

Floristic and medical diversity interest of Djebel Aissa national park (Ksour Montains, Algeria)

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Abstract

Declared national park since 2003 in the province of Naâma in Algeria, it covers an area of around 24,400 hectares. Djebel Aissa national park offers particularly favorable conditions for the development of important floristic diversity with endemic and or rare taxa. The objective of the study is the floristic and ecological characterisation of vegetation in the park. The inventory of the plant biodiversity in study area revealed the existence of 379 taxa belonging to 53 families and 233 genera. An important endemics number has recorded: 24 North Africa, 23 Algerian-Moroccan, 4 North Africa and Iberian Peninsula, 5 Algerian, 6 Saharan, 1 Algerian-Tunisian, 1 ibero-algero-Moroccan and 2 ibero-Moroccan. 65 species were reported as rare or very rare, including 15 quite rare species, 36 rare species, 12 very rare species and 2 extremely rare species. Biological characterisation of species show on clear abundance of therophytes (45%), hemicryptophytes (21%) and chamaephytes (20%).

Keywords: Djebel Aissa national park, Naâma, Floristic diversity, endemic, rare

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INTRODUCTION

Algeria, like all Mediterranean countries, has long been involved in the politics of preservation and conservation of biodiversity through the creation of several national park's (Vela & Benhouhou, 2007). Currently, it counts eleven (11) national park's including all original landscapes the main hot spots of plant biodiversity in the country (Oakes, 2008). Indeed, several authors evoked that the conservation and the development of a natural ecosystem pass by a good knowledge of its biodiversity (Daget & Poissonnet, 1971; Médail & Quezel, 1997; Vela & Benhouhou, 2007).

Old research mainly focusing on the identification of biodiversity has been carried out in the territory of Djebel Aissa: Battandier & Trabut (1889), Hochreutiner (1904), MAIRE (1916). These research works underlined the rich flora of these areas and highlighted panoply of endemic and/or rare species which must be placed in conservation priorities.

In addition, medicinal plants are valuable resources for the vast majority of rural populations in Naâma, where the population uses them to provide health care. According to Bensaid (2006), Naâma by its position, offers a great ecological diversity (steppe ecosystem that dominates) and flora (steppe vegetation occupies almost 74% of the total area). phytotherapy is practiced by the population of Naâma whatever the age group or the level of study. Surveys of the local population and herbalists showed the therapeutic effect of species such as *Hammada scoparia*, *Artemisia herba alba*, *Cotula cinerea*, *Citrullus colocynthis*... (Boucherit et al, 2017).

Given the scarcity of ecological studies carried out in the park territory, the updating of the flora of this region and the identification of the medicinal plants most used by the rural population remains indispensable. In this context the aim of this work will focus on the study of the flora of this region and the characterization of the interests and values of the medicinal species.

EXPERIMENTAL

Presentation of study area

The Ksour Mountains (south west Algeria) belong to the south of the Oran Meseta and north of the Saharan platform. It is an intracontinental chain formed by meso-Cenozoic folded terrain during the alpine orogeny (Kacemi et al, 2011). The Ksour Mountains are characterized by the dominance of the gresous facies of the Jurassic and Lower Cretaceous (Boualla, 2006).

During the last decades, the Ksour Mountains were the focus of several studies, these studies indicate that the Ksour mountains correspond to an old asymmetric rift, trending NE-SW, which underwent extension during the Triassic and Liassic (Yelles et al, 2001). Djebel Aissa is one of many mountains ranges of the Ksour mountains in southern oranais, separated south of the Ksour mountain axis by the Tiout depression and to the north by the depression of Faidjet el Bétoum. Djebel Aissa is a part of a fluvio-deltatic system, these sillico-clastic formations constitute the sandstones of the Ksour. The park is subject to a semi-arid Mediterranean climate which it is very cold in winter with an average annual rainfall of 483 mm / year and an average temperature of around 8.14 °C (Gordo, 2014).

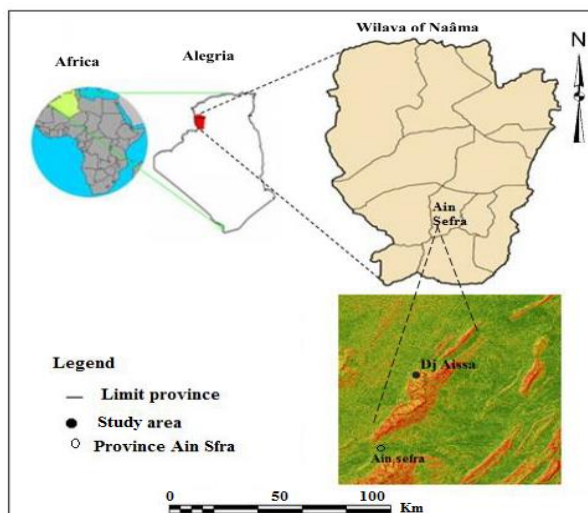


Fig 1. Location of study area.

Methodological approach

The study materials of selected plant taxa from the park national of Djebel Aïssa were collected during the vegetation seasons in the years of 2012 and 2016. Vegetation surveys (56 surveys) covering as possible all the types of settlements encountered are carried out according to a stratified sampling by drawing up a list of all plant species present on a previously determined area unit within a homogeneous station (Gounot, 1969). The surface 100 m² seems sufficiently representative of the minimal area in our region and majority plant formations. In this regard (Djebaili, 1984) used a minimum area of 100 m² for the entire steppe.

Species were identified according to the flora of Quezel & Santa (1962-1963), flora of North Africa of Maire (1952 – 1987), Flore et végétation du Sahara (Ozenda, 2004), the new nomenclature was updated for the species surveyed in the light of recent work compiled in the synonymous and bibliographic index of the North African flora (Dobignard and Chatelain, 2010-2013).

The recorded species were indicated by their biogeographical type recomposed by Pignatti (1982), Blanca et al., (2009), Dobignard and Chatelain, (2010-2013).

According to Pignatti (1982), Blanca et al., (2009) and Boucherit and al (2017), the species found in the park were indicated by their biological type. The biological classification takes into account the renovation bud position of the plant to the ground during the cold period and can recognize five biological types (phanerophyte, chamaephyte, hemicryptophyte, therophyte and geophytes) as defined by Raunkiaer (1934).

RESULTS AND DISCUSSION

Floristic diversity

Enumerated taxa were 379 species belonging to 233 genera and 53 botanical families of vascular plants; approximately 8 % of the Algerian total flora estimated at 4300 species by Dobignard and Chatelain (2010-2014). The richest families in taxa are Asteraceae (22, 16%), Poaceae (10,39%) and Fabaceae (8,18%). These three families alone represent more than 40% of the studied flora, the other families present an extremely small percentage which varies between 0, 26 to 6, 07 %.

The research of Gordo (2014) in the Jebel Aïssa park on 50 vegetation surveys has led to a herbarium containing 261 species belonging to 58 families and 197 genera.

Biological types

Biological types are used as indicators of the distribution of morphological and probably of physiological traits. The biological spectrum are typical of the semi-arid Mediterranean bioclimatic (Fig. 2), with a high percentage for therophytes (45%), 21% for hemicryptophytes, 20% for chaméphytes, 5% for the

nanophanerophytes, 4% for phanérophytes, 3% for geophytes, 2% for Phanerophytes liana.

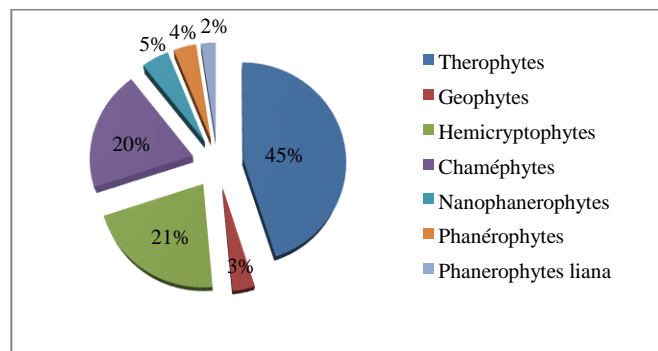


Fig 2. Histogram of biological types.

The therophytes, hemicryptophytes and chaméphytes are the biological types that dominate in the region. This shows the anthropozoologic high pressure experienced by vegetation in the study area.

In the steppe formations, the therophyte predominate over other life forms (Kaabeche 1990; Kaabeche et al, 1993; Aidoud, 2005; Amghar and Kadi-Hanifi, 2008). The abundance of therophyte can be explained by the strong presence of seasonal habitats for the development of rapid annual germination and growth (Hammada et al 2004). According to Daget (1980), the therophytisation is a characteristic of arid environment; it expresses a commitment towards the adaptation strategy in unfavourable conditions and is a form of resistance to the harsh climate.

Chorological Types

Floristic analysis shows the presence of several phytochoric units (Fig 3). Mediterranean is the most representative with 169 species (45%). This whole Mediterranean is divided into several subsets: Oromediterranean (4 species), mediterranean (93 species), western Mediterranean (23 species), Circummediterranean (12 species), Ibéro-mauretanean (27 species), Eury-mediterranean (1specie), North Africa, Spain, Caucasase, Turkey (1 specie), North Africa (8 species). Wide distribution and cosmopolites are relatively well represented in the park with 114 species (30%). Species belonging to the Sahara, Sahara-Sindian, Mediterranean Sahara, Mediterranean-Sahara-Sindian subsets represent 30% (35 species) of the wide distribution type. This composition is normal because the study area is located in the Saharan Atlas. The endemic chorological species are 65 species (17%) distributed as follows: Algerian (4 species), North African (27 species), Algeria and Morocco (21 species), Algerian-Tunisian (1 specie), Ibero-Moroccan (3 species). The rest of species correspond to Nordic chorologic type with 31 species (8%), of which 3 species are Circumboreal, 17 species Eurasian, 9 species paleo-tempered and 1specie South West European Eurasian.

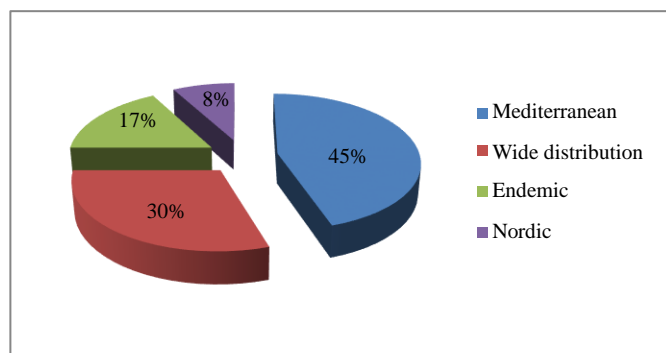


Fig 3 Chorological spectrum of flora

Analysis of endemism

66 taxa were recorded, about 17,41% of total species of the park and 12,02% compared to the total endemic flora of the country estimated at 549 species by Quezel (1964). Endemism rate is relatively high compared to that recorded in several park's in central and eastern Algeria such that of Belezma (32 species), Gouraya (26 species) (Rebbas et al., 2011), Djurdjura (35 species) (Meribai, 2006), Kala (75 species) (Stevenson, 1988), and Taza (52 species) (Bounar, 2013). Endemic flora of Djebel Aissa park consists mainly of endemic North Africa (24 species), Algerian-Moroccan (23 species), North Africa and Iberian Peninsula (4 species), Algerian (5 species), Saharan (6 species), Algerian-Tunisian (1 specie), ibero-algero-Moroccan (1 specie), ibero-Moroccan (2 species).

Endemic species are distributed between 20 families from 53 families enumerated in the park : Asteraceae 20 species (*Artemisia atlantica* Coss. et Dur, *Artemisia judaica* L.ssp.sahariensis Chev, *Atractylis aristata* Batt...); Apiaceae 5 species (*Hohenackeria polyodon* Coss. et Dur, *Bupleurum atlanticum* subsp. *algeriense* Cauwet & Carb, *Pseudorlaya biseriata* Murb...); Laamiaceae 5 species (*Ballota hirsuta* Benth, *Thymus lanceolatus* Desf, *Thymus pallidus* Coss...); Brassicaceae 5 species (*Alyssum simplex* Rudolphi, *Alyssum scutigerum* Dur, *Diploxys pitardiana* Maire...); Fabaceae 4 species (*Astragalus gombo* Bunge, *Colutea atlantica* Browicz...); Rubiaceae 3 species (*Crucianella hirta* Pomel...); Boraginaceae 3 species (*Megastoma pusillum* Coss. et Dur...); Euphorbiaceae 3 species (*Euphorbia retusa* Forssk...); Poaceae 3 species (*Festuca deserti* (Coss. et Dur.) Trab...); Caryophyllaceae 2 species (*Cerastium gracile* L. Dufour...); Geraniaceae 2 species (*Erodium tordylioides* Desf L'Her. Ssp. *eu-tordylioides* Maire...); Papaveraceae 2 species (*Hypecum littorale* Wulfen...); Thymelaeaceae 2 species (*Thymelaea virescens* Coss. et Dur...); Amaranthaceae 1 specie (*Polycnemum fontanesii* Durieu & Moq); Cistaceae 1 specie (*Helianthemum pergamaceum* Pomel); Plantaginaceae 1 specie (*Veronica rosea* Desf. subsp. *rosea*); Rununculaceae 1 specie (*Delphinium balansae* Boiss. et Reult); Santalaceae (*Thesium mauritanicum* Batt); Scrophulariaceae 1 specie (*Verbascum atlanticum* Batt) and Plumbaginaceae 1 specie (*Ceratolimon feii* (Girard) M.B. Crespo & Liedó).

Analysis of the rarity

Relying on Quezel and Santa data (1962; 1963) nearly 65 species were reported as rare or very rare, including 15 quite rare species (*Ammochloa palaestina* Boiss, *Sisymbrium Sophia* L, *Telephium sphaerospermum* Boiss...); 36 rare species (*Astragalus gombo* Coss. et Dur, *Nepeta amethystina* Poir. subsp. *Amethystina*, *Alyssum scutigerum* Dur...); 12 very rare species (*Pulicaria arabica* (L.) Casso, *Carthamus duvauxii* (Batt.) Prain...); and 2 extremely rare species (*Crupina vulgaris* Casso, *Centaurea sicula* L). On the basis of these data, the national park of Djebel Aissa records a 17, 15% rarity rate of all its inventoried taxa and around 3,57% over the entire national territory.

Analysis of the park rare flora show that the kinds represented are varied, only 6 families have the most important kinds (Asteraceae 21,54 %, Poaceae 12,12 %, Brassicaceae 10,77 %, Caryophyllaceae 7,57 %, Lamiaceae and Fabaceae 6,15 %). The other families such as those Boraginaceae, Geraniaceae, Plantaginaceae 3,08 % and Rubiaceae, Papaveraceae, Thymelaeaceae, Amaranthaceae, Cistaceae, Rununculaceae, Scrophulariaceae, Plumbaginaceae, Rosacea, Crassulaceae, Caprifoliaceae, Resedaceae, Primulaceae, Linaceae, Orobanchaceae and Cucurbitaceae 1,54 %.

According to Executive Decree number 12-03 of 4 January 2012, establishing the list of non-cultivated plant species protected in Algeria, 9 taxa identified in the park appear on this list. These species are: *Pistacia atlantica* Desf, *Artemisia atlantica* Coss. Et Dur, *Centaurea sicula* L, *Crupina vulgaris* Casso, *Onopordon algeriense* (Munby) Pomel, *Teucrium luteum* (Mill.) Degen, *Thymus lanceolatus* Desf, *Juniperus oxycedrus* L. ssp. *rufescens*, *Juniperus phoenicea* L. subsp. *phoenicea*.

Medicinal plants

According to the WHO (2002), statistics, about 80% of African populations use traditional medicine for their primary health care (Ang-Lee and al, 2006). In recent years, there has been a remarkable rise of medicinal plant's use, probably due to their local abundance, cultural significance and inexpensive procurement. The knowledge of the properties and uses of medicinal plants are generally acquired following a long experience accumulated and transmitted from one generation to another. As in the majority of Algerian areas, some of these species are employed by inhabitants bordering the park as traditional medicine and are marketed by herbalists. The survey with the rural population of Djebel Aissa shows that there is a great diversity of medicinal plants, the most used of which are shown in Table 1.

Table 1. Medicinal plants most used by rural population near Djebel Aissa national park.

t	Used for
<i>Rosmarinus officinalis</i> L	Antihypertensive, antitumoral
<i>Malva sylvestris</i> L	anti-inflammatory
<i>Hordeum murinum</i> subsp. <i>leporinum</i> (Link) Ar	digestive disorders
<i>Ferula communis</i> L	Weight loss
<i>Neurium oleander</i> L	Lleishmanicidal, eczema
<i>Artemisia campestris</i> L	Antidiabetic, antihypertensive
<i>Artemisia herba alba</i> Asso	Antidiabetic, antispasmodic
<i>Pallenis spinosa</i> (L.) Cass.	Antidiabetic
<i>Santolina rosmarinifolia</i> L	Digestive disorders
<i>Paronychia argentea</i> Lamk	Antilithiasis
<i>Citrullus colocynthis</i> (L.)	Antihypertensive, antitumor
<i>Juniperus oxycedrus</i> L. subsp. <i>rufescens</i> (Link) Deb	Anti-inflammatory, eye infections
<i>Juniperus phoenicea</i> L	Digestive disorders, antihypertensive
<i>Retama raetam</i> (Forssk.) Webb	Vermifuge, eczema
<i>Hammada scoparia</i> (Pomel) Iljin	Antidiabétique, anti-poison
<i>Ballota hirsuta</i> Benth	Digestive disorders
<i>Maropsis deserti</i> (de Noé) Pomel	Leishmanicidal, antidiabetic
<i>Marrubium vulgare</i> L	Leishmanicidal, antidiabetic
<i>Salvia verbenaca</i> L. subsp. <i>eu verbenaca</i> Maire	Wound healing, carminative, tonic
<i>Mentha pulegium</i> L	Antihypertensive, antispasmodic
<i>Teucrium luteum</i> subsp. <i>flavovirens</i> (Batt.) Greuter & Burdet	Antidiabetic, antihypertensive
<i>Ziziphus lotus</i> (L.) Lam	Anti-inflammatory, wound healing
<i>Tamarix africana</i> Poiret	Digestive disorders
<i>Peganum harmala</i> L	Antidiabetic, antihypertensive
<i>Anethum graveolens</i> L	Diuretic, hepatic diseases
<i>Rhamnus alaternus</i> L	Hepatic diseases
<i>Olea europea</i> L	Antidiabetic, antihypertensive
<i>Ephedra alata</i> DC. subsp. <i>alenda</i> (Stap) Trav	Digestive disorders

CONCLUSION

Analysis of the floristic diversity of Djebel Aissa national park shows well its great richness and its ecological and phylogenetic originality. These data justify its classification as protected area. The flora of the park is one of the most diverse in the region, with about 379 taxa including 66 endemic species and 65 rare species. The

Asteraceae, Poaceae and Fabaceae are the families that are most represented in the study area. The biological characterization shows the dominance of therophytes. For the phytogeographical characterization, it is the Mediterranean component which dominates. The study shows that there is a high diversity of medicinal plants used by rural population for treating common ailments and some very important diseases.

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REFERENCES

- Aidoud, A., 2005. Fonctionnement des écosystèmes méditerranéens. *Conférences*, 11, Université de Rennes. Retrieved from http://museum.agropolis.fr/pages/savoirs/biomes/MESOE_AIDOUUD_conf_03.pdf
- Amghar, F., Kadi-Hanifi, H. 2008. Diagnostique de la diversité floristique de cinq stations steppiques du Sud Algérois. *Les cahiers d'Orphée*, 386-395.
- Ang-Lee, M. K., Moss, J., Yuan, C. S. 2001. Herbal medicines and perioperative care. *Journal of the American Medical Association (JAMA)*, 286, 208–216.
- Battandier, J. A., Trabut, L. C. 1889. Excursion botanique dans le sud de la province d'Oran. *Bulletin de la Société botanique de France*, 35, 338-347.
- Bensaid, A. 2006. *SIG et télédétection pour l'étude de l'ensablement dans une zone aride : Cas de la Wilaya de Naama (Algérie)*. Thèse de Doctorat Université Joseph Fourier Grenoble, 319.
- Blanca, G., Cabezudo, B., Cueto, M., Lopez, C. F., Torres, C. M. 2009. *Flora vascular de Andalucía Oriental, 4 vols.* Sevilla, Spain: Consejería de Medio Ambiente (Junta de Andalucía).
- Bouallala, M. 2006. *Contribution à l'étude phytoécologique des écosystèmes steppiques : Cas du Djebel Aïssa (Monts de ksour, Aïn Sefra, Naama)*. Thèse de Magister, Université d'Oran, 110.
- Boucherit, H., Benabdeli, A., Benaradj, A. 2017. Biological recovery the steppe of hammada scoparia after enclosure in the region of naama (Algeria). *Ekológia (Bratislava)*, 36(1), 52–59.
- Boucherit, H., Benabdeli, A., Benaradj, A. 2017. Contribution to the phytotherapy against scorpion sting envenomation in the Naama region (Algeria). *Lazaroa*, 38(1), 75-82.
- Bouhar, R., Rebbas, K., Gharzouli, R., Djelouli, Y., Abbad, A. 2013. Ecological and medicinal interest of Taza national park flora (Jijel, Algeria). *Global Journal of Research on Medicinal Plants & Indigenous Medicine*, 2, 89–101.
- Daget, P. 1980. *Sur les types biologiques en tant que stratégie adaptative*. In Barbault, R., Blandin, P., Meyer, J.-A. (Eds.), *Recherches d'écologie théorique, les stratégies adaptatives* (pp. 89–114). Paris: Maloine.
- Daget, Ph et Poissonet, P. 1971. Une méthode d'analyse phytologique des prairies : critères d'application. *Annales Agronomiques*, 22(1), 5-41.
- Djebaili, S. 1984. Recherches phytosociologiques et phytoécologiques sur la végétation des hautes plaines steppiques et de l'Atlas saharien algérien. *OPU, Alger*.
- Dobignard, A., et Chatelain, C. 2010-2013. Index synonymique de la flore d'Afrique du Nord (4 vol.). Genève : C. J. B. G.
- Hamada, S., Dakki, M., Ibn Tattou, M., Ouyahya, A., Fennane, M. 2004. Analyse de la biodiversité floristique des zones humides du maroc. flore rare, menacée et halophile. *Acta Botanica Malacitana*, 29, 43-66.
- Hochreutiner, B. T. G. 1904. *The South Oranais: Floristic and Phytogeographic Study*. Geneva: IMP Romet.
- Gordo, B. 2014. *Contribution à l'analyse phytoécologique de la région d'Ain Sefra (Wilaya de Naâma)*. Thèse Mag, Département de biologie, Université d'Oran.
- Gounot, M. 1969. *Méthodes d'étude quantitative de la végétation*. Paris: Masson.
- Kaabeche, M. 1990. *Les groupements végétaux de la région de Boussaâda (Algérie)*. Essai de synthèse sur la végétation steppique du Maghreb. Thèse Doct. d'Etat. University of Paris Sud, Orsay, 104.
- Kaabeche, M., Gharzouli, R., Gehu, J. M. 1993. *Observations phytosociologiques sur le Tell et Les Hautes Plaines de Sétif (Algérie)*. Documents Phytosociologiques. N. S. XV, Camerino, 117-125.
- Kacemi, A., Talbi, D., Ben Salah, M. 2011. Mise en évidence d'une déformation synsédimentaire transverse en compression au passage Lias-Dogger (Secteur de Zerga - Monts des Ksour - Atlas saharien - Algérie), *Geo-Eco-Trop*, 35, 81 – 90.
- Médail, F., Quezel, P. 1997. Hot-spot analysis for conservation of plants biodiversity in the Mediterranean Basin. *Annals of the Missouri Botanical Garden*, 84, 121–127.
- Maire, R. 1916. La végétation des montagnes du sud oranais. *Trav. Labo. Botanical Faculty : CSCI, Algeria*.
- Maire, R. 1952-1987. *Flore de l'Afrique du Nord (Maroc, Algérie, Tunisie; Tripolitaine, Cyrénaïque et Sahara)*. Paris : Ed. Le Chevalier.
- Meribai, Y. 2006. *Etude de la végétation dans le Parc national du Djurjura (phytosociologie et propositions de développement)*. Thèse Mag, Ecologie: Phytosociologie, Institut national d'agronomie Alger.
- Oakes, J. 2008. Algeria, The bradt travel guide. USA: GIDES Ltd, UK the glob Pequot Press INC.
- Ozenda, P. 2004. *Flore et végétation du Sahara*. 3ème Ed. Paris: C.N.R.S.
- Pignatti, S. 1982. Reprint 1997. *Flora d'Italia*. Edagricole, Bologna (IT), 3Vols.
- Quézel, P., Santa S. 1962-1963. *Nouvelle flore de l'Algérie et des régions désertiques méridionales*. Paris : CNRS.
- Quézel, P. 1964. Endémisme dans la flore de l'Algérie. *C. R. Social Biogéogr*, 361, 137-149.
- Raunkiaer, C. 1934. *The life form of plants and statistical plant geography*. Oxford: Clarendon Press.
- Stevenson, A. C., Skinner, J., Hollis, G. E., Smart, M. 1988. The El Kala national park and environs, Algeria: An ecological evaluation. *Environmental Conservation*, 15, 335–348.
- Vela, E., Benhouhou, S. 2007. Evaluation d'un nouveau point chaud de biodiversité végétale dans le Bassin méditerranéen (Afrique du Nord). *C. R. Biologies*, 330, 589–605.
- World Health Organization. 2002. WHO Strategy for traditional medicine 2002-2005. Geneva: WHO, 78.
- Yelles Chaouche, A. K., Ait Ouali, R., Barcene, R., Derdere, M. E. M. Djelil, H. 2001. Chronologie de l'ouverture du bassin de ksour (Atlas saharien, Algérie) au début du mésozoïque. *Bulletin de la Société Géologique de France*, 172(3), 285-293.