

First report of an exceptional monoecious type of *Pistacia atlantica* ssp. *atlantica* in Algeria (North Africa)

Mehdeb Djamila^{1,2}, Benhassaini Hachemi³, Adda Ahmed², Soudani Leila², Mykola Kharytonov⁴

¹Higher school of Agronomy, ex-Hall of Technology, Kharrouba, Mostaganem 27000, Algérie

²University Ibn Khaldoun, BP 78, 14000 Tiaret, Algeria, email: dmechdeb@gmail.com

³Université Djillali Liabes, Sidi Bel Abbes 22000, Algeria, e-mail: ecoreve@yahoo.fr

⁴Dnipro State Agrarian and Economic University, Sergiy Yefremova st., 25, 49600, Dnipro, Ukraine, e-mail: kharytonov.m.m@dsau.dp.ua

Received: 21.02.2018. Accepted: 08.04.2018

The Pistachio Atlas tree (*Pistacia atlantica* Desf.) is a dioecious specie that belongs to the Anacardiaceae family. Recently, some researchers have found a monoecious species which belongs to this family in Turkey (*P. atlantica* Desf.), (*P. terebinthus*L.), Bulgaria and China (*P. Chinensis*). No study has reported the case of monoecious species in *Pistacia atlantica* Desf. in North Africa. However, our research describes for the first time the phenomenon on that takes place in Algeria. During our observation, the tree exhibited seeds and a vestige of pistillate inflorescence. In general, pollen shedding started in staminate clusters as vegetative buds broke. Cluster distribution of both sexes on the tree appeared highly complex and variable. This discovery also proves that there are subjects of this species - a monoecious species - in northern Africa and especially in Rechaiga, Tiaret.

Keywords: *Pistacia atlantica* Desf., monoecious, Tiaret, Algeria.

Introduction

The *Pistacia* genus (*Anacardiaceae*) includes 12 species, all of which are trees (Zohary, 1952). Among them, only *P. vera* is domesticated and cultured. The plants grow well in all types of soil, including rocky areas because of their drought resistance. Pistachio trees, as all other members of the genus, are strictly anemophilic and dioecious, producing male and female flowers on separate trees. Male and female flowers are apetalous, and wind is the pollinating agent.

Until recently there were only six reports of such trees in the literature. Ozbek and Ayfer (1958) have found two hermaphrodites, probably hybrid trees of *P. vera* or hybrids of *P. vera* and *P. terebinthus* in Turkey, where the male and female organs are in one and the same blossom. The second report is that of Crane (1974), where he describes three trees, hybrids between *P. vera* and *P. atlantica*, where the male and female flowers are on separate shoots. Kafkas et al. (2000) have reported of found an exceptional wild population of *P. atlantica* that consisted of several monoecious trees in Yunt Mountains in Turkey. In the summer of 2002 during a visit to the Rhodopes, a scientist found a unique transsexual form of *P. terebinthus* (Avanzato and Quarta, 2004; Avanzato, 2003). İsfendiyaroğlu (2007), shown in his report, the inflorescence features of an exceptional monoecious *Pistacia atlantica* Desf. Tree having hermaphrodite flowers found in the Barbaros Plain of Izmir/ Turkey were exhibited. Recently, a transsexual form of pistachio (*Pistacia terebinthus* L.) trees was found in Rodopi Mountains of Bulgaria, a region that is quite distant from the natural distribution area of this species. Wang et al., (2015) revealed for the first time the existence of monoecious *P. Chinensis* trees in Tang County Hebei Province, China.

Until now, there is no report case on the monoecious *P. atlantica* Desf. ssp. *atlantica* in the north of Africa. The present work is the first one who describes the morphological traits of a monoecious *P. atlantica* Desf. ssp. *atlantica* tree, found in Rechaiga, Tiaret Province (Algeria).

Materials and Methods

In the course of the field observations and specimen collection works, an isolated and rich population of *P. atlantica* trees was explored in the canton Houassi is located 6 km southeast of the town of Rechaiga and about 59 km east of Tiaret city.

Our examinations on 23 august 2017 resulted in the discovery of an exceptional *P. atlantica* tree bearing both staminate inflorescence and infructescence. The existing tree, growing in an unprotected, uncultivated location was geo-referenced with a GPS device (GARMIN-12) at 38°19'30.6"N, 26°34'02.7"E-165 m asl. 35°20.40.40'N, 002°02.35.52'E. The relief of the studied zone is uneven and presents a slope of 0 to 5% and an estimated altitude with an average value of 820m (Mauvezy, 1951). The soil is

sandy in nature with shallow limestone and according to Mokhfi (2012) it is loamy to sandy loamy and alkaline pH. The climate of Rechaiga is of Mediterranean type contrast with two seasons: one summer dry and hot and the other winter rainy, cool and cold. Precipitation is characterized by high intermittent and inter-annual instability. The average high temperatures recorded are between 29.5° C and 28.55 ° C for the months of July and August. For low temperatures, for the months of January and February are as follows 7.45° C and 8.5 °C. The thermal data are relatively contrasting continental type. The region belongs to the arid bioclimatic stage with cold winter (ONM, 1999-2009).

Results and discussion

The pistachio stand of the canton of Houassi, located at the forest of Rechaiga, located 6 km southeast of the town of Rechaiga, has about 2149 feet of pistachio Atlas. The forest has a sparse population and the average height of the trees is about 5.63m, some subjects have a maximum height of 17m and the average circumference at 1.30m of the soil has a value of 1.02m to 5.12m (Mokhfi, 2012). During our observation, the tree exhibited seeds and a vestige of pistillate inflorescence. In general, pollen shedding started in staminate clusters as vegetative buds broke. Cluster distribution of both sexes on the tree appeared highly complex and variable. The height of the concerned tree is 2.40m and we saw the beginning of the inflorescence and the fructification from a height equal to 1.90m. The tree was multi-stemmed, nearly upright and 5 m in height with a canopy spread equal to its height (Fig.1).



Fig.1. General view of the trees: dioecious one (left) and the monoecious one (right)

Male inflorescence was generally conical in shape, compact, not loosening, and brown before pollen shedding. Branches only with male inflorescences were very scarce on the canopies of tree. In tree, they were some male inflorescences differed with their darker colors than normal ones. We note also, that only one branch had male inflorescence and infructescence was very scarce on the canopies of tree (Fig. 2).



Fig.2. Male inflorescence and female infructescence on two different branches of the monoecious tree of the Atlas pistachio (acut branch).

Occurrence of mixed inflorescences originated from one-year old wood of the weak lateral branches in a narrow part of the canopy (Fig.3).



Fig.3. Male inflorescence and female infructescence on two different branches on the monoecious tree of the Atlas pistachio (at the level of the tree)
 They were mostly unmixed, but rarely appeared with male inflorescences on several branches in tree Fig.4 A and B).

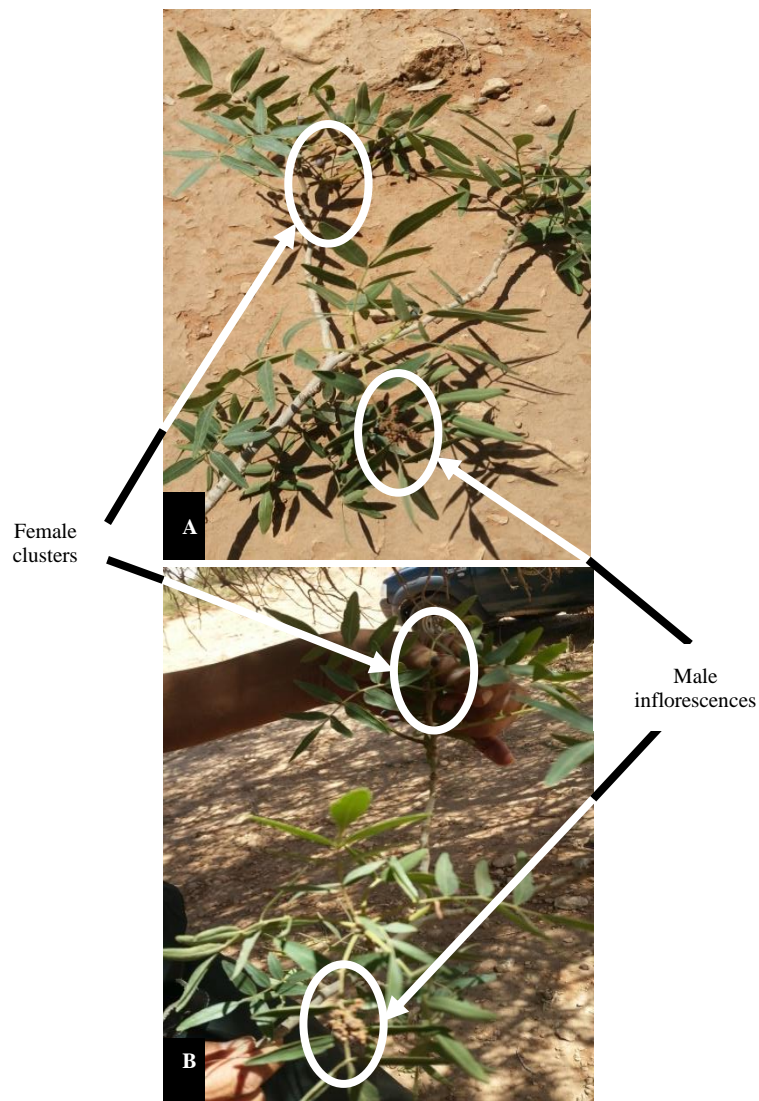


Fig. 4. Typical female clusters at the top and male inflorescences at the bottom (Fig.A, B).

The same observation was reported on *Pistacia atlantica* from Turkey (İsfendiyaroğlu, 2007) and on *P. terebinthus* from Bulgaria. The found plants are first case of defined trans-sexuality (Gercheva, 2008). Conversely, the number of female and male panicles

was equal. At the time of blooming, growth and development of male and female clusters were not synchronous. The tree seemed to have protandrous dicogamy and male clusters bloomed about one week before female ones. Protandrous *P. atlantica* trees were observed previously (Kafkas et al., 2000; Grundwag, 1975).

Pistacia is dioecious (Desfontaines, 1799) which showed an exceptional monoecious and /or hermaphrodite trees (İsfendiyaroglu, 2007; Kafkas et al., 2001; Crane, 1974). This exceptional trait may have arisen as a somatic mutation and may be expressed as a result of an interaction with unknown biotic/abiotic environmental factors.

Conclusion

Results of this study showed the case of the monoecious *P. atlantica* in Algeria. In general, the expression of monoecious traits is simple with mixed inflorescences originated from one-year old wood of the weak lateral branches in a narrow part of the canopy. This exceptional trait may have arisen as a somatic mutation and may be expressed as a result of an interaction with unknown biotic/abiotic environmental factors. It has been cited that in pistachio breeding, the problems of floral biology would more

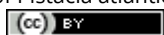
or less affect the final yield. So they have to be considered as potential risks in transferring the monoecious traits. Currently in Algeria, there is a strong craze for the cultivation of *Pistacia vera*. The opportunity to have a monoecious case of *P. atlantica* opens up a potential for transfer of the monoeciousness feature to cultivars of *P. vera*. So it is important to choose by hand seed trees before. It can allow growing of pistachio plantations without the necessary planting of non-productive male trees for pollination and thus at least 10 % increase of the crop yield can be achieved.

References

- Avanzato, D., Quatra, R. (2004). Monoecious *Pistacia terebinthus* found in Bulgaria. *Crop wild relative*, 2, 14-16.
- Avanzato, D. (2003). Una forma monoica di *Pistacia terebinthus* L scoperta in Bulgaria. *Frutti coltura*, 10, 51-53.
- Crane, J.C. (1974). Hermaphroditism in *Pistacia*. *California Agriculture*, 28 (2), 3-4.
- Gercheva, P., Zhivondov, A., Nacheva, L., Avanzato, D. (2008). Transsexual forms of Pistachio (*Pistacia terebinthus* L.) from Bulgaria – Biotechnological approaches for preservation, multiplication and inclusion in selection programs. *Bulgarian Journal of Agricultural Science*, 14(5), 449-453. Agricultural Academy.
- İsfendiyaroglu, M. (2007). Hermaphroditism in *Pistacia atlantica* Desf. : A New Report from Izmir/Turkey. *Ege Üniv. ZiraatFak. Derg.*, 44(3), 1-12
- Kafkas, S., Açar, I., Gozel, H. (2005). A project on developing monoecious pistachio (*Pistacia vera* L.) populations and determination of sex mechanism in *Pistacia*. In: Oliveira M.M. (ed.), Cordeiro V.(Ed.). XIII GREMPA Meeting on Almonds and Pistachio. Zaragoza : CIHEAM, p. 57 -60 (Options Méditerranéennes : Série A. Séminaires Méditerranéen s; n. 63)
- Kafkas, S., Perl-Treves, R., Kaska, N. (2000). Unusual *Pistacia atlantica* Desf. Monoecious sex types in the Yunt Mountains of the Manisa province of Turkey. *Isr. J. Plant Sci.*, 48(4), 277-280.
- Mokhfi, F.Z. (2012). Mémoire de magister: Inventaire et étude éco-dendrométrique du pistachier de l'Atlas "Pistacia atlantica Desf." dans la forêt domaniale de Rechaiga.
- Ozbek, S. and Ayfer M., (1958). A hermaphrodite *Pistacia* found in the vicinity of Antep, Turkey. *Proc. Amer. Soc. Hort. Sci.*, 72, 240-241.
- Wang, H., Hao, Q., Bai, P., Qi, S., Su, X., Chen, F. (2015). Hermaphroditism and fertility in *Pistacia Chinensis* Bunge ISHS Acta Horticulturæ 1074: II International Symposium on Wild Relatives of Subtropical and Temperate Fruit and Nut Crops. DOI: [10.17660/ActaHortic.1074.19](https://doi.org/10.17660/ActaHortic.1074.19).
- Zohary, M., (1952). A monographical study of the genus *Pistacia*. *Palestine Journal of Botany, Jerusalem Series*, 5(1), 187-287.

Citation:

Mehdeb Djamila, Benhassaini Hachemi, Adda Ahmed, Soudani Leila, Kharytonov Mykola (2018). First report of an exceptional monoecious type of *Pistacia atlantica* ssp. *atlantica* in Algeria (North Africa). *Ukrainian Journal of Ecology*, 8(2), 276–279.



This work is licensed under a Creative Commons Attribution 4.0. License