EVOLUTION ACCORDING TO PLANTS: COOPERATION AS KEYSTONE IN VEGETAL STUDIES*

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Abstract

In vegetal studies, cooperation is a plant's well-known ability. Pieces of evidence show that botanical species can connect with other organisms to achieve their physiological objectives (Mancuso & Viola 2015). In this paper, we aim to investigate two different aspects of these interindividual and interspecies ties. In the first section, we will focus specifically on the vegetal agency (Gilroy & Trewavas 2022), supporting the idea of its strong orientation to cooperation. Therefore, we will place our research alongside cooperative evolution models rather than competitive ones (Margulis 1999). From this perspective, symbiosis plays a fundamental role in explaining plant life and permits a focus shift from individuality to networks of cooperation and interaction. Following this interpretative line, we will analyse some fundamental aspects of vegetal agency, particularly the capacity to interpret and create significant signs, which are essential for communication and organisation (Witzany 2008), two critical factors of cooperation. In the second section, we will apply this perspective to analyse the multifaceted dimensions of human-plant interaction. We will discuss how this interaction unfolds in different contexts and with

* This article was produced while attending the PhD programme in Sustainable Development And Climate Change at the University School for Advanced Studies IUSS Pavia, Cycle 38 and 39, with the support of a scholarship financed by the Ministerial Decree no. 351 of 9 April 2022, based on the NRRP - funded by the European Union - NextGenerationEU - Mission 4 "Education and Research," Component 1 "Enhancement of the offer of educational services: from nurseries to universities" - Investment 3.4 "Advanced teaching and university skills" OR Investment 4.1 "Extension of the number of research doctorates and innovative doctorates for public administration and cultural heritage."
This paper and related research have been conducted during and with the support of the Italian national inter-university PhD course in Sustainable Development and Climate Change.

varying degrees of awareness (Myers 2015; Gibson 2018). For instance, plants' morphology – or phenotypic plasticity (Trewavas 2015) – reflects plants' biography and history of *comparticipation* with humans, as Mathews (2021) pointed out. Then, we will explore some ethical consequences of plant-human cooperative entanglements in the third section of our paper, since it is crucial to consider the moral implications of human-plant interactions and the ethical responsibilities that follow (Kohn 2020). Indeed, we will argue that plants' cooperation-oriented agency could be the starting point for an ethical shift in humans' approach to vegetal life.

Keywords: Plant Agency; Biosemiotics; Vegetal Ethics; Interspecies Cooperation; Phytocentrism.

1. *Introduction*

The issue of cooperation in the plants' world, and more generally in the non-human biosphere, is a complex and fascinating topic. If, on the one hand, it is difficult to imagine a mutualism between living forms that exceed the human domain or mechanistic and deterministic explanations, on the other hand, we have several pieces of evidence that permit us to claim the spontaneity and importance of the mutually beneficial intra- and inter-species ties. To achieve the aim of this paper, namely, to demonstrate that plants are active participants in all the cooperative relationships they establish and that this condition does have ethical implications in the human-plant relationships, we will dwell on several issues and points. Through discussing crucial topics such as semiotic agency (Sharov & Tønnessen 2021), the semiosphere (Hoffmeyer 1993; tr. en. 1996), domestication as a cooperative tie (Scott 2017), and the phytocentrism (Marder 2014), we will highlight the core of our thesis: plants, to thrive and flourish must cooperate. Even if all living forms are in a state of dependence on their environment or other organisms – as Sharov and Tønnessen (2021) note, autonomy for life can never be absolute – plants are in a particular condition where the lack of sudden movement and central organisation as well as the need to act both underground and above ground created refined forms of cooperation (Mancuso 2019; tr. en. 2021).

Consequently, in this paper, we do not claim that plants are, somehow, fitter than other organisms regarding cooperation. However, they have evolved particular kinds of co- and inter-action that must have their legitimacy and consideration. We know this discourse can be done only through abstraction since botanical species have several differences, even in sym-

biosis and life organisation. On the other hand, it is possible to recognise some patterns in vegetal life that permit us to generalise. After these preliminary clarifications, in the subsequent pages, we will discuss, firstly, the theoretical horizon in which we move to demonstrate the reborn philosophical interest in plant lives we have been assisting in the last years. Then, in the *Cooperative Ties with Non-Humans* section*,* we will pursue the idea that a biosemiotic perspective on plant communication and agency can pave the way to understanding the cooperative actions of plants and their processes. In particular, through the concept of semiosphere, we will give a phytosemiotic reading of interspecies mutual ties. In the section *Human and Vegetal Entanglements: Domestication as a Cooperative Act,* we will explore the debate on the domestication of species such as grain, stressing a perspective through which plants are actors in this process and that even humans have been "domesticated" by plants. This interpretation permits us to support the idea that plants evolved refined ways to communicate with humans, like the morphological changes. Finally, in the section *The Ethics of Interspecies Cooperation,* we will dwell on the ethical consequences of our reasoning, showing how a cooperative perspective focused on the semiosphere can embrace a phytocentric viewpoint and, indeed, positively influence the relationship between humans and plants.

2. *Theoretical horizon*

In contemporary philosophy, plants have become a theoretical issue. After being reputed as mere "natural objects" or little more than inanimate matter in most Western philosophical traditions (Miller 2002), current perspectives argue differently. Indeed, botanical specimens are considered fundamental organisms in our ecosystems and pivotal starting points for philosophical reasoning on the relationship between human and non-human worlds. In the renewed attention toward vegetals, the cooperative abilities of plants and their relational way of living are essential aspects that have been analysed in recent years. The reason for this consideration lies in a fundamental distinction between these organisms and most animal forms of life: the impossibility of a repenting and immediate movement capable of removing the individual from a possible threat. If in the past this lack of mobility has been considered as the proof of vegetal passivity (Scheler 1928; tr. en. 1962; Plessner 1928; tr. en. 2019; Bergson 1907; tr. en. 2002), nowadays it is read as the fundamental condition that made possible the development of very refined forms of cooperation (Mancuso 2019; tr. en.

2021). Many philosophical theories are starting to recognise that what was once regarded as a weakness of plants compared to animal abilities is now a fundamental evolutionary aspect of botanical species, worthy of closer reflection and consideration. Our paper aims to fit into this philosophical emerging current that stands against zoocentrism – namely, the tendency to study plant life by choosing as a yardstick animal skills and abilities (Sandford 2022). Consequently, the basis of our work needs to be rooted in the fields of study that directly deal with the issues of plant communication and cooperation, taking into account the disciplines that provide valuable evidence for our research.

Thus, theoretical biology is fundamental for defining plant cooperation and relationality. Indeed, it is our idea that a philosophical theory on plants focused on evolutionary theory and cooperative coexistence differs from orthodox Darwinism and needs a solid biological foundation. The work of Lynn Margulis (1999), who discovered the importance of symbiosis in the evolutionary process, specifically endosymbiosis, is undoubtedly a keystone for much philosophical literature that deals with non-human organisms (Haraway 2016). The author posed cooperation and mutualism at the centre of the debate on life, opening new horizons even for our understanding of plants. Moreover, in the last few years, theoretical biology has started an exciting and intense discussion on agency, another notion we will deeply analyse in this paper. Indeed, to prove the plants' cooperative forms of existence, it is essential to demonstrate their non-passivity in the environment but, on the contrary, their ability to act and co-act with other organisms. Indeed, the debate on vegetal agentivity is rich and offers different perspectives: from intelligence to communication, many authors pursue the idea that plants are active and directly involved in shaping territories (Trewavas 2014; Calvo & Lawrence 2022). Even the philosophy of biology can help us to dwell on the concept of agency, providing a solid foundation for a theory on the plants' ability to act. The work of Samir Okasha (2018; 2023) offers different perspectives on the theme, supporting the idea that a biological perspective on organisms' actions should highlight their ability to interpret external stimuli and choose the best option that maximises the utility for the agent.

Another significant body of literature interested in the plants' turn in philosophy is directly connected to the issue of the interpretation of the outside world. We are referring to biosemiotics, the discipline that studies the semiotic processes of living organisms in a non-mechanistic way (Maran 2016; Sharov & Tønnessen 2021). Biosemiotics is, therefore, fundamental in the study of plants' cooperative agency: it allows us

to study which communication processes are put in place when mutual relationships are established, focusing on the interpretative abilities of vegetal organisms. Moreover, a branch of biosemiotics is specifically interested in vegetal signs and semiosis: phytosemiotics (Krampen 1981; Kull 2000) deepens the particular abilities of plants, maintaining the perspective of semiotic freedom, namely that organisms can evaluate the various signals, choosing which ones to interpret and looking for the best answer among the possible. Moreover, plants' chemical (Witzany 2008) and non-chemical communication (Khait *et al*. 2023) paint a complex picture of cooperation. It allows us to consider them active and purposeful organisms (Comollo 2024). Indeed, they can establish mutual ties not only as a physiological reflex but even as a response chosen by the plant organism among the other possible actions.

These studies also open up important ethical questions: if plants are cooperative and active beings, what are the moral consequences/our ethical responsibilities toward them? How can we *act with* them instead of perceiving them as mere resources? In the contemporary debate on plant ethics, there are many different perspectives on whether and on what grounds plants should be attributed moral status or consideration. The hypotheses are various (Pellegrino 2018), from the proposal of vegetal axiology based on aesthetics to the theories that support a moral extensionist approach, namely the inclusion of plants in the moral sphere due to possessing a specific moral quality – like intelligence (Calvo & Lawrence 2022), life (Attfield 1981; ECNH 2008) or interests (Sandler 2018). Others claim that, based on being living, thriving entities, plants should have granted rights (Stone 2012) or even personhood (Hall 2011). The debate on plant ethics is still ongoing and has created new paths for considering the role of plants as active entities in a shared world.

Nevertheless, we can move a crucial criticism against these approaches: they have a narrow conception of moral value that is still too anthropocentric (Hendlin 2021). This is because the features that ground moral consideration to plants reiterate animal or human exceptionalism. The philosophical horizon in which we aim to insert this paper takes a different direction. Indeed, focusing on the vegetal reciprocal interchange can pave the way for a relational ethic of plants. This approach presents cases for relational ethics applied to plants, meaning that plant value does not emerge from an ontology or moral status but within human-plant entanglements and practices (Coeckelbergh 2018; Schörgenhumer 2018). These works are mainly concerned with virtue ethics and practices of care instead of duties and obligations. With this concept, we adopt the perspective of Coeckelberg

(2018), who clarifies that this kind of discussion should include even the phenomenological participation of the human subject-observer to ensure the objective and subjective content of the investigation.

3. *Cooperative ties with non-humans*

As we have highlighted, cooperation is central to many debates on organisms and plants and is a crucial perspective for many theoretical biological studies. In this section, we will dwell on plant cooperation with non-human organisms, trying to figure out how botanical species can construct solid ties with other living beings and highlighting the importance of this capability from an evolutionary perspective. The point of view we will use is strongly influenced by biosemiotics and biological breakthroughs, as anticipated in the previous section. Our first point wants to clarify an essential aspect: on which shared layer can a relational and cooperative tie be structured between individuals of different species? Or, in other words, does a shared level between organisms exist where interactions and cooperation can arise? Indeed, plants need to establish a form of communication with other organisms to create a mutually beneficial exchange. Biosemiotics help us define this relational field using the concept of "semiosphere" (Hoffmeyer 1993; tr. en. 1996), namely the semiotic niche where every organism is inserted[1] and, consequently, can perceive and act. Semiosphere is paramount as it is the sphere of meaning that living beings attribute to external stimuli and events. This perspective built following the Uexküllian idea of *Umwelt* (von Uexküll 1934; tr. en. 2010), has an important implication: as Kotov and Kull pointed out (2011), the semiosphere is highly relational. Indeed, meaning can be communicated to other organisms through the interaction between different semiospheres. The biosemiotics researcher Jesper Hoffmeyer defined this ability as "semetic interaction" (Hoffmeyer 1998, p. 287), namely the process through which organisms translate habits or behaviours into signs and communicate them to other individuals. This discussion plan helps provide an operational definition of agency. Every semiosphere is characterised by semiotic freedom, namely, the ability of each organism to choose which stimuli to interpret and signs to send actively. Indeed, semiotic freedom is the capacity to bring out new

1 According to biosemiotic theory and Hoffmeyer's work on this concept, we should state more accurately that the semiosphere of life systems emerges in unison with them. However, in this paper, we opted for the term "inserted" to convey the idea of a sphere analogous to the atmosphere or the biosphere.

habits, not (always) deterministically. As written by Norbert Wiley in his work *The Semiotic Self* (1994), semiotic freedom permits the maintenance of free will in the debate, understood as the creative and interpretative semiotic work that the agent does. Consequently, organisms, and therefore even plants, are not passive entities but, instead, are actively involved in the relationships they build in the semiosphere. Hence, cooperative ties are not a mechanical response to external stimuli; on the contrary, they are established through meaningful communication between living beings and can be considered as an expression of agency.

After this preliminary explanation, we can deepen the cooperative nature of plants, focusing on some vital abilities of these organisms. In the semiosphere, botanical species address other living beings, expecting a response based on their needs. Phytosemiotics, namely the study of signs in the vegetal world, provide several exciting pieces of evidence that plants can send various signals to the surrounding environment. As the researcher Günther Witzany pointed out, in the roots' area, plants have 100,000 chemical elements that make up an actual vocabulary (Witzany 2008). The semiosphere of each plant is characterised by a high communicative ability due to the necessity of these organisms to interact and cooperate with other living forms. Therefore, we argue that botanical species evolved a strong "semetic"[2] interaction to induce individuals to enter symbiotic and cooperative relationships. If, on the one hand, following Margulis' perspective, all five kingdoms of the biosphere can be read as the result of coaction, on the other hand, it is interesting to notice that plants are considered particularly cooperative even in their structure. As proposed by Anthony Trewavas, plants developed following the principle of cooperation (Trewavas 2014). Since these organisms do not have a central nervous system and a brain, individual parts of the same plants may compete in scarce situations. The botanical species evolved internal cooperative features to avoid this potentially mortal danger. In particular, the interdependence of shoots and roots and their equivalent growth is a clear example of cooperation and balance that the entire plant tries to establish and maintain (Trewavas 2014, p. 107).

Moreover, vegetal organisms have to deal with "above- and below-ground habitats" (Ryan 2020, p. 167) differently, generally, from humans and non-human animals. This aspect, as noticed by Trewavas (2016), caused the botanical species to face very different problems that required an essential degree

2 With this term, Hoffmeyer refers to the semiogenic behaviour of translating habits into signs and passing them to others.

of intelligence and, we add, internal and external cooperation. We can identify several examples of mutualistic and cooperative symbiotic relationships established with various organisms, from invertebrate pollinators to fungi. The critical aspect is that all these interactions are created through direct communication between living beings. For instance, exchanging information and resources is characterised by the well-known mycorrhizal symbiotic tie between fungi and plants' roots. Plants offer fungi substances consisting of carbohydrates created through the photosynthetic process. In return, fungi provide chemical elements that plants could not obtain without collaborating, such as phosphorus (Sheldrake 2020). Following the theory of semiosphere, all these adaptive and evolutive traits of plant cooperation have been developed through organisms' interpretative and creative abilities. As Sharov and Tønnessen noticed, these organisms' semiotic competencies are found even at the cellular level and, therefore, do not require intentionality or a centre of control (Sharov & Tønnessen 2021). In addition, this process cannot be reduced to a mechanical and physiological automatic response since, as we said, plants can eventually create new habits and symbiotic relationships non-deterministically and communicate them through semetic interaction.

At this point, analysing plants' cooperative ability from a profound evolutionary perspective is necessary. Indeed, as we pointed out, cooperation is not just a surface-level phenomenon. Still, it is deeply intertwined even with plants' structure, and their life on this planet would not be the same without strict forms of collaboration and species-specific symbiosis. How can we explain this reading of plant life in theoretical biology? As anticipated, Lynn Margulis' work is pivotal in providing a theoretical outline of plants' cooperative abilities.

> Symbiosis […] is crucial to an understanding of evolutionary novelty and the origin of the species. Indeed, I believe that the idea of species itself requires symbiosis. Bacteria do not have species. No species existed before bacteria merged to form larger cells including ancestors to both plants and animals (Margulis 1999, p. 8).

Margulis' perspective is clear. Complex life started with cooperation when bacteria lived in symbiosis and specialised their mansions inside a larger cell. Through endosymbiosis, organisms began to emerge. Even in this case, the semiosphere is central: bacteria, cells and simple organisms need to chemically communicate their necessities to others in order to establish connections and ties. Margulis spotlighted cooperation and its evolutionary value: all organisms evolved through internal and external collaboration. This explains, on the one hand, the structure plants adopted following internal cooperative necessities.

On the other hand, it explains the vast number of mutual ties plants can create with different organisms. As Samir Okasha pointed out in his definition of biological agency, an organism acts by interpreting the external world and maximising its resources (Okasha 2023). Therefore, plants established mutual relationships since it was the better adaptive path to survive and flourish in an environment without the ability to move quickly. That does not imply that plants will create cooperative and mutualistic relationships with all the organisms they encounter. On the contrary, there are competitive traits even in the vegetal world, and some species are more "aggressive" than others. However, every plant will cooperate with some organisms to fulfil their reproductive or nutritive aims. The breakthroughs from various empirical studies in plant behaviour and science enhance this perspective, simultaneously revealing how research on plant behaviours continues to hold many surprises. For instance, an "intertwining behaviour" has been discovered in pea plants (Bonato *et al*. 2024, p. 4), while many botanical species can perceive volatile cues in their environments and respond to them accordingly, for instance, defending themselves from herbivores (Karban *et al*. 2014, p. 51). All these studies demonstrate how plant life is not isolated but characterised by a strong interdependence.

What has been said so far opens critical horizons: If all organisms emerged from strict cooperation and symbiosis, and the vegetal world more than others developed its communicative and mutualist capabilities, what relationship will these forms of life establish with humans? Moreover, is this perspective just descriptive, or does it entail ethical consequences? In the following sections, we will dwell on these issues.

4. *Human and vegetal entanglements: domestication as a cooperative act*

As we have shown, plants are not passive in their environment but rather active in establishing symbiotic ties with other individuals and species. This section will apply the cooperative perspective to analyse the multifaceted dimensions of human-plant interactions. In other words, we will explore how botanical species have constructed solid ties with human beings. To do so, we will use a biosemiotics perspective and unveil the social dimension that characterises these human and vegetal *entanglements*[3] (Tsi-

3 According to Tsing, assemblage thinking is about understanding how a phenomenon is contingent upon and constituted through ever-changing relations. An assemblage is composed of various elements – human and non-human (e.g., plants, animals, places, objects, etc.) – and the relations between these elements. Take for

ng 2015). Indeed, when approaching biology from a human perspective, it is impossible to ignore the socio-cultural dimension attached to it (Latour 2005). Culture, biology, humans, and nature are deeply entangled.

Several authors call for disrupting this neat dichotomic approach to the world (See Whitehead 1920; Descola 2014; Latour 2005). As Whitehead argues in the *theory of the bifurcation of nature* (1920), the nature/culture dichotomy brings an abstraction of nature that cannot account for immediate experience. Instead, Whitehead encourages us to move toward a relational perspective, understanding the *being in the world* as a mode of existence embedded in a concerned relation guided by the 'doing with' something/someone else. In other words, the assemblages of beings are continuous *inter-actions* (Haraway 2016) focused on competition and concern, care, and involvement with the environment and the multiple organisms that inhabit it.

A renewed attention to non-human agency and the active cooperation between beings lies at the heart of this approach. For instance, Haraway (2016) introduces the concept of *sympoiesis* – the idea of "making with" others – to show how species co-produce environments and relationships, emphasising co-evolution and mutual aid. Latour (2005) discusses the notion of non-human agency, proposing that non-human organisms (and even artefacts) possess a "power to act" that influences the state of affairs just as humans do. Applying these theories to plants and vegetal organisms repositions human individualities and collectiveness within a broader network of agents in constant interaction. This space of *inter-action* corresponds to the *semiospheres* where humans and non-human organisms communicate and interpret each other's signs, signals or behaviours and act accordingly (Hoffmeyer 1993; tr. en. 1996).

From a more social point of view, the freedom that organisms experiment through the *semiospheres*, which we understand as a form of agency, can also be interpreted as the power to act and influence other agents' actions (Latour 2005). This approach allows for shifting the perception of humans as "natural capitalists" to humans as "natural cooperators" (Mabey 2015, p. 8) within a network of other non-human agents. To unveil this relation of cohabitation and cooperation, James Scott uses the notion of *domestication* (2011). In 2011, in a series of lectures at Harvard University,

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example, an agriculture field. When thinking of a field as an assemblage, this is not just the physical space/structure, it also encompasses the farmers, the animals (domestic and wild), the plants (wanted, e.g., crops, and unwanted, e.g., weeds), the equipment, and so forth, and is constituted by the relations between these different elements.

Scott referred to fire, plants and animals as three crucial *domestications* that have profoundly reshaped the environment and human beings. However, domestication is an ambiguous concept. It can be understood as a cooperative relationship or a form of exploitation, coercion and domination of humans against non-humans. This work follows Scott's understanding of domestication as a mutualistic, cooperative coevolution between humans and vegetal organisms. Here, domestication from "domus"[4] is taken literally as a space of concentrated seeds, people, and animals. It refers to a coevolving process with unforeseen and unique trajectories (Scott 2011) and a mode of relation that diverse organisms take advantage of.

The traditional perspective of human-plant history understands humans as the leading force in breeding and dominating plant species. Humans have chosen, selected and cross-bred vegetal traits that they find desirable and valuable based on colour, taste, hardiness and so forth (Mabey 2015). At the beginning of domestication, a crop had many purposes; not all were determined or in favour of human beings, whereas later, they were grown in an artificial environment, selected, mixed and 'created' by humans. In this way, plants became super specialised and entirely dependent on humans. However, recently, scholars have recognised the agency, mutuality, and cooperative dimensions involved in these cultivation and domestication practices. Consequently, the previous approach was criticised as anthropocentric (Scott 2011) since it overlooked plants' agentive and collaborative capacities. Taking a step further, Scott argues that from this point of view, humans were fully domesticated by plants, not the contrary:

> Michael Pollan puts it roughly this way in his sudden aperçu while gardening. As he is weeding and hoeing around his tomato plants, it dawns on him that he has become the slave of the tomato. Here, he is on his hands and knees, day after day, weeding, fertilizing, protecting, and, in general, reshaping the immediate environment to the utopian expectation of his tomato plants. Who is doing whose bidding becomes almost a problem in metaphysics (Scott 2011, p. 194).

The excerpt highlights this idea of human-plant domestication and shows how plants can also 'use' humans – or, better, cooperate with them – to succeed and survive. If we think of cooperation instead of

4 Domus is a Latin word that means 'house'. Therefore, domestication traditionally refers to the process through which an animal or plant species is made "domestic", that is, dependent on coexistence with the human being.

domestication, this dimension of mutual agency becomes even more apparent. In their long history together, plants and humans have collaborated, shaped, modified, and forced each other into their own worlds, temporality and spaces. These entanglements of humans and vegetal organisms organised our routines, social ties, settlement patterns and ritual life (Scott 2011). Plants have shaped human bodies as much as humans have influenced vegetal organisms, especially when domestication constitutes the main mode of relationship. Instead, this mutuality diminishes when we turn to exploitation (Barua 2023). Given this view, domestication is not understood as a degradation process but rather as a cooperative one (Scott 2011).

The domestication process as an inter-action between humans and plants unfolded within the *semiosphere*, characterised by continuous and mutual interpretation. In this context, humans and plants learn to interpret and respond to each other's actions, reactions, forms and behaviours. Semiotic signs, thus, serve as the medium for interspecies communication, facilitating complex forms of plant-human cooperation. Moreover, the semiotic agency of plants is manifested not only by what they do but also by their *morphology*, which becomes a crucial interface through which humans interpret plant behaviours, experiences and histories. Human responses to plant morphology, in turn, reflect a recognition of plants' desires and needs.

Plant morphologies tell stories about encounters with various agents, including humans, insects, animals, diseases and the atmospheric elements. Many stories have left indelible marks on the landscape and are embedded in the physical forms of plants. As Mathews observes, plants are shapeshifters capable of incredible metamorphoses as they form alliances to share nutrients and care for their environment. Their shapeshifting capacities reveal the histories of places and entire landscapes, and their morphology records biographies of encounters (Mathews 2022). Rooted in place, the movement of plants is inscribed in their growth patterns, making plant morphology a kind of biography that reflects where they have been, where they are headed, and the various beings they have encountered along the way (Mathews 2022). In other words, through their semiotic agency, plants interpret signs and respond to their encounters with other beings, often altering their morphology. Even a single detail, such as an area of dying or flourishing stems, can modify human perception of the morphology of a whole vegetal organism.

Moreover, morphology is a form of sign communication even in the non-human world. As Timo Maran notices, while giving a biosemiotics reading of mimicry, it is a peculiar way of interspecies communication

and signalling. Mimicry is the process through which an organism sends signals to living forms to resemble other species or objects, obtaining feedback (Maran 2017). As Kull states (2020), even if mimicry is more observed in animals, it can also be found in botanical species. It is a clear example of how interspecies and signs interaction can be an active factor in organisms' morphology. Back to the specificity of human-plant cooperative ties, a clear example of this can easily be the grain that succeeded, almost globally, as a species thanks to its deep entanglement with humans. Today, grain is the most diffused cereal worldwide, which would not have been possible without domestication. The grain shaped and modified human bodies and settlements – such as sedentism, crowding and cereal-based diets (Scott 2017). According to Scott, this demonstrates that we are a product of domestication in intended and unintended ways as much as other species of the Domus. Consequently, cooperation and domestication have clear morphological and physiological consequences and changes in behaviour and sensibility.

5. *The ethics of interspecies cooperation*

Once again, cooperative behaviours bring to light the close connection between the physical/biological and the social/cultural realms. Semiotics played a central role in the mutual co-construction of vegetal and human bodies: to thrive, both need to learn how to interpret internal and external stimuli and act accordingly. For instance, we can say that vines *interpret* the presence of sticks and wires as potential helpers in reaching further places. Consequently, by reading plants' capacity to move and thrive towards useful objects and paths, winegrowers can influence plants' behaviours and directions of movement. At the same time, vines and wine have profoundly shaped human culture, behaviours and bodies, influencing rituality, interpretation of the world and interspecies relationships, at least in Western history (Crenn *et al*. 2021).

As we will see in this section, the semiotic, cooperative agency has crucial consequences in our contemporary practices and ethics toward vegetal organisms. Indeed, several key insights emerge from a relational approach to plants and their cooperative agency. Even from a biosemiotics viewpoint, many authors abandoned a purely descriptive approach to give an ethical description of the various relations that can be created between species and individuals. In particular, Yogi Hendlin notices in *Interspezies-Ethik* (2015) that organisms' actions are not neutral but can entail sev-

eral consequences to other life forms. The philosopher proposes to read these interactions as ethical, even if some are not intentional but driven by genetics. This approach focuses on the direct consequences of actions instead of the source of a hypothetical non-human will; effectively, organisms' actions can hinder or enforce others' lives and flourishing. Considering this perspective, some actions are more helpful than others – and few actions are as valuable for other individuals as those aimed at establishing a cooperative and symbiotic mutual relationship. Biosemiotics, reading organisms as active and focusing on the living's agency, can enlarge the field of ethics to interspecies actions, overcoming the problem of sentientism (Beever & Tønnessen 2015).

Thus, if we assume that (human and non-human) actions are not neutral, we must re-read some perspectives on plant ethics from a different point of view, recognising the value that plants bring within interactions. For instance, a fundamental difference exists in understanding human relationships with plants as either *exploitation* or *domestication-as-cooperation*. The first approach (*exploitation*) understands plants as mere natural objects, resources for human survival that can be used and capitalised for legitimate anthropocentric reasons. On the contrary, looking at plants as agentive and cooperative beings opens new interpretations focused on mutuality, reciprocity and long-term involvement that consider vegetal organisms and their interests. Plant life forms influence human responsibilities towards them, and, in this sense, how humans treat and approach plants and think with them matters in terms of moral value. For this reason, we suggest that the plant cooperation-oriented agency we have discussed could be the starting point for an ethical shift in human approaches to vegetal life from *moral anthropocentrism*[5] to vegetal ethics or *phytocentrism* (Marder 2014).

Avoiding a totalising perspective that considers botanical species as a meter of moral value, phytocentrism proposes an ethics based on vegetal life as a way of "greening" human consciousness (Marder 2014). In other words, phytocentrism does not take plants as an absolute model for moral value but as a connection between living beings and nature as a whole. By

5 Moral anthropocentrism is a human-centred ethic in which humans are the only moral agents and bearers of intrinsic value. All the other beings, in this view, hold value only in an instrumental sense – as material and cultural resources for humans. In other words, it supports humans as the measure and standard for different forms of existence. Indeed, this perspective derives from human exceptionalism (Lettow 2022), namely the idea that humans are an exception in the world and the only ethical and political subjects.

doing so, Marder aims at de-centring and de-constructing the hierarchisation of intrinsic values where the plant represents the perfect "synecdoche of growth" (Marder 2014, p. 243).

> Capitalizing on the indeterminacy of vegetal life, phytocentrists bear in mind the whole biosphere by initially concentrating on its part, namely the flora. Analogous to growth, which articulates nature as a whole and plants, phytocentrism is the jointure of the singular and the universal, animated by the desire to promote vegetal, cross-species, and cross-kingdoms communities, to let them thrive on their own accord, and to affirm life throbbing in the shared trajectories of plant, animal, and human flourishing (Marder 2014, p. 245).

According to Marder, phytocentrism focuses on plants at the centre as indeterminate beings that are both individuals and undifferentiated parts of nature as a whole on a broader scale. This connection is required by the very essence of plant life, which oscillates between the apparently neat categories of being as an individual or a collective. Baluska and Mancuso (2021) demonstrate some features of plant agency and describe vascular plants as individual entities able to recognise themselves from others. In environmental ethics, Pellegrino argues that the intrinsic value of plants lies indeed in their individuality: plants have value as "particular givens" (Pellegrino 2018, p. 22). On the contrary, Hendlin maintains that plants are intrinsically and radically plural. They are interspecies ensembles and not individuals (Hendlin 2020).

A phytocentric approach aims to reunite these two poles and produce a multidimensional gaze that continually shifts from the individual to the collectivity. From the plant to nature as a whole (Marder 2014). This comprehensive perspective requires a plurality of responses when addressing the question of the right action for plants, balancing the different positions and interests at stake in a specific context.

The biosemotic theory can reinforce this perspective: if it is true that every organism has its semiosphere, it is also true that inter-actions arise when several semiospheres (or *Umwelten*) interact with each other. Thus, the whole of nature is composed of all the meanings of the organisms that interact with each other, exchanging and sharing their needs. Since plants construct their meanings and fulfil their necessities through many exchanges with other organisms (for instance, fungi or pollinators), the semiospheres of botanical species are particularly rich. This condition derives from their indeterminacy and more vital interdependence with the territory rather than animals and humans.

Hence, communication is needed to create a mutually beneficial exchange. Since plants are actively involved in the relationship, their agentive dimension represents a crucial ground for ethical reflection. Indeed, this constant communication and interaction with the environment implies that agency is not solely a human prerogative but a shared characteristic among all organisms. Traditional ethical frameworks often marginalise non-human beings by focusing on human-centric values and forms of communication, thus reinforcing an anthropocentric worldview. However, as previously demonstrated, the semiosphere reveals that non-human organisms, including plants, are active agents capable of influencing and being influenced by their surroundings. This reconfiguration of agency, as distributed across species, supports the ethical shift from exploitation to cooperation, as it positions humans not as dominators but as participants in a broader, co-creative process of life.

One criticism that could be raised against our claim is that plants cannot communicate with humans and, therefore, cannot actualise their interests. As we have seen above, the semiotic approach allows us to develop a non-anthropocentric view of communication that is not based on structured, symbolic language but rather on a continuous interpretation of signs that enable various organisms to modify their behaviour according to others. One example is the above-mentioned plant morphology, which manifests the history of encounters with its environment and the myriad organisms with which it comes into contact, including humans. Thus, as James Scott pointed out, domestication is a univocal act of control and power and a mutual construction of bodies, spaces and habits. When we apply this reasoning to plant organisms, from a relational ethics perspective, we should ask ourselves what plants do and what they make us do *to* and *for* them.

6. *Final remarks*

Intertwining theoretical biology, phytosemiotics, and ethics, we analysed the role of cooperation in vegetal agency and inter-action with other species. Co-agency and collaboration are at the centre of the strategies for survival and are depleted through the capacity to interpret significant signs and create meaning. This perspective permits a shift from competition to cooperation and allows new values and moral responsibilities, overcoming anthropocentrism and human self-recognition as an ethical standard. Moreover, it turns from individual models to collective networks of inter-action. The plant is immanently de-centred,

and so is the philosophical and moral reflection. Thus, understanding interactions within a community of differentiated beings as an interaction of legitimate semiospheres should offer a concrete example of political organisation, cooperation, cohabitation, thought and action. The cooperative-oriented perception of vegetal and human entanglements provides the base for a relational ethic that can influence environmental policies and agricultural practices, such as promoting biodiversity and sustainable farming processes as concrete manifestations of an ethic based on cooperation, not exploitation. Including the promotion of permaculture agriculture, the protection of rainforests and the development of green cities.

By identifying plants' communicative and agentive capacities within the semiosphere, we can develop a more inclusive and relational ethic that respects the intrinsic value of all life forms, thereby overcoming the limitations of anthropocentric moral systems. Vegetal beings, non-human organisms and humans, in this sense, are continuously inter-acting to survive, reproduce and evolve. Therefore, cooperation and co-agency *become moral,* and one understands the intertwined *teloi* in plant domestication. Moral domestication requires an ethical approach that considers all the beings involved, human or vegetal, to negotiate different interests in the action (Pouteau 2023). This dimension of context-based evaluation of moral becoming constitutes the main difference between a unilateral approach – often used in industries and mono-crop agriculture, where maximising human profit is the only and most important objective – and mutual reciprocity in the relation between humans and plants focused on details, mutual exchange and actions. These ideas of cooperation in evolution and symbiosis suggest a relational approach to guide human actions toward plants based on Marder's understanding of phytocentrism. Plants are put at the centre as long-standing allies and co-producers of environments, landscapes and bodies. Following the agentive domestication framework, the values can be based on 'growing together', 'living with' and recognising cooperation, co-agency and symbiosis. This point is crucial because it involves a redefinition of human responsibility toward vegetal life, which also challenges the classical notion of individuality. This leads us to consider how we might treat plants ethically but also to reflect on how our own subjectivity is co-constructed with them. In this sense, phytoethics is not merely an addition to existing ethical frameworks but a radical rethinking of ethics itself – one in which plants debunk many of the categories through which we typically understand the world.

In conclusion, shifting to a phytocentric perspective transforms our relationship with plants. It suggests a broader vision of value and ethics focused on the well-being of species – vegetals, animals, humans, fungi and so forth – as the goal to reach growth and ethical practices. Instead of understanding living beings in hierarchical terms, we can see them as part of a whole that, through biosemiotic agentivities, requires mutual help and care. This view aligns with the emerging theories of environmental ethics and post-humanism. In this scenario, human beings are not the rulers of nature but respectful and responsible co-inhabitants, capable of recognising and valuing life in all its forms. If we adopt this vision, we can hope for a future in which moral ecology becomes an indispensable foundation for our planetary coexistence.

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