Rangelands and pastoralism towards a new strategy of development in the world

AZEDDINE HACHMI[1], ASMAE ZBIRI[1], FATIMA EZZAHRAE EL ALAOUI-FARIS[1]

[1]Department of Biology, Mohammed V University, Faculty of Science, MOROCCO

Abstract: - After addressing the subject of conservation of Moroccan and African rangelands, in this work we try to linkage these lands on a global scale. With the pandemic of COVID-19 and the impacts of climate change these rural populations have suffered great problems. Their weak or absent means of resistance pose a real handicap to live in peace. The only way is to migrate to places where they can continue with their cattle this battle of life or death. On the other hand and from the point of view of natural resources, these lands have immense power to manage a whole community by the richness of these medicinal plants and their soils. Due to the lack of interest in these areas, there is a risk of losing an entire ecosystem rich in fauna, flora, habitat, nomadic population and traditions. In this work we propose many recommendations: natural, socio-economic, cultural and public health.

Key-Words: - Rangelands, pastoralism, strategy of development.
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1 Introduction

1.1 Definition of rangelands and pastoralism

Rangelands are lands composed primarily of native vegetation (trees, grasses, forbs or shrubs). These lands also include natural grasslands, savannas, many wetlands, some deserts, and tundra. Although they may include areas seeded with introduced species, rangeland plant communities are primarily natural ecosystems (Society of Range Management 2001) [1].

Pastoralism refers to extensive livestock production using rangelands located mainly in arid and semi-arid areas (FAO, 2014) [2]. It is based on open pastures: savannahs, grasslands, steppes, shrublands) managed by nomadic herders. According to the French Association of Pastoralism (AFP), pastoralism is the set of livestock activities that develop the spontaneous forage resources of natural areas through extensive grazing, to ensure all or part of the animals' diet.

Pastoralism is a production activity (suckling or dairy farming, with possible transformation for the production of cheese), it can be carried out on pastoral surfaces close to the farm (local pastures and estives) or be organized on a regional or interregional scale by resorting to summer or winter transhumance.

1.2 Rangeland and pastoralism in the world

Rangeland is estimated to occupy nearly half of the world's land surface (Heady, 1975; Kotzé et al., 2013) [3; 4], with estimates varying considerably depending on the meaning of the term "rangeland" (Lund, 2007) [5]. These lands are generally used for livestock production (Menke and Bradford, 1992; Smet and Ward, 2006) [6; 7]; and are mostly located in areas with low, irregular rainfall and very high evaporation (Aidoud et al., 2006) [8]. They cover about 75% of the total area of Australia (Taylor, 2004) [9], 43% of the African continent (Hoffman and Vogel, 2008; Galvin et al., 2008) [10; 11], 36% of the United States (Department of rangeland ecology and management, 2009) [12], 33% of South America (Yahdjian and Sala, 2008) [13] and 32% of Asia (World resources institute, 1986) [14] Russia, Australia, and Canada are the top three countries with the largest area of rangeland representing 18%, 10%, and 8% of the world's land area, respectively (Reeves et al., 2014) [15].

In the United States, the total area of rangeland is 308 million hectares (Havstad et al., 2007) [16]. These rangelands cover about 10% of the country's annual meat needs (USDA, 1989) [17].
South America encompasses both tropical (savannah) and temperate (pampas) rangelands.

Tropical rangelands make up the majority of the land cover with over 2 million km² (Blench and Sommer, 1999) [18]. The two most extensive rangeland ecosystems are the Brazilian Cerrados (1,700,000 km and 540 species recorded) and the Lianos (plains) in Colombia and Venezuela (Blench, 1999) [19].

The rangelands of southern Russia are arid steppe type (Golub, 1994) [20], populated by nomads (Hölzel et al., 2002) [21] with a pastoral mode adapted to the fragile ecological conditions of the region (Walther and Box, 1983; Khodarkowsky, 1992) [22; 23].
In Australia, rangelands have multiple uses and functions, and are important to the national economy (Rola-Rubzen and McGregor, 2008) [24].
In Mongolia, 72% of land is classified as rangeland (Jamsranjav, 2009) [25] rich in plants (Groombridge, 1992) [26] and animals (Blench and Sommer, 1999) [18].
Chinese rangelands are similar to those of Mongolia and are characterized by a semi-arid to arid bioclimate, particularly vulnerable to degradation, desertification, and salinization (Feng et al., 2009) [27].

Iranian rangelands account for nearly 52% of the country's area and are classified as good to poor (Rostami et al., 2014) [28]. Southern Iran is rich in pastoral groups specialized in sheep rearing (Barth, 1961; Black-Michaud, 1986) [29; 30].
Syrian steppe rangelands cover more than half of the country's area (Al- Khatib, 2008) [31].
The Iberian Peninsula has semi-arid and subhumid rangelands derived from ancient Mediterranean oak forests (Gea-Izquierdo et al., 2006; Pulido-Fernández et al, 2013) [32; 33]. The extension of agriculture and the degradation of trees and shrubs have created a mosaic of vegetation cover, grasslands and scrublands (Plieninger et al., 2004) [34].
However, the classification of rangelands faces the problem of ordering biogeographic entities, based on factors as diverse as climate, vegetation, soils, and the modalities of exploitation of the environment by man (Carriere, 1995) [35].
At present, climate and vegetation are the most acceptable basis for classifying rangelands, since the major vegetation formations integrate climatic and geographic criteria as well as rangeland exploitation systems (figure 1).

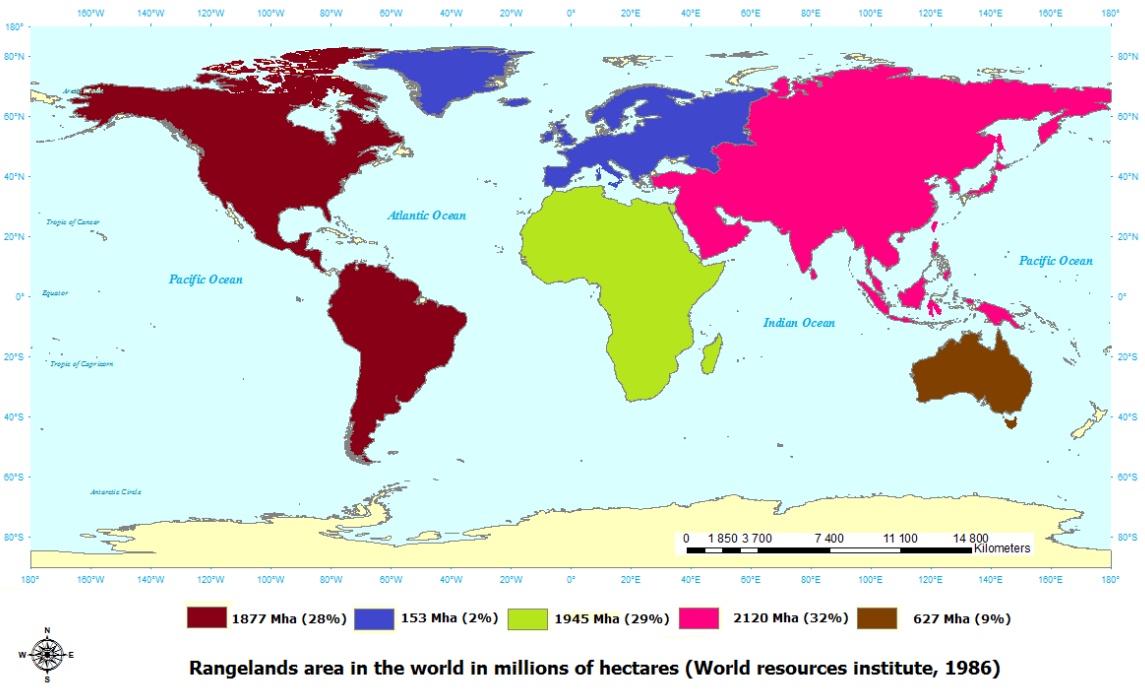

Fig 1. Rangelands area in the world in millions of hectares (World resources institute, 1986)

Each rangeland physiognomy type presents a favorable space for extensive pastoral livestock production, which uses about 25% of the world's land and produces about 10% of the meat used for human consumption (Alkemade et al., 2012) [36]. More than 120 million pastoralists depend on over 5 billion hectares of rangeland for their livelihoods (Joshi et al., 2013) [37]. Swift (1988) considered pastoral populations to be 10-25% of the rural population, or 12-16% for western and eastern regions of north-tropical Africa (Bonfiglioli, 1992) [38; 39]. Table 1 is a summary of the distribution and status of pastoralism around the world (Blench and Sommer, 1999) [18]. There is a great diversity of animal species throughout the world.

But, the status of these ecological systems has a tendency to be transformed into agricultural land. However, in Central Asia and Siberia, pastoral improvement actions have succeeded in increasing the area of rangeland.

In the Near East and North Africa, pastoral livestock farming developed from a belt of semi-arid, arid and Saharan rangelands from the Straits of Gibraltar to the deserts of Pakistan.

Archaeological evidence has confirmed that sheep production was the pastoral system that enabled the colonization of this vast belt, although now camels have a fairly important contribution to this husbandry system (Blench and Sommer, 1999) [18].

Table 1. Distribution and status of pastoralism in the world (Blench and Sommer, 1999**)**

Area	Major species	Status
Sub-Saharan Africa	Cattle, Sheep, Goats, Camels	Declining due to agriculture
Mediterranean	Small ruminants	Declining everywhere due to agriculture
Near East and South Central Asia	Small ruminants	In local decline due to containment and development of agriculture
India	Cattle, Sheep, Goats, Camels	Declining due to agriculture with expansion of peri-urban livestock production
Central Asia	Yaks, Cattle, Sheep, Goats, Camels and Horses	Expansion after pastoral improvement actions
Circumpolar	rennes	Expansion after pastoral improvement actions in Siberia, but under pressure in Scandinavia
North America	Cattle, Sheep	Declining with the increase in land enclosure and alternative economic opportunities
Andes	Ilamas, Alpacas	Subcontracting of llama production due to the expansion of road networks and European breeding, but the expansion of alpaca wool production

1.3 Ecological importance of rangelands

In addition to serving as a resource base for livestock production, rangelands provide a filtering area for pollutants and preservation of biodiversity (Sincich, 2002; Chatelard, 2005) [40; 41]. These rangelands provide habitat for wildlife and a variety of products for people to use (Kawanabe et al., 1998) [42]. The diversity of rangeland vegetation contributes to soil fertility and preservation against erosion (Buresh and Tian, 1998) [43]. Table 2 describe the different forms and plant architectures, according to their adaptation strategy where they dominate, the absence or the presence of some biological types is a very important character for rangelands flora. In general, biological types provide information on the morphological characteristics by which plants have adapted to the environments in which they live.

A relationship exists between rangeland degradation and biodiversity loss.

In California, for example, livestock grazing improves biodiversity and oak regeneration (Barry, 2011) as well as carbon sequestration in rangelands (Booker et al., 2012) [44; 45].

In Africa and Asia, the presences of large mammals play an important role in rangeland ecology. For example, the floristic diversity of African rangelands, expressed as the number of species per

10000 km², is 1750 species not far from the 2020 species found in rainforests (Menaut, 1983) [46].

Ecological services provided by rangelands include water conservation, soil stabilization, climate change mitigation and erosion and desertification control (Malagnoux et al., 2007; Rotenberg and Yakir, 2010) [47; 48]. According to Campbell et al. (2008), rangelands store a significant amount of terrestrial carbon, 36% globally and 59% in Africa, and thus contribute to mitigating the impact of climate change (Neely et al., 2009) [49, 50].

1.4 Socio-economic importance of rangelands

Rangelands are multifunctional spaces that can provide many essential products and services to more than a billion people living in arid and semi-arid climates (Easdale and Domptail, 2014) [51]. These products and services are important for the livelihoods of the people living there (Alizadeh et al., 2010) [52]. Rangelands contribute 9% of the world's beef production and 30% of sheep and goat production (Ferchichi, 2004) [53].

The grazing process and the type of livestock are an integral part of the social and ecological system of livestock production in the world's rangelands. Ecosystem service is one of the privileges that people derive from these ecosystems (Millennium Ecosystem Assessment, 2005) [54]. This concept has been used to encourage conservation programs in these drylands, but often criticized for hiding the complexity of natural systems (Norgaard, 2010) [55]. Despite low productivity, many ecosystem products and services derived from rangelands are increasingly recognized (Havstad et al., 2007) [56]. Pastoral livestock farming makes an important contribution to the countries concerned. For example, almost 20% to GDP in Mongolia (Jamsranjav, 2009) and Kyrgyzstan (IMPD, 2008) [57; 58].

In Kenya, 50-95% of family income comes from pastoral livestock (Aklilu and Catley, 2009; Kenya Ministry of Agriculture, 2008) [59; 60], while in Senegal, 80% of milk consumed by households is of pastoral origin (Knips, 2006) [61].

1.5 Cultural importance of rangelands

Pastoralism, or the extensive use of communal rangelands for livestock production, is an essential cultural way of life that affects 100-200 million people worldwide (Secretariat of the Convention on Biological Diversity, 2010) [62]. These lands contribute to the cultural and spiritual identity and diversity of the people who live there. The sacredness of plants and their respect by local populations has resulted in the protection of many pastoral species, some of which have been included in the UNESCO World Heritage List and their ecosystems were declared a biosphere reserve in 2008 (UNESCO, 2009) [63].

1.6 Policy for rangelands managing

The expansion of cultivated areas and the overexploitation of rangelands are often linked to the general policy of pastoral management; in Tunisia, for example, the privatization of collective rangelands has led to the further degradation of steppe rangelands (Auclair and Picouet, 1994) [64].

Poor governance is the main cause of rangeland degradation worldwide: poor effective investment policy, institutional support and planning processes to support pastoral communities (FAO, 2016) [65].

Table 2. List of plant species with their classifications and phytogeography.

Species	L	BT	Biogeo	DR	Familly
Iris xiphium L.	P	Ge	W. MED	V	*Iridaceae*
Filago pyramidata L.	A	Th	EUR-MED	R?	*Asteraceae*
Adonis aestivalis L.	A	Th	EURAS	R?	*Ranunculaceae*
Adonis dentata Delile.	A	Th	MED	R?	*Ranunculaceae*
Aizoanthemum hispanicum (L.) HEKHartmann	A	Th	MED-ASIE		*Aizoaceae*
Althaea ludwigii L.	A	Th	MED		*Malvaceae*

Anacyclus monanthos Pomel.	A	Th	AFN	R	*Asteraceae*
Androsace maxima L.	A	Th	EURAS-AFN		*Primulaceae*
Argyrolobium uniflorum Jaub. and Spach	P	Ch	AFN		*Fabaceae*
Arnebia decumbens (vent.) Cross. and Kralik.	A	Th	EURAS-AFN		*Boraginaceae*
Artemisia herba-alba Asso.	P	Ch	EURAS-AFN		*Asteraceae*
Asparagus stipularis Forsk.	P	Ge	MED		*Asparagaceae*
Asphodelus microcarpus Salzm et Viv.	P	Ge	CANAR-MED		*Asphodelaceae*
Asteriscus pygmaeus (DC.) Coss. and Dur.	A	Th	CANAR-EUR-MERID		*Asteraceae*
Astragalus armatus Willd.	P	Ch	MED		*Fabaceae*
Astragalus epiglottis L.	A	Th	MED		*Fabaceae*
Atractylis cancellata L.	A	Th	MED		*Asteraceae*
Atractylis flava Desf.	P	Ch	AFN-TUR-ARAB	RR	*Asteraceae*
Atractylis humilis Desf.	P	H	MED-IBERO-MAUR	V	*Asteraceae*
Atractylis serratuloides Sieber ex Cass	P	Ch	SAH-MED		*Asteraceae*
Biscutella didyma L.	A	Th	MED	??	*Brassicaceae*
Bromus madritensis L.	A	Th	MED		*Poaceae*
Bromus rubens L.	A	Th	PALEO-SUB-TROP	RR	*Poaceae*
Calendula arvensis L.	A	Th	EURAS-AFN	??	*Asteraceae*
Carduus pycnocephalus L.	A	Th	EURAS-MED		*Asteraceae*
Carthamus lanatus L.	A	Th	MED		*Asteraceae*
Carthamus pinnatus Desf.	A	Th	MED	R	*Asteraceae*
Catananche caerulea L.	P	H	W-MED	RR	*Asteraceae*
Centropodia forsskalii Vahl.	A	H	AFN		*Poaceae*
Ceratocephala falcata Maire and Weiller	A	Th	EURAS		*Ranunculaceae*
Chrysanthemum coronarium L.	A	Th	MED		*Asteraceae*
Cistanche tinctoria L.	P	Ge	AFN-ASIE		*Orobanchaceae*
Cistanche violacea (Desf.) G. Beck	P	Ge	AFN-ASIE		*Orobanchaceae*
Cladanthus arabicus (L.) Cass.	A	Th	MED		*Asteraceae*
Convolvulus althaeoides L.	P	H	MACAR-MED		*Convolvulaceae*
Dactylis glomerata L.	P	H	PALEO-TEMP		*Poaceae*
Echinops spinosus L.	P	H	S-MED-SAH	R?	*Asteraceae*
Echium humile Desf.	P	H	MED	RR	*Boraginaceae*
Elizaldia calycina Roem. and Schult.	A	H	AFN	RR	*Boraginaceae*
Erodium cicutarium (L.) L'Hérit.	A	Th	MED		*Geraniaceae*
Eruca sativa Mill.	A	Th	MED		*Brassicaceae*
Euphorbia falcata L.	A	Th	COSMP		*Euphorbiaceae*

Fagonia cretica L.	P	Ch	MED		*Zygophyllaceae*
Ferula communis L.	P	Ge	MED	??	*Apiaceae*
Festuca coerulescens Desf.	P	H	EUR-AFN		*Poaceae*
Fumaria agraria Lag.	A	Th	MED	RR	*Papaveraceae*
Helianthemum hirtum (L.) Mill.	P	Ch	AFN		*Cistaceae*
Helianthemum ledifolium (L.) Mill.	A	Th	CANARIES-EURAS-AFN		*Cistaceae*
Helianthemum lipii (L.) Dum.Cours.	P	Ch	EURAS-MED		*Cistaceae*
Helianthemum pilosum Pers.	P	Ch	AFN-ASIE	RR	*Cistaceae*
Helianthemun virgatum (Desf.) Pers.	P	Ch	AFN		*Cistaceae*
Herniaria hirsuta L.	P	H	EURAS-AFN	R	*Caryophyllaceae*
Hordeum murinum L.	A	Th	CIRCUMBOR	RR	*Poaceae*
Hypochaeris radicata L.	A	H	MED	RR	*Asteraceae*
Iris sisyrinchium L.	P	Ge	MED		*Iridaceae*
Koelpinia linearis Pall.	A	Th	AFN		*Asteraceae*
Lappula spinocarpos Forssk.	A	Th	AFN-ARAB		*Boraginaceae*
Launaea acanthoclada Maire.	A	Th	AFN-ARAB		*Asteraceae*
Lepidium draba L.	A	H	EURAS-AFN		*Brassicaceae*
Lomelosia stellata (L.) Raf.	A	Th	MED		*Caprifoliaceae*
Marrubium vulgare L.	P	Ch	COSMP		*Lamiaceae*
Matthiola fruticulosa (ou *M. longipetala*) (L.) Maire.	A	Th	EURAS-AFN	R	*Brassicaceae*
Moricandia suffruticosa Coss. and Durieu	P	Ch	MED		*Brassicaceae*
Muscari comosum (L.) Mill	P	Ge	MED		*Asparagaceae*
Noaea mucronata Asch. and Schweinf	P	Ch	AFN-ASIE		*Amaranthaceae*
Onopordon macracanthum Coss. and Bonnet	P	H	MED	R?	*Asteraceae*
Pallenis spinosa (L.) Cass.	P	H	EUR-MED		*Asteraceae*
Papaver rhoeas L.	A	Th	PALEO-TEMP		*Papaveraceae*
Paronychea argentea Lamk.	A	Th	MED	RR	*Caryophyllaceae*
Peganum harmala L.	P	Ch	MED-ASIE		*Zygophyllaceae*
Picris hispanica (Willd.) P.D.Sell	A	H	EUR-MED		*Asteraceae*
Pistacia atlantica Desf.	P	Ph	IRAN-AFN		*Anacardiaceae*
Plantago albicans L.	P	H	MED		*Plantaginaceae*
Reichardia tingitana L.	A	Th	MED		*Asteraceae*
Reseda alba L.	A	Th	EURAS	R	*Resedaceae*
Rhaponticum acaule (L.) DC.	A	Th	AFN		*Asteraceae*
Rumex vesicarius L.	A	Th	MED		*Polygonaceae*
Salvia verbenaca L.	P	H	MED-ASIE		*Lamiaceae*
Savignya parviflora (Delile) Webb	A	Th	AFN		*Brassicaceae*

Schismus barbatus L.	A	Th	MACAR-MED	RR	*Poaceae*
Scolymus hispanicus L.	P	H	MED		*Asteraceae*
Scorzonera angustifolia L.	A	Th	EUR-MED		*Asteraceae*
Scorzonera laciniata L.	A	Th	EUR-MED		*Asteraceae*
Scorzonera undulata Vahl.	A	H	EUR-MED		*Asteraceae*
Scorzoneroides hispidula Greuter and Talavera	A	Th	AFN		*Asteraceae*
Silybum marianum (L.) Gaertner	P	Th	MED		*Asteraceae*
Sinapis arvensis L.	A	Th	PALEO-TEMP		*Brassicaceae*
Stipa parviflora Desf.	P	H	EURAS-AFN-IBERO		*Poaceae*
Stipa tenacissima L.	P	H	IBERO-MAUR		*Poaceae*
Telephium sphaerospermum Boiss.	P	H	AFN		*Caryophyllaceae*
Teucrium luteum (Mill.) Degen.	P	Ch	MED	RR	*Lamiaceae*
Teucrium polium L.	P	Ch	MED	R	*Lamiaceae*
Thapsia garganica L.	P	Ge	MED		*Apiaceae*
Thymelaea microphylla Coss. and Dur.	P	Ch	AFN		*Thymelaeaceae*
Thymus algeriensis Boiss. and Reut.	P	Ch	AFN		*Lamiaceae*
Tirmania nivea (Desf.) Trappe.	A	Ge	AFN		*Pezizaceae*
Tulipa sylvestris L.	P	Ge	EUR-MED	RR	*Liliaceae*
Vicia sativa L.	A	Th	EUR-MED	RR	*Fabaceae*
Ziziphus lotus (L.) Lam.	P	Ph	MED	RR?	*Rhamnaceae*

***L:** longevity (**A:** annual, **P:** perennial); **BT:** biological type; **DR:** degree of rarity.*

2 Conclusion and recommendations

The rangelands in the world also include grasslands, savannahs, many wetlands, some deserts and tundra. These lands occupy 6.7 billion hectares, of which 3.3 billion hectares are degraded. Despite the fact that the socioeconomic and environmental conditions of drylands are lower than those observed in other regions of the world and that poverty is concentrated in these lands (IPCC, 2019) [66], livestock production in these rangelands feeds about 675 million rural people in developing countries (Peters et al., 2013) [67]. Indeed, while per capita demand for meat has reached an optimal level in developed countries, it is still increasing significantly in developing countries (Steinfeld et al., 2010) [68].

The food security of pastoral populations is dependent on their livestock, which in turn is dependent on the vegetation offered by rangelands.

Rangelands provide over 19 million tons of meat and 12% of milk worldwide (FAO, 2012) [69].

Pastoral populations derive their food resources from livestock production. In India or Tanzania, a rural household with one or two animals will use milk production for their own consumption and these animals can be sold to maintain their income or purchase other food items (Knips, 2006) [61].

To achieve economically viable and ecologically sustainable use of the sites studied, it is necessary to keep 50% of the phytomass produced (Take half leave half) on the soil for its protection for sustainable productivity.

Good management of these rangelands must be accompanied by the integration of other revenue-generating activities such as wildlife tourism (e.g., in Kenya, the tourism sector accounts for 13% of Gross Domestic Produc (GDP), while the livestock sector contributes between 5% and 10% of GDP).

Ecotourism can be a vector of development of steppe spaces and could very well be based on the organization of safaris and the realization of action or historical films through the great alfatiers spaces for an American, Asian, European or Moroccan clientele. Why not reassignment?

The life under the tent can constitute products sought by this clientele more and more stressed, by the way of life of the great civilizations.

Other perspectives can be given to this work in other fields of ecology such as the eco-ethology and eco-physiology of certain species that present a special adaptation to the difficult conditions of the arid environment.

Given the results of our investigations, emergency and support plans and conservation or restoration actions must be proposed and operationalized in the framework of a necessary pastoral development.

These rangelands, as natural points of biodiversity, represent a bank of genetic resources that can be exploited in the agronomic field as well as in the public health field. For example, *Artemisia herba-alba* was used in traditional medicine since these difficult periods of the COVID-19 pandemic. This plant has an antiseptic power and relieving effect of anxiety types. So it can be used as a therapeutic cure after COVID-19.

Several species can be the object of further studies and protection measures by the competent authorities.

Heteroptera are recently reproduced and incorporated in the discipline of biological control of pests of cotton, apple and tomato.

Realization of a chromosomal study of pastoral plants.

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