nepenthes*, but also *Sarracenia*, *Drosera*, and *Cephalotus*, for tips and reports on threat scenarios for CPs at the natural sites, on conservation law, and for providing photos for this article, I would like to thank Lubomír Adamec, Greg Bourke, Charles Clarke, Adam Cross, Christian Dietz, Michal Golos, Paulo Gonella, Thomas Gronemeyer, Klaus Keller, Thilo Krueger, Chien Lee, Drew Martinez, Stewart McPherson, François Mey, Brian Quinn, Barry Rice, Alastair Robinson, Maurizio Saroldi , André Scatigna, and Willy Zahlheimer. John Brittnacher, Barry Rice, and Bob Ziemer made helpful comments to the manuscript. Finally, I would especially like to thank all the unknown CP growers who care about nature conservation and do not buy wild-collected plants and seeds.

#### References

- Adlassnig, W., Mayer, E., Peroutka, M., Pois, W., and Lichtscheidl, I.K. 2010. Two American Sarracenia species as neophyta in Central Europe. Phyton 49: 79-292.
- Biodiversity Conservation Act. 2016. https://www.legislation.wa.gov.au/legislation/statutes.nsf/ main\_mrtitle\_13811\_homepage.html (accessed 07.05.2021)
- Borges, P.A.V., Costa, A., *et al.* (eds.). 2010. A list of the terrestrial and marine biota from the Azores. Principia, Cascais. 432 pp.
- Braverman, I. 2014. Conservation without nature: the trouble with *in situ* versus *ex situ* conservation. Geoforum 51: 47-57. https://doi.org/10.1016/j.geoforum.2013.09.018
- Brittnacher, J. 2012. Butterfly Valley Drosera × hybrida removal. https://www.carnivorousplants.org/ conservation/projects/ButterflyValley (accessed 07.05.2021).

- Cantley, R., Clarke, C., Cokendolpher, J., Rice, B., and Wistuba, A. 2005. Nepenthes clipeata survival project. Carniv. Pl. Newslett. 34: 116-120. https://doi.org/10.55360/cpn344.rc647
- Carnivorous Plant Poachers. 2023. Records of Carnivorous Plant Poaching. https://cppoachers.com/ [accessed 2023-02-25].
- Chatters, C. 2020. The New Forest non-native plants project. Control of pitcher plant *Sarracenia purpurea* in the New Forest 2009 to 2019. Hampshire and Isle of Wight Wildlife Trust, England. 61 pp.
- Clarke, C.M. 1997. Nepenthes of Borneo. Natural History Publications (Borneo), Kota Kinabalu. 207 pp.
- Clarke, C.M. 2001. Nepenthes of Sumatra and Peninsular Malaysia. Natural History Publications (Borneo), Kota Kinabalu. 325 pp.
- Clarke, C., Cross, A.T., and Rice, B. 2018. Conservation of carnivorous plants. In: Adamec, L., Ellison, A. (eds.), Carnivorous Plants: Physiology, Ecology and Evolution. Oxford University Press, 375-388. https://doi.org/10.1093/oso/9780198779841.003.0027
- Conn, B.J., Brown, E.A., and Fairley, A.T. 2004. Utricularia sandersonii (Lentibulariaceae), a new record for Australia. Telopea 10: 811-814.
- Costa, H., Bettencourt, M.J., Silva, C.M.N., Teodósio, J., Gil, A., and Silva, L. 2013. Invasive alien plants in the Azorean protected areas: invasion status and mitigation actions. In: Foxcroft, L.C. *et al.* (eds.), Plant invasions in protected areas: patterns, problems and challenges. Invading Nature - Springer Series in Invasion Biology 7. Springer, Dordrecht. https://doi.org/10.1007/978-94-007-7750-7\_17
- Cross, A.T., Krueger, T.A., Gonella, P.M., Robinson, A.S., and Fleischmann, A. 2020. Conservation of carnivorous plants in the age of extinction. Global Ecology and Conservation 24: e01272. https://doi.org/10.1016/j.gecco.2020.e01272
- Dančák, M., Majeský, L., Čermák, V., Golos, M.R., Płachno, B.J., and Tjiasmanto, W. 2022. First record of functional underground traps in a pitcher plant: *Nepenthes pudica* (Nepenthaceae), a new species from North Kalimantan, Borneo. PhytoKeys 201: 77-97. https://doi.org/10.3897/phytokeys.201.82872
- eBay. 2021. eBay makes sure illegal wildlife and their products are not traded online. https://www. ebaymainstreet.com/eupublicpolicy/blog/ebay-makes-sure-illegal-wildlife-and-their-productsare-not-traded-online (accessed 05.12.2022)
- EPBC Act 1999. Environment Protection and Biodiversity Conservation Act 1999: https://www.legislation.gov.au/Details/C2021C00182 (accessed 07.05.2021).
- Fleischmann, A. 2016. Utricularia inflata Walter erstmals in Deutschland. Berichte der Bayerischen Botanischen Gesellschaft 86: 291-292.
- Fleischmann, A. 2021. Karnivoren und Naturschutz die Rolle von Karnivorenliebhabern. Das Taublatt 89: 6-35.
- Fleischmann, A., and Roccia, A. 2018. Systematics and evolution of Lentibulariaceae: I. *Pinguic-ula*. In: Ellison, A.M. & Adamec, L. (eds.), Carnivorous plants: physiology, ecology, and evolution. Oxford University Press, 70-80. https://doi.org/10.1093/oso/9780198779841.003.0006
- Franklin, E., Evans, D., Thornton, A., Moody, C., Green, I., and Diaz, A. 2017. Exploring the predation of UK bumblebees (Apidae, *Bombus* spp.) by the invasive pitcher plant *Sarracenia purpurea*: examining the effects of annual variation, seasonal variation, plant density and bumblebee gender. Arthropod-Plant Interactions 11: 79-88. https://doi.org/10.1007/s11829-016-9468-2
- Goddard, E.L., Naczi, R., Walker, K., Millett, J., and Wood, P.J. 2022. First records of the pitcher plant mite *Sarraceniopus gibsoni* (Nesbitt, 1954) (Astigmata: Histiostomatidae) in Europe. Bio-Invasions Records 11: 62-69. https://doi.org/10.3391/bir.2022.11.1.07
- Hobbs, R.J. 2000. Invasive Species in a Changing World. Island Press, Washington & Covelo.

- IUCN/SSC 2014. Guidelines on the use of *ex situ* management for species conservation. Version 2.0. Gland, Switzerland: IUCN Species Survival Commission.
- Jennings, D.E., and Rohr, J.R. 2011. A review of the conservation threats to carnivorous plants. Biological Conservation 144: 1356-1363. https://doi.org/10.1016/j.biocon.2011.03.013
- Kadono, Y., Noda, T., Tsubota, K., Shutoh, K., and Shiga, T. 2019. The identity of an alien Utricularia (Lentibulariaceae) naturalized in Japan. Acta Phytotax. Geobot. 70: 129-134.
- Kagawa, T. 2015. Drosera of Japan. CreateSpace Independent Publishing Platform. 63 pp.
- Kataoka, H., and Nishimoto, T. 2012. Distribution of invading insectivorous plants alien to Okayama Prefecture. The third report – ecology of *Drosera intermedia* Hayne and effect of the removal. Bull. Okayama Pref. Nature Conservation Center 19: 29-41.
- Kondo, K., Kokubugata, G., Varghese, S.B., Itoyama, M., Breckpot, C., Kromer, K., and Kaminski, R. 1997. Conservation of endangered *Aldrovanda vesiculosa* by tissue culture. Carniv. Pl. Newslett. 26: 89-92. https://doi.org/10.55360/cpn263.kk463
- Krueger, T., Robinson, A., Bourke, G., and Fleischmann, A. 2023. Small leaves, big diversity: citizen science and taxonomic revision triples species number in the carnivorous *Drosera microphylla* complex (*D.* section *Ergaleium*, Droseraceae). Biology 12: article 141. https://doi.org/10.3390/biology12010141
- Lamont, E.E., Sivertsen, R., Doyle, C., and Adamec, L. 2013. Extant populations of *Aldrovanda vesiculosa* (Droseraceae) in the New World. Journal of the Torrey Botanical Society 140: 517-522. https://doi.org/10.3159/1095-5674-140.4.517
- Lee, C.C., Wistuba, A., Nerz, J., Zimmermann, U., Paserang, A.P., and Pitopang, R. 2011. Nepenthes undulatifolia, a new pitcher plant from South East Sulawesi. In: McPherson, S. (ed.), New Nepenthes 1. Redfern Natural History, Poole: 492-505.
- Mansur, M., Brearley, F.Q., Esseen, P.J., Rode-Margono, E.J., and Rafi'i Ma'arif Tarigan, M. 2021. Ecology of *Nepenthes clipeata* on Gunung Kelam, Indonesian Borneo. Plant Ecology & Diversity 14: 195-204. https://doi.org/10.1080/17550874.2021.1984602
- Maschinski, J., and Haskins, K.E. (eds.) 2012. Plant Reintroduction in a Changing Climate: promises and perils. Island Press. https://doi.org/10.5822/978-1-61091-183-2
- Mathieson, M.T., and Thompson, S.L. 2020. Drosera buubugujin M.T.Mathieson (Droseraceae, Drosera section Prolifera C.T.White), a spectacular new species of sundew from the Cape York Peninsula bioregion. Austrobaileya 10: 549-557.
- McPherson, S. 2022a. A report on the conservation status of endangered *Nepenthes*. In: McPherson, S., and Golos, M.R. (eds.), New *Nepenthes* 2. Redfern Natural History, Poole: 667-671.
- McPherson, S. 2022b. An account of horrific poaching and the Ark of Life Project. In: McPherson, S., and Golos, M.R. (eds.), New *Nepenthes* 2. Redfern Natural History, Poole: 672-677.
- Mey, F., Catalano, M., Clarke, C., Robinson, A., Fleischmann, A., and McPherson, S. 2008. Nepenthes holdenii (Nepenthaceae), a new species of pyrophytic pitcher plant from the Cardamom Mountains of Cambodia. In: McPherson, S. (ed.), Carnivorous plants and their habitats. Redfern Natural History, Poole: 1306-1331.
- Meyers-Rice, B.A. 1996. CLODS, collectors and pseudo-environmentalists. Carniv. Pl. Newslett. 25: 122-124. https://doi.org/10.55360/cpn254.br278
- Meyers-Rice B.A. 2001. Rare *Sarracenia* poaching and the ICPS. Carniv. Pl. Newslett. 30: 43-50. https://doi.org/10.55360/cpn302.br555
- Moldowan, P.D., Smith, M.A., Baldwin, T., Bartley, T., Rollinson, N., and Wynen, H. 2019. Nature's pitfall trap: salamanders as rich prey for carnivorous plants in a nutrient-poor northern bog ecosystem. Ecology 100(10): e02770. https://doi.org/10.1002/ecy.2770

- Nehring, S., Kowarik, I., Rabitsch, W., and Essl, F. (eds.) 2013. Naturschutzfachliche Invasivitätsbewertungen f
  ür in Deutschland wild lebende gebietsfremde Gef
  ä
  ßpflanzen. Bundesamt f
  ür Naturschutz (BfN), Bonn. 204 pp.
- Nobis, M.P., Jaeger, J.A.G., and Zimmermann, N.E. 2009. Neophyte species richness at the landscape scale under urban sprawl and climate warming. Diversity and Distributions 15: 928-939. https://doi.org/10.1111/j.1472-4642.2009.00610.x
- Parisod, C., Trippi, C., and Galland, N. 2005. Genetic variability and founder effect in the pitcher plant *Sarracenia purpurea* (Sarraceniaceae) in populations introduced into Switzerland: from inbreeding to invasion. Ann. Bot. 95: 277-286. https://doi.org/10.1093/aob/mci023
- Peruzzi, L., Passalacqua, N.G., and Cesca, G. 2004. *Pinguicula crystallina* Sibth. et Smith subsp. *hirtiflora* (Ten.) Strid (Lentibulariaceae) in Calabria (Southern Italy). Cytotaxonomical study and *ex situ* conservation in the Botanic Garden of Calabria University. Carniv. Pl. Newslett. 33: 68-74. https://doi.org/10.55360/cpn333.lp220
- Piria, M., Radočaj, T., Vilizzi, L., and Britvec, M. 2022. Climate change may exacerbate the risk of invasiveness of non-native aquatic plants: the case of the Pannonian and Mediterranean regions of Croatia. In: Giannetto, D., Piria, M., Tarkan, A.S., and Zięba, G. (eds.), Recent advancements in the risk screening of freshwater and terrestrial non-native species. NeoBiota 76: 25-52. https://doi.org/10.3897/neobiota.76.83320
- Pyšek, P., Hulme, P.E., Simberloff, D., et al. 2020. Scientists' warning on invasive alien species. Biological Reviews 95: 1511-1534. https://doi.org/10.1111/brv.12627
- Rice, B.A. 2008. Mendocino/Albion Bog carnivorous plant removal. International Carnivorous Plant Society Forum. http://icps.proboards.com/thread/1810 (accessed 10.05.2021)
- Rice, B.A. 2019. Stop sharing information, Dammit! You're not helping! Carniv. Pl. Newslett. 48: 174-177. https://doi.org/10.55360/cpn484.br277
- Sanderson, N. 2012. Ecological importance of Holmsley Bog in relation to the exotic pitcher plant *Sarracenia purpurea*. Neil Sanderson Botanical Survey and Assessment.
- Shimai, H. 2021. Introduced populations of *Pinguicula primuliflora* (Lentibulariaceae) in Japan. Journ. Jap. Bot. 96: 44-51.
- Simpson, R. 1995. *Nepenthes* and conservation. Curtis's Botanical Magazine 12: 111-118. https://doi.org/10.1111/j.1467-8748.1995.tb00496.x
- Tan, H.L., Lim, G., Mey, F.S., Golos, M.R., Wistuba, A., McPherson, S., and Robinson, A.S. 2023. *Nepenthes berbulu* (Nepenthaceae), a pitcher plant from Peninsular Malaysia with remarkably long lid bristles. Carniv. Pl. Newslett. 52:15-43. https://doi.org/10.55360/cpn521.fm322
- Trippi, C. 2006. Evaluation d'une réserve naturelle: points de vue du protecteur de la nature et du visiteur. Le cas des Tenasses (Vaud). Master thesis, Université de Lausanne, 116 pp.
- Walker, K.J. 2014. Sarracenia purpurea subsp. purpurea (Sarraceniaceae) naturalised in Britain and Ireland: distribution, ecology, impacts and control. New Journal of Botany 4: 33-41. https://doi.org/10.1179/2042349714Y.0000000035
- Walker, K.J., Auld, C., Austin, E., and Rook, J. 2016. Effectiveness of methods to control the invasive non-native pitcherplant *Sarracenia purpurea* L. on a European mire. Journal for Nature Conservation 31: 1-8. https://doi.org/10.1016/j.jnc.2016.02.003
- Wistuba, A., Nerz, J., and Fleischmann, A. 2007. *Nepenthes flava*, a new species of Nepenthaceae from the northern part of Sumatra. Blumea 52: 159-163. https://doi.org/10.3767/000651907X612418
- Ziemer, B. 2010. Exciting conservation news: The rare Nepenthes collection project. Carniv. Pl. Newslett. 39: 67. https://doi.org/10.55360/cpn393.bz815