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Research Article

An analysis of plant palatability on pastures of the delta: Case study, Danube Delta area, Romania

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Abstract

The palatability of a plant refers to the degree of attraction or preference that animals show toward that particular plant. Various factors can influence palatability, including the plant's chemical composition, texture, taste, aromas, and the circumstances under which herbivorous animals consume it. The study aims to assess the plant species composition in grasslands and pastures within the Danube Delta, Romania. Both old or new references on palatability were considered. The evaluation of plant composition and degree of plant palatability was carried out in 12 grazing areas in the Danube Delta and the surrounding region. The study revealed 121 plant species identified in some pastures. Of these, 31 were "Non-Palatable", 16 were "Highly Palatable", 32 were "Mostly Palatable", 16 were "Less Palatable", and 26 were "Rarely Palatable". Animals preferred 60 plant species in their fresh condition, with 29 preferred in fresh and dry. Most animals consumed whole plants (48 species), followed by leaves (43 species), fruits (three species), and inflorescences (two species). By analysing the feeding preferences of animals, it was found that cows exhibited a preference for the broadest range of plants (75 species), followed by sheep (67 species), goats (59 species), and horses (34 species). Domestic animals like goats, sheep, cows, and horses may prefer certain plants based on nutritional content or digestibility while avoiding toxic plants. The study showed that the investigated areas have a diverse flora with a varied supply of plants, including palatable species. The palatability index is essential in assessing the quality of pastures, especially in obtaining average daily gains based on the species of animals living on the pastures. Considering the dynamic climatic conditions and poor pasture quality in the Danube Delta, more detailed and interdisciplinary studies are needed to understand the deltaic biocenoses comprehensively.

Keywords: animal preference; Danube Delta; palatability class; pasture; plant condition; species

Introduction

Plants are a vital element of life on Earth, having profound importance in many aspects of our existence (Baluška and Mancuso, 2020). Analysing their palatability is essential from a global and individual perspective. Globally, plants are fundamental to human and animal food, providing critical nutrients and contributing to food security (Ulian *et al.*, 2020). Assessing palatability is essential to identify safe and beneficial plants for

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consumption, ensuring a balanced and healthy diet. In this context, domestic animals can select plants in different seasons according to their preferences and needs (Fraser *et al*., 2022). This selection is based on a complex and specific interaction between the animal and the plants in their natural habitat (Fraser *et al*., 2022; Haq and Badshah, 2023). Each animal species develops specific preferences for various plants based on palatability, nutritional value, and other characteristics. The close relationship between the animal and the plants available in its natural habitat is essential for their health and survival. This complex relationship is often described regarding animals' palatability and food preferences (Haq and Badshah, 2023).

The definition of palatability is complex and reflects a wide range of interpretations depending on the field of research. According to the literature (Heady, 1964; Heath *et al*., 1985; Khan and Hussain, 2012; Kochare *et al*., 2018; Abu-Alrub *et al*., 2018; Chebli *et al*., 2023), palatability is the satisfaction that animals feel when consuming plants or plant parts and is determined by the animal's sensory reactions, such as taste. The perspectives of botanists and zoologists discuss different aspects of palatability (Haq and Badshah, 2023). Botanists focus on the availability of plants in their natural habitat, chemical composition, and structure in the context of grasslands or pastures (Burritt, 2011; Haq and Badshah, 2023). Instead, zoologists define palatability in terms of the degree to which animals appreciate or prefer certain plants, including their flavours (Burritt 2011). The National Research Council (2006) guidelines define palatability as food's physical and chemical characteristics that can stimulate or suppress feeding behaviours before or after food intake. Regarding the terms preference and selection, preference has been shown to refer to choices made by animals given the most straightforward physical constraints (Parsons *et al*., 1994; Rutter, 2006), while selection implies a preference that is modified or influenced by environmental factors (Hodgson 1979; Rutter, 2006). Animal food preferences are generally influenced by plants' palatability, abundance, and availability in their natural habitat (Cory, 1930; Chebli *et al*., 2023).

The palatability of plants or animal feed is influenced by some factors from both animal and plant perspectives (Khan and Hussain, 2012; Haq and Badshah, 2023). From an animal perspective, palatability is affected by species-specific preferences for certain plants, their general health status, different stages of reproduction or gestation, and the animal's hunger level (Khan and Hussain, 2012). On the other hand, from the plant perspective, the palatability of plants is influenced by factors such as the seasonal availability of plants, their maturity level, growth stage, phenology, and morphological and chemical characteristics of plants (Amjad *et al*. 2014).

The proposed study to assess the floristic composition and palatability of plants in the Danube Delta, Romania, aims to identify animal food preferences and understand how these preferences can influence land management practices in these areas. The analysed regions have not previously been subjected to detailed research to identify animal preferences regarding species and plant parts consumed. The proposed research could provide essential clues to guide and improve land management strategies in the Danube Delta, promoting the health of natural habitats and the well-being of animals in this area (which is recognized, including outside the areas occupied by water, for the beauty of the landscape and pastoral images – Figures A1 and A2). The objectives of the study were: (1) palatability according to the number of plant species; (2) distinct feeding preferences of animals for plants; (3) differential palatability of plant parts; (4) differential palatability according to plant condition.

Materials and Methods

Study area

The study was conducted in 2022 - 2023 in 12 grazing areas from nine localities (Figure 1) in the Danube Delta and the bordering area, Romania. Annual precipitation ranges from 388 mm to 462 mm, and average annual temperatures range from 9.9 °C to 11.3 °C. The elevation varied from 30 m (Carasuhat - Mahmudia)

to 177 m (Niculițel-Ocol). Predominants are gleyic soils, typical scales, solonchaks (on continental deposits), salinized solonetz, gleased alluvial protosols, and salinized alluvial soils (Florea and Munteanu, 2003).

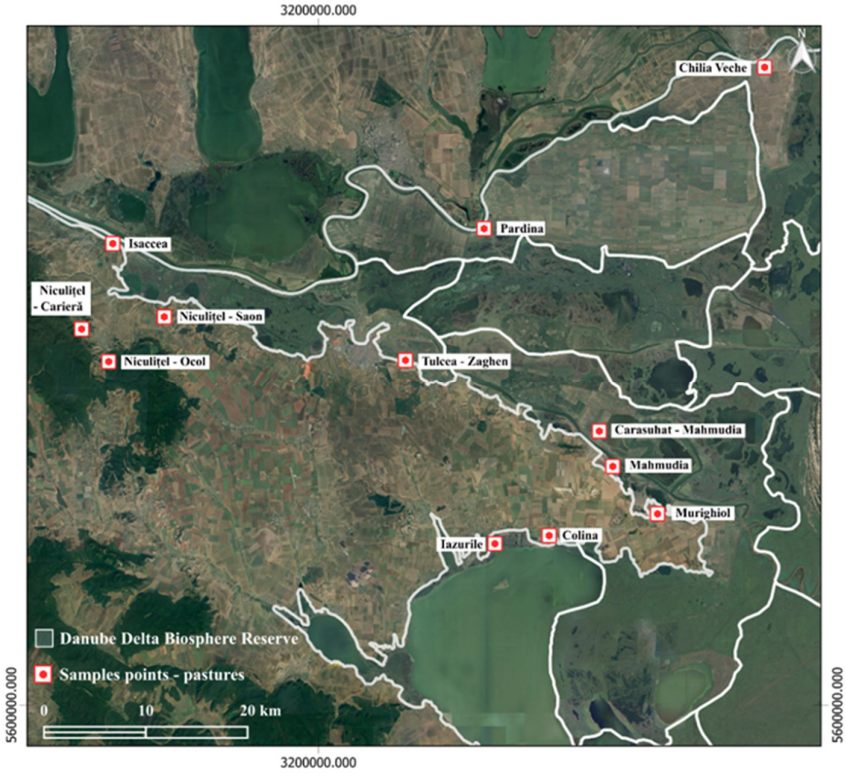

Figure 1. Map of pastures in some localities of the Danube Delta Biosphere Reserve where the study was carried out

Animal species studied

Four animal species (goats, cows, sheep, and horses) were analysed to understand their preference for grazing plants. These evaluations were essential to determine the palatability of the studied edible plants.

Vegetation analysis

The plant species were identified from each area studied, and the scientific names were updated according to EURO+MED (EURO+MED, 2023). Based on animal preferences, palatable plant species were grouped according to their consumed parts (whole plant, leaves, inflorescence, and fruit). Subsequently, these consumed parts were classified according to their condition: fresh, dry, or fresh.

Palatability index

Palatability was assessed by daily observation of how the animals grazed and supplemented by discussions with shepherds who use the analysed lands as a source of food for their animals. The degree of palatability of each plant species for livestock was determined using the palatability index. This indicator is widely used to measure plants' attractiveness to animals, based on the traditional knowledge of shepherds. The palatability index varies from 1 to 5 (Hussain and Durrani, 2009): (1) Non-Palatable (NP): not grazed by animals at any stage; possibly toxic or harmful; (2) Highly Palatable (HP): species, which animals most preferred; (3) Mostly Palatable (MP): species with medium preference by animals; (4) Less Palatable (LP): species with fewer preferences; (5) Rarely Palatable (RP): species rarely grazed by compulsion when no other forage was available.

Data analysis

The maps were made using the QGIS program version 3.28 (QGIS Development Team 2023). The elevation was recorded in the field, and the average annual precipitation and temperature values were obtained from the WorldClim database (Fick and Hijmans, 2017). The graphs were made in Microsoft Excel 2021.

Results

The study carried out in some localities in the Danube Delta and the bordering area revealed that out of the total of 121 recorded plant species, 90 were considered to be palatable (74%), while 31 were identified as "Non-Palatable" - NP (26%; Figure 2). The most "Non-Palatable" species were recorded in Carasuhat - Mahmudia and the highest number of very palatable species were recorded in Isaccea.

The results showed that among the 90 palatable species, 16 species were classified as "Highly Palatable" - HP (17.77%), 32 species as "Mostly Palatable" - MP (36%), 16 species "Less Palatable" - LP (18%), and 26 species "Rarely Palatable" - RP (30%). It has been found that most of the species considered "Less Palatable" (18%) and "Rarely Palatable" (30%) belonged to the Lamiaceae, Rosaceae, and Compositae families. Among them are *Achillea setacea*, *Potentilla argentea*, and *P. reptans* which are considered "Less Palatable", and *Ambrosia artemisiifolia*, *Artemisia santonicum*, *A. annua*, and *A. vulgaris* which are considered "Rarely Palatable" (Figure 2).

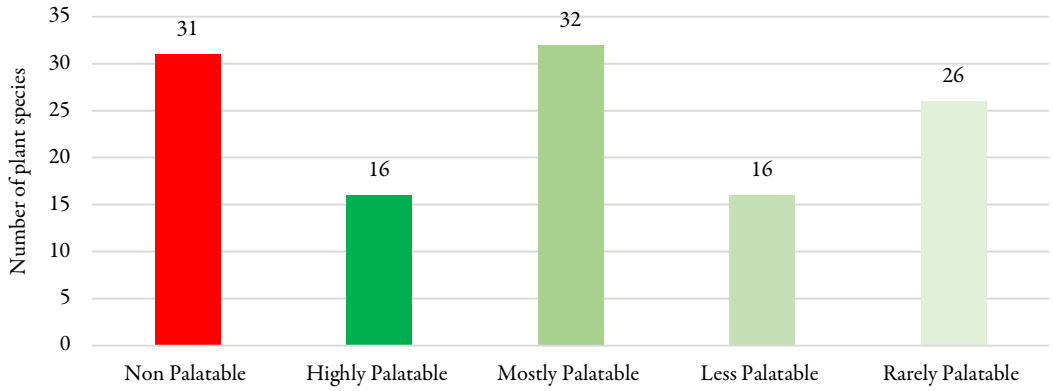

Figure 2. The number of plant species depending on the palatability classes

The Niculițel - Carieră, Carasuhat – Mahmudia, and Tulcea - Zaghen areas showed considerable species from the "Highly Palatable" and "Rarely Palatable" classes. This aspect suggests a wide diversity of plants in these categories, possibly due to favorable ecological conditions supporting these species' growth and development. In contrast, areas such as Isaccea and Mahmudia showed a significant number of species classified as "Mostly Palatable" or "Less Palatable" but fewer species in the "Rarely Palatable" or "Non-Palatable" class. This status may indicate a different composition of the flora, with a higher concentration of plants of moderate or lower nutritional value but less presence of species considered not palatable (Figure 3).

The Murighiol and Pardina areas revealed a balanced distribution of species in all categories of palatability without an evident dominance of one or the other. This even distribution may reflect a greater variety of species and their adaptability to diverse environmental conditions in these areas. There are also areas, such as the Iazurile and Colina, which recorded a low number of species in all categories of palatability. It indicates a lower diversity of plants in these areas, possibly due to more restrictive ecological conditions or other factors that limit the development and diversity of species. Overall, these findings highlight the importance of

environmental variability on the distribution and diversity of plants in different areas, with significant implications for local ecosystems and the interactions of these species within their natural environment.

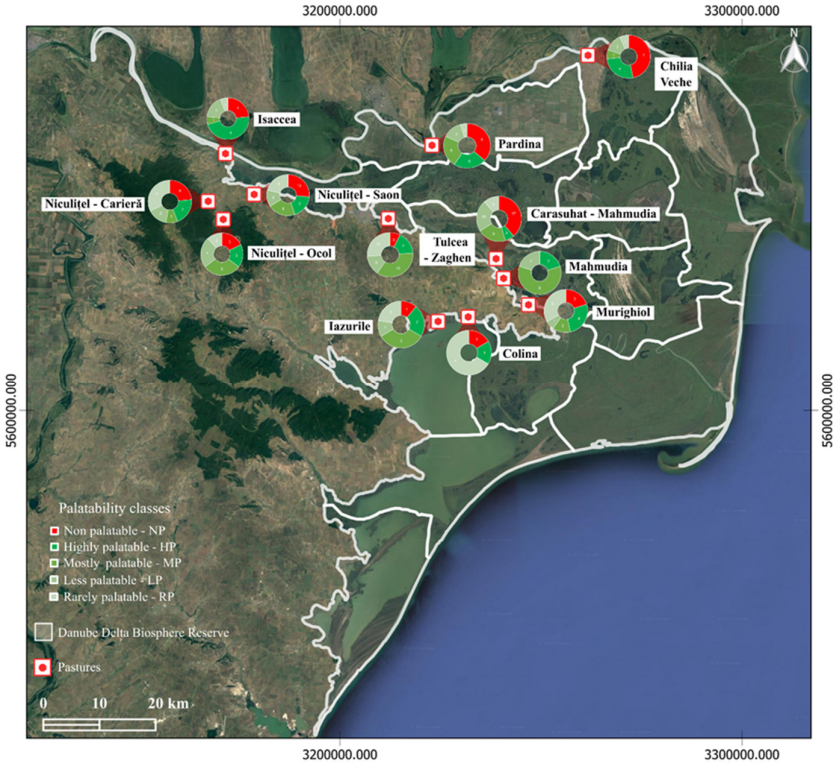

Figure 3. Distribution of the number of plant species by palatability classes in the study areas

Domestic animal preference

Figure 4 shows the distinct feeding preferences of horses, cows, sheep, and goats for various plant species. According to the research, cows showed a preference for the most diverse range of plants (75 species, 32%), followed by sheep (67 species, 29%), goats (59 species, 25%), and horses (34 species, 14%). These animal species exhibit distinct feeding behaviours, each having specific preferences for certain plants, parts thereof, or particular stages of plant development.

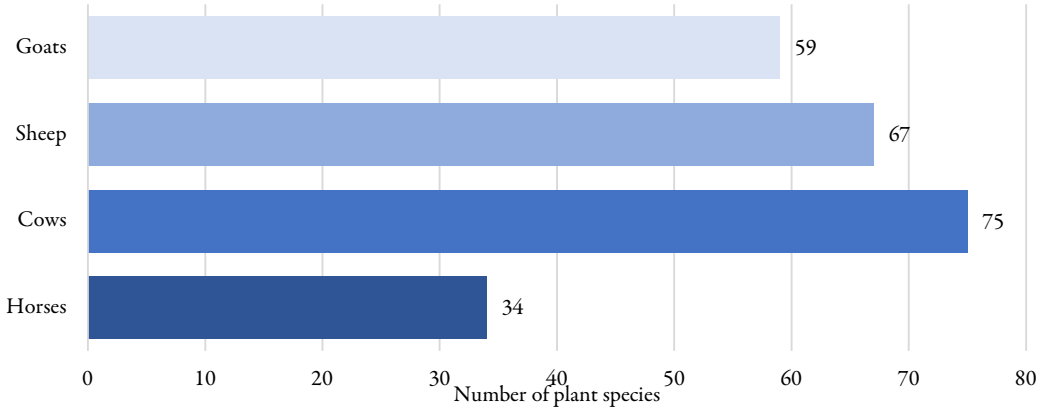

Figure 4. The number of plant species depending on the animals

In the data analysis presented in Figure 5, significant differences are observed in the number of plant species consumed by horses, cows, sheep, and goats in various of pastures. Tulcea - Zaghen stands out with maximum values for all four species of animals, indicating a wide diversity of plants consumed. Also, Niculițel - Saon and Niculițel - Ocol show high values for all four animal species, suggesting a significant diversity of plants consumed. In contrast, Colina and Iazurile show lower values for all four animal species, indicating a lower diversity of plants consumed.

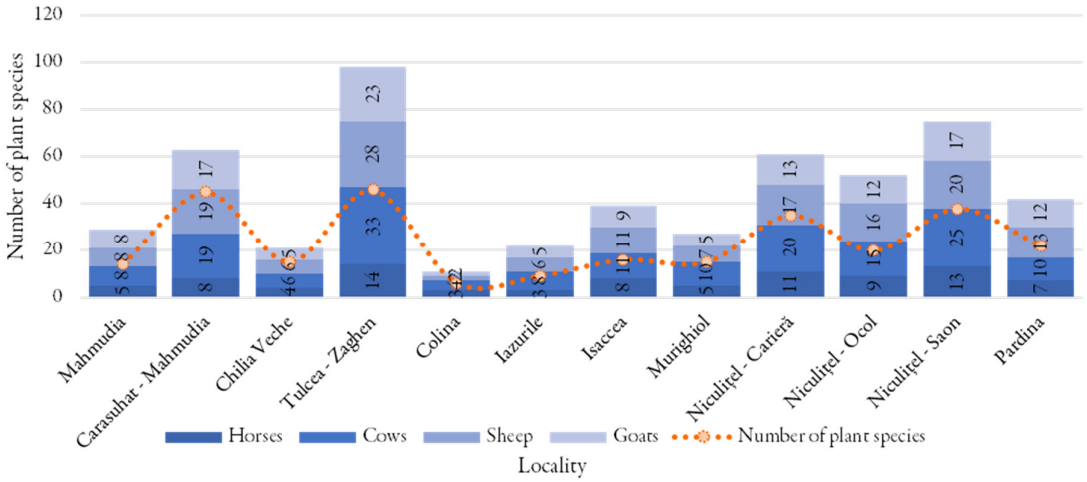

Figure 5. The number of plant species grazed by various animals depending on the locality

These findings highlight the distinct variations in animal foraging preferences depending on the different characteristics of geographic areas or types of pastures. It is important to note that these differences can influence the feeding behaviour of animals and their adaptability to different grazing environments.

Plant used

Figure 6 shows the varied preferences of animals for various parts of plants, highlighting that most preferred whole plants (48 species, 50%), followed by leaves (43 species, 45%), fruits (three species, 3%), and inflorescences (two species, 2%).

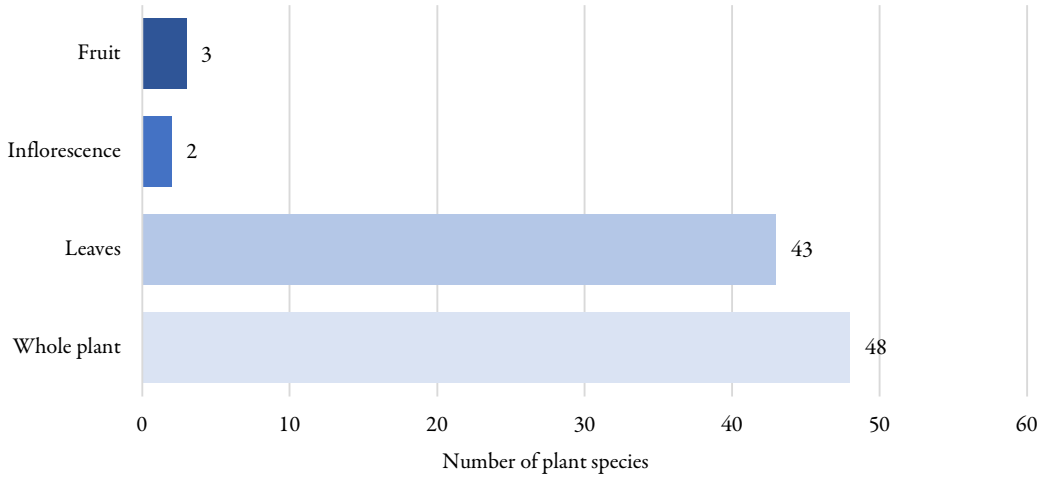

Figure 6. The number of plant species and differential palatability of plant parts used consumed by animals

Figure 7 highlights the types of plant parts consumed by animals in various areas or types of pasture. Observations indicate that Tulcea - Zaghen has the highest values for all plant parts, suggesting extensive consumption of whole plants, leaves, inflorescences, and fruits. This situation emphasizes the diversity and adaptability of animals in that area for eating different plant parts. The areas Niculițel - Saon and Niculițel - Carieră also show significant values for all plant parts, indicating a considerable variety of plants consumed. In contrast, Colina and Isaccea show lower values for all plant parts, suggesting a lower use of various plant components.

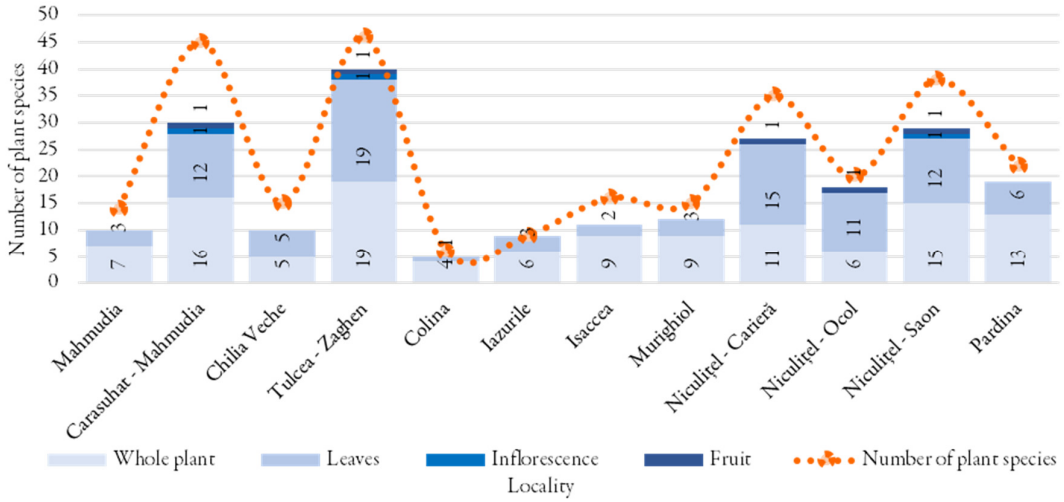

Figure 7. The number of plant species and differential palatability distribution of plant parts according to locality

Plant condition

The results of the study indicate that of the 90 plant species considered palatable, 60 of them (67%) were consumed by animals in their fresh condition, while 29 species (33%) were preferred both in fresh and dry condition (Figure 8).

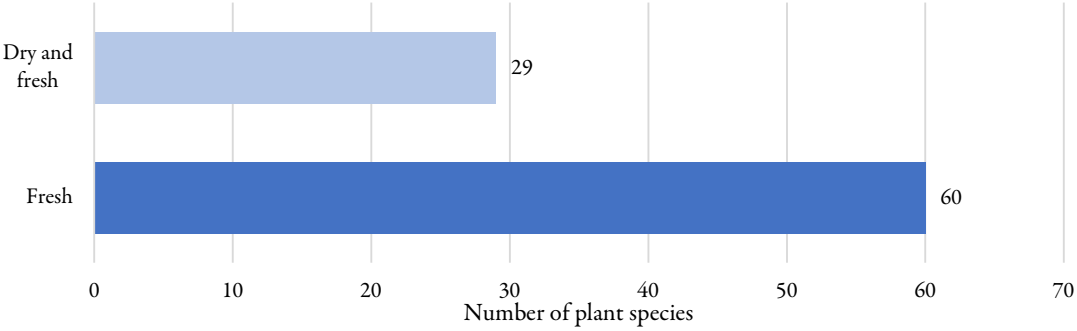

Figure 8. The number of plant species and plant condition consumed by animals

The analysis of animal preferences for the consumption of plants in different conditions (fresh, dry and fresh) highlights significant differences between the studied areas. At Tulcea - Zaghen and Carasuhat - Mahmudia, there is an apparent preference for plants consumed in the fresh condition, suggesting that these animals show a significant attraction for fresh vegetation. This aspect may indicate a natural propensity or a better acceptance of the plants in their fresh condition. In contrast, at Niculițel - Carieră, Isaccea, and Niculițel - Ocol, the number of plants consumed fresh and dry is comparable to or even higher than the number of plants

consumed only fresh. This observation suggests a more balanced preference or even greater adaptability of animals to plant consumption in both conditions. These differences may be influenced by several factors, including plant availability, palatability, or other individual vegetation characteristics that may make certain plants more attractive to animals in one condition or another (Figure 9).

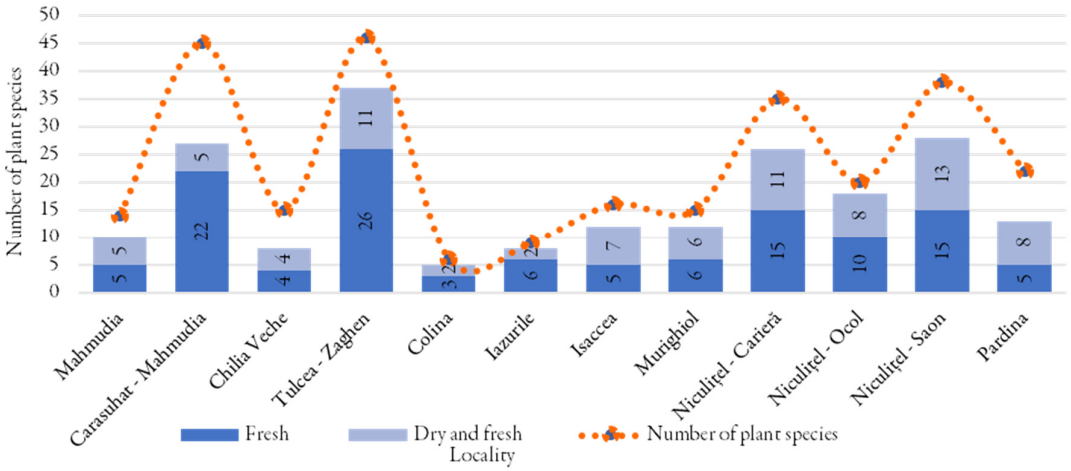

Figure 9. The number of plant species and distribution of plant condition according to locality

Discussion

The study's results provide valuable information about the composition of plants, their degree of palatability, and how these characteristics influence the choice of food by animals in the Danube Delta. This more profound understanding of animal food preferences can contribute to developing more efficient and sustainable land management practices that support and encourage biodiversity conservation.

Palatability class

This study demonstrated that plant palatability is not a static attribute but is influenced by many factors. Although many plant species are naturally palatable, this characteristic can vary significantly depending on different factors (Ullah *et al.*, 2018). Animal preferences for plants also differ, determined by their nutritional requirements, specific environmental requirements, and climatic conditions. Food choices can be influenced by the nutritional quality of plants and their adaptation to a particular habitat (Haq and Badshah, 2023). The study also highlighted the strong impact of overgrazing on vegetation. Overgrazing can lead to soil degradation and depletion of plant resources, causing desertification and land degradation (Macheroum and Chenchouni, 2022).

It has become apparent that plant palatability is a variable aspect, influenced by more factors than just the plant species themselves. Factors such as animal species, season, habitat, and weather conditions are essential in determining plants' palatability level. Although the nutritional values of plants are necessary to support animals and improve their physical condition, the specific requirements of animals for food must also be taken into account. It is essential to understand and adapt farming or grazing practices to the nutritional requirements of animals to support the production and health of domestic animals in that region.

The degree of palatability of plants was structured into five distinct categories (Hussain and Durrani, 2009): "Non-Palatable", "Highly Palatable", "Mostly Palatable", "Less Palatable", and "Rarely Palatable" (Table 1). This classification is based on the preferences of animals in the consumption of plants and influences their interactions in the ecosystem. The non-palatability characteristics have led to animals' rejection of these species,

causing their extensive dominance in certain areas. This dominance is the consequence of overgrazing that has reduced the number of palatable species (Hussain and Durrani, 2008; Shaheen *et al*., 2014), who argue that overgrazing results in reduced cover of edible plants and decreased species diversity. Moreover, the stimulation of grazing animals is influenced by the morphological characteristics of plant parts, growth stages, and chemical composition (Haq and Badshah, 2023). Some plant species, such as *Eryngium campestre* or *Cirsium vulgare* have physical characteristics such as thorns, which can cause irritation or discomfort to herbivorous animals. Such physical features can deter herbivores from grazing (Lyons and Hanselka, 2001). At the same time, the availability of palatable plants is related to the geographical distribution, climate, and local ecological requirements (Dostálek *et al*., 2020; Godde *et al*., 2021; Stolter *et al*., 2022).

However, some plant species, such as *Persicaria hydropiper*, are "Non-Palatable" but are eaten by animals. The literature (Gorade and Datar, 2014) showed that when edible species are overgrazed and become rare, cows subsequently consume "Non-Palatable" species. According to Nymangara and Ndlovu (1995), saliva could interact with volatile oils and tannins in plants to convert them into non-toxic compounds or reduce their harmful effects on animals. According to the literature (Badshah and Hussain, 2011; Abdullah *et al*., 2017), the causes of the unpalatability of plants are textural morphology, chemical composition, and unpleasant aroma. Also, secondary metabolites such as phenols, alkaloids, saponins, and other undesirable compounds influence the palatability of plants (Kayani *et al*., 2007; Haq and Badshah, 2023). These compounds give plants a specific taste and smell that serve as a form of protection against herbivores (Divekar *et al*., 2022). For example, alkaloids can add a bitter taste, and volatile oils can have a distinct smell due to the presence of terpenes. Plants containing these compounds can significantly impact animal performance, causing health problems (Tadele, 2015). The elevation can play an essential role in the palatability of plants. Thus, the species identified at elevations from 30 m to 40 m were "Less Palatable", compared to the plant species identified at elevation from 150 m to 230 m. At lower elevations, according to the research of Grunwaldt *et al*. (1994), salt marsh plant species are "Less Palatable", than those identified at higher elevations. Some plant species, such as *Datura stramonium*, were "Non-Palatable". Instead, plant species such as *Cynodon dactylon*, *Bothriochloa ischaemum* etc., were "Highly Palatable" in the study areas. Moreover, it has been shown that the nitrogen content in plant species influences the increase in plant attractiveness for herbivores (Palkova and Leps, 2008).

Domestic animal preference

This analysis showed that the plant species were mainly grazed by cows (Table 1). In this case, cows are less selective compared to other animals. Sheep, for example, graze plants based on physical and chemical characteristics (Raufirad *et al*., 2016). The most selective animals were the horses. In general, animals have a visible effect on the palatability of plants (Bagheri *et al*., 2007; Raufirad *et al*., 2015). Goats were more selective than sheep or cows. According to Hussain and Durrani (2009), goats consume more species of grasses, shrubs, and trees than other animals.

Furthermore, the goat diet is characterized by a wide variety of plants, grasses, and shrubs, which are more diverse than the diets of cows and sheep (Casey *et al*., 1988). Goats are known for being more tolerant of certain harmful plant compounds compared to other ruminants, such as cows or sheep. The tolerance is due to their digestive system's different composition and functioning (Molina-Alcaide *et al*., 2008).

Overgrazing can lead to regressive succession in grassland ecosystems. When animals overgraze, favouring palatable plants and leaving "Less Palatable" plants to be eaten, this can change the composition and structure of the plants in the area. More palatable plants are often overgrazed, while "Less Palatable" plants may be left untouched or eaten to a lesser extent. Thus, plants resistant to grazing or less preferred by domestic animals may tend to dominate long-term, displacing more palatable plants (Archer *et al*., 1991; El Otmani *et al*., 2021).

The variability of grazing preferences is evident between the areas studied (Dasmann, 1949), between different seasons (Heady and Torell, 1959), and even within the same day or between individuals within a few

days (Kochare *et al*., 2018). The study areas are populated, and the fragmentation of agricultural land has exerted substantial pressure on existing palatable plant species. This pressure determined animal diet adaptations, directing them towards "Non-Palatable" or "Less Palatable" plants. It is important to note that most plants become toxic only when consumed in large quantities but can provide nutrients when consumed in small amounts or combination with other food sources (Hussain and Durrani, 2009).

Plant used

In the case of this analysis, it was shown that most animals preferred whole plants, followed by leaves, fruits, and inflorescences (Table 1). Animal preference or rejection of particular species or plant parts is closely related to their availability in the pastures (Khan and Hussain, 2012). Certain plants or their parts may be rejected under certain conditions but preferred in other contexts (Kochare *et al*., 2018). Annuals have significantly reduced grazing pressure on palatable perennial species (Khan and Hussain, 2012; Kochare *et al*., 2018). This was due to the migration of livestock from shrub grazing to Poaceae and aromatic plants when annual plants started to grow, especially at the beginning of the short rainy season in late March (Kochare *et al*., 2018).

During poor management or drought periods, low-quality or "Non-Palatable" plants or plant parts replaced or dominated good-quality forage plants when other sources were unavailable. These observations are aligned with other studies, such as that of Khan and Hussain (2012), which revealed that most forage species are present during March-April when forage availability is at its maximum. Also, Marques *et al*. (2004) noted that in the absence of annual plants, shrubs provided fresh forage for livestock. Thus, this study highlights the complexity of the interactions between animal preferences for various plant parts and the availability of food resources in varied environments and under different climatic conditions.

Plant condition

Most of the animals consumed the plants in fresh condition (Table 1). Most animals prefer fresh leaves (green) because they are easier to digest than dry leaves (Amjad *et al*., 2013; Ibrahim *et al*., 2015). Among the palatable plants frequently eaten by animals are *Cynodon dactylon, Eragrostis minor, Bromus hordeaceus, Bothriochloa ischaemum, Dactylis glomerata, Elytrigia repens, Robinia pseudoacacia*, etc. These plants serve as animal food and contain active compounds with therapeutic properties associated with improving digestion and relieving specific ailments. Animals, especially goats and sheep, easily digest the leaves of palatable plants, according to the study by Raufirad *et al*. (2015), who found these animals' preference for the predominant consumption of fresh plant leaves. In the cold season, when herbaceous plants become scarcer and livestock access to pastures is limited, the locals practiced gathering palatable herbs before winter. These grasses were dried and stored for later use as animal feed. Moreover, due to the conversion of starch into sugar, wilted tissues have a high sugar content and are very palatable (Anderson, 1994).

Table 1. Palatable flora of the Danube Delta and the adjacent area. **Palatability class**: Non-Palatable – NP, Highly Palatable - HP, Mostly Palatable – MP, Less Palatable – LP, Rarely Palatable- RP; **Parts used**: Wp - whole plants, Lf – leaf, Inf – inflorescence, Fr – fruit; **Plant condition**: F – fresh; FD – fresh and dry; **Animal preference**: Hr – horses, Co – cows, Sh – sheep, Go – goats

	Palatability class					**Parts used**				**Plant condition**		**Animal preference**			
	NP	**HP**	**MP**	**LP**	**RP**	**Wp**	**Lf**	**Inf**	**Fr**	**F**	**FD**	**Hr**	**Co**	**Sh**	**Go**
Abutilon theophrasti Medik.				+		+				+			+	+	+
Achillea setacea Waldst. & Kit.				+			+			+			+	+	
Agr*imoni*a eupatoria L.					+		+			+			+	+	

	Palatability class					Parts used				Plant condition		Animal preference			
	NP	**HP**	**MP**	**LP**	**RP**	**Wp**	**Lf**	**Inf**	**Fr**	**F**	**FD**	**Hr**	**Co**	**Sh**	**Go**
Agropyron cristatum subsp. *pectinatum* (M. Bieb.) Tzvelev		+				+					+	+	+	+	+
Eragrostis minor Host		+				+					+	+	+	+	+
Alisma plantago-aquatica L.					+		+			+			+	+	
Amaranthus retroflexus L.	+														
Ambrosia artemisiifolia L.					+		+			+			+		
Anisantha sterilis (L.) Nevski		+				+					+	+	+	+	+
Arctium lappa L.	+														
Artemisia santonicum L.					+	+				+			+		
Artemisia annua L.					+	+				+			+		
Artemisia austriaca Jacq.					+	+				+			+		
Artemisia vulgaris L.					+	+				+			+		
Atriplex patula L.				+		+				+			+	+	
Bromus hordeaceus L.		+				+					+	+	+	+	+
Ballota nigra L.					+		+			+			+		
Berteroa incana (L.) DC.				+			+			+			+	+	
Bidens tripartitus L.				+			+			+			+		
Bothriochloa ischaemum (L.) Keng		+				+					+	+	+	+	+
Brassica rapa (L.) L.			+			+				+			+		
Bromus squarrosus L.		+				+					+	+	+	+	+
Carduus acanthoides L.	+														
Carduus nutans L.	+														
Carex distans L.			+			+					+	+	+	+	+
Centaurea calcitrapa L.	+														
Centaurea diffusa Lam.	+														
Centaurea orientalis L.					+		+			+			+		
Chenopodium album L.			+			+				+			+	+	+
Cichorium intybus L.					+		+				+	+			
Cirsium arvense (L.) Scop.				+			+			+				+	+
Cirsium vulgare (Savi) Ten.				+			+			+				+	+
Clinopodium vulgare L.			+				+				+	+	+	+	+
Convolvulus arvensis L.			+			+				+		+	+	+	+
Crataegus monogyna Jacq.			+				+			+		+		+	+
Cruciata laevipes Opiz					+	+				+			+	+	
Cynodon dactylon (L.) Pers.		+				+					+	+	+	+	+
Dactylis glomerata L.		+				+					+	+	+	+	+
Datura stramonium L.	+														
Daucus carota L.			+			+				+		+	+	+	+
Consolida regalis Gray			+				+			+			+	+	+
Dipsacus laciniatus L.	+														

	Palatability class					Parts used				Plant condition		Animal preference			
	NP	HP	MP	LP	RP	Wp	Lf	Inf	Fr	F	FD	Hr	Co	Sh	Go
Echinops sphaerocephalus L.	+														
Echium italicum L.	+														
Echium vulgare L.	+														
Elytrigia repens (L.) Nevski		+				+					+	+	+	+	+
Erodium ciconium (L.) L'Hér.					+		+			+					
Erodium cicutarium (L.) L'Hér.					+		+			+					
Eryngium campestre L.	+														
Euphorbia seguieriana Neck.	+														
Festuca valesiaca Gaudin		+				+					+	+	+	+	+
Fragaria viridis Weston		+					+		+	+		+	+	+	+
Galium mollugo L.				+			+			+			+	+	
Geranium sanguineum L.					+		+			+			+	+	+
Heliotropium europaeum L.				+		+				+					
Hordeum murinum L.	+														
Hypericum elegans Willd.					+		+			+			+	+	
Juncus compressus Jacq.			+			+					+	+	+	+	+
Juncus conglomeratus L.			+			+					+	+	+	+	+
Juncus littoralis C. A. Mey.			+			+				+		+	+	+	+
Knautia arvensis (L.) DC.			+				+			+			+	+	+
Lactuca serriola L.				+		+				+				+	+
Lamium purpureum L.					+		+			+			+		
Leonurus cardiaca L.							+			+			+		
Lepidium ruderale L.					+	+	+				+		+	+	
Linaria genistifolia (L.) Mill.					+		+			+			+		
Linum austriacum L.			+				+			+			+		
Lycopus europaeus L.	+														
Malva neglecta Wallr.			+			+				+		+	+	+	+
Malva sylvestris L.			+				+				+	+	+	+	+
Marrubium peregrinum L.	+														
Marrubium vulgare L.	+														
Matricaria chamomilla L.			+			+				+		+	+	+	+
Medicago falcata L.			+			+				+			+	+	+
Melilotus officinalis (L.) Lam.			+			+				+		+	+	+	+
Mentha aquatica L.			+			+					+	+	+	+	+
Mentha longifolia (L.) L.			+			+		+			+	+	+	+	+
Mentha pulegium L.			+			+					+	+	+	+	+
Onopordum acanthium L.	+														
Origanum vulgare L.					+		+				+		+	+	+
Orlaya grandiflora (L.) Hoffm.					+		+			+			+		

	Palatability class					Parts used				Plant condition		Animal preference			
	NP	HP	MP	LP	RP	Wp	Lf	Inf	Fr	F	FD	Hr	Co	Sh	Go
Phragmites australis (Cav.) Steud.			+			+	+			+			+	+	+
Picris hieracioides L.					+		+			+			+	+	+
Plantago lanceolata L.			+			+					+		+	+	+
Plantago major L.			+			+					+		+	+	+
Plantago media L.			+			+							+	+	+
Ochlopoa annua (L.) H. Scholz			+			+					+			+	+
Polygonum aviculare L.		+				+					+				
Argentina anserina (L.) Rydb.				+			+			+				+	+
Potentilla argentea L.				+			+			+				+	+
Potentilla reptans L.				+			+			+				+	+
Ranunculus repens L.					+		+			+			+		+
Ranunculus sceleratus L.				+		+				+				+	+
Raphanus raphanistrum L.			+				+		+	+		+	+	+	+
Reseda lutea L.					+	+				+			+		
Robinia pseudoacacia L.		+					+	+		+		+	+	+	+
Rorippa sylvestris (L.) Besser			+				+			+			+	+	+
Rosa canina L.			+				+			+			+	+	+
Rubus caesius L.					+				+	+		+	+	+	+
Rumex crispus L.			+				+			+		+	+	+	+
Salsola kali L.	+														
Schoenoplectus lacustris (L.) Palla			+			+					+		+	+	+
Scolymus hispanicus L.	+														
Setaria viridis (L.) P. Beauv.		+				+					+	+	+	+	+
Solanum nigrum L.	+														
Sonchus arvensis L.					+		+			+			+	+	
Sonchus asper (L.) Hill	+														
Sorghum drummondii (Steud.) Millsp. & Chase		+				+					+	+	+	+	+
Spergularia marina (L.) Griseb.	+														
Tamarix ramosissima Ledeb.	+														
Taraxacum sect. *Taraxacum* F. H. Wigg.	+														
Taraxacum besarabicum (Hornem.) Hand.-Mazz.	+														
Teucrium chamaedrys L.	+														
Teucrium polium L.	+														
Trifolium repens L.		+				+					+	+	+	+	+
Urtica dioica L.	+														
Verbascum phlomoides L.					+		+			+			+		
Verbena officinalis L.				+		+				+					+
Veronica serpyllifolia L.				+			+			+			+	+	+

	Palatability class					Parts used				Plant condition		Animal preference			
	NP	HP	MP	LP	RP	Wp	Lf	Inf	Fr	F	FD	Hr	Co	Sh	Go
Xanthium orientale subsp. *italicum* (Moretti) Greuter	+														
Xanthium spinosum L.	+														

Conclusions

Most of the plant species identified were palatable. Comparatively, the most "Highly Palatable" species were recorded at Isaccea, and the Tulcea - Zaghen and Niculițel - Carieră locations have the most "Rarely Palatable" and most "Mostly Palatable" species. At Carasuhat-Mahmudia, there are most "Non-Palatable" and "Less Palatable" species. From the study, it was observed that cows were the least selective, and horses were the most demanding. Regarding the plant parts used and the state of the plants, most animal species preferred the whole plant, in the fresh condition. Large ruminants that do not have incisors on the jaw but only on the mandible need tall vegetation because they do the main prehension with the tongue, after which they cut the plants with the lower incisors. The small ruminants have mobile lower incisors, so they can change the floral profile of the pastures due to the manner of grasping the plants. The most important thing is that they pull a good part of the roots of the plants. Large monogastrics grasp with their lips and cut with their teeth, which means they do the best greening of all species because they mow the grass, not pull it, unlike large and small ruminants who also pull the roots.

Authors' Contributions

Conceptualization: Ș.R. and M.D.; Data curation: S.D.C. and M.D.; Formal analysis: Ș. R., L.O.D.; Investigation: S.D.C. and S.C.; Methodology: S.C.; Writing - original draft: S.D.C., L.O.D.; Writing - review and editing: M.D. All authors read and approved the final manuscript.

Ethical approval (for researches involving animals or humans)

Not applicable.

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Conflict of Interests

The authors declare that there are no conflicts of interest related to this article.

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Appendix

Figure A1. Map of pastures in some localities of the Danube Delta Biosphere Reserve where the study was carried out (I)

Figure A2. Map of pastures in some localities of the Danube Delta Biosphere Reserve where the study was carried out (II)