

# Two New Records of Orchid Species for the Flora of Iraq: *Anacamptis papilionacea* (L.) R.M. Bateman, Pridgeon & M.W. Chase and *Dactylorhiza romana* (Sebast.) Soó

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**Abstract**—*The Orchidaceae* is one of the most cosmopolitan flowering families; however, the national floristic knowledge for Iraqi territories is restricted by the outdated and incomplete status of Flora of Iraq. We already recently add two new records of orchid species for Iraq, and the study objective was to pursue the dynamics on field studies and thus provides new contribution for the Flora of Iraq. Two new orchid species were recorded for the first time in Iraq: (i) *Anacamptis papilionacea* found on Silé waterfall locality (Dostaka mountain, Duhok governorate), and (ii) *Dactylorhiza romana* found in Hariké locality (Gara mountain, Duhok governorate). Field illustrations, infraspecific identification (*A. papilionacea* subsp. *schirwanica* and *D. romana* subsp. *georgica*), environment and geographical distribution, conservation status, and a brief discussion about the new records are provided. This study highlights the importance of floristic surveys and their continuity over time as a first step toward the modern floristic knowledge including open databases.

**Index Terms**—*Anacamptis papilionacea* subsp. *schirwanica*, Biodiversity, *Dactylorhiza romana* subsp. *georgica*, Flora databases floristic, Kurdistan Region.

## I. INTRODUCTION

The *Orchidaceae* family has a wide ecological niche range with a center of diversity on tropical rain forest: Almost all

orchids occurring in tropical and subtropical are perennial epiphytes (growing with trees and shrubs), whereas grassland and forest are the favorable habitats for terrestrial orchids in the temperate and Mediterranean regions (Arlott, 1978; Dressler, 1993; Ramírez, et al., 2007). As a consequence, *Orchidaceae* is one of the most cosmopolitan and diversified flowering families (about 800 genera with some 20-30,000 taxa) occurring in all territories except real desert and glaciers (Dressler, 1993; Cozzolino and Widmer, 2005; Christenhusz and Byng, 2016). The orchids flower has specific traits that can be recognized easily from other plant species (for example, spectacular specific petal “labellum” often similar to animal shapes, for example, bees, spiders, lizards, and monkey-like; anthers produce large pollen masses “pollinia”). These specific flowers play an important role in pollination by developing a particular life history strategy in response to evolutionary selective pollinator pressure (Adams and Lawson, 1993; Weston, et al., 2005). In terms of ethnobotany, in Eastern Mediterranean countries called “Levant,” the dried underground tubercles of some *Orchis* species often used as a cooking powder by the local people in a hot beverage named “Saleb” or refreshment ice cream named “dondurma” (Kasperek and Grimm, 1999; Kreutz and Çolak, 2009; Löki, et al., 2015). However, it has been reported (Sezik, 2002; Kreutz, 2004; Löki, et al., 2015) that these tubercles collecting activity became threats to *Orchidaceae* family, especially subtribe Orchidinae (*Ophrys*, *Orchis*, *Himantoglossum*, and *Anacamptis*) in the Levant. In Kurdistan Region, the local people (such as in Amadyia and Barwarya Bala) collect Orchids’ tubercles and then sell the powder to Turkish traders which they in turn sell it in traditional Turkish markets (Véla, et al., 2013; Youssef, et al., 2015).

Although the terrestrial Orchid family is well represented in the Kurdistan Region, as a part of the Flora of Iraq,

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due to its Mediterranean and/or Eurasiatic biogeographical affinities (Wood, 1985; Véla, et al., 2013; Youssef, et al., 2015), the diversity and taxonomical status of these Orchid taxa still far from being updated and achieved: For example, in the recent field guide work of European and Middle-East orchids (Baumann, et al., 2006), only the 13 regional endemism taxa are accurately cited for Kurdistan Region and/or all Northern Iraq but without any explicit geographical distribution mention for each country. At a starting point, in the previous documented works such as Flora of Iranica (Renz, 1978) and Flora of Iraq (Wood, 1985), 20 and 25 taxa are respectively recorded in the Northern Iraq territories. Whereas, according to Govaerts, et al., (2017) which is the recent world checklist, there are 28 orchids species mentioned for Iraq, but deleted or added taxa are not justified due to lacking of bibliographic data. Therefore, this partial floristic knowledge highlights the importance of the continuity of field surveys to update the Flora of Iraq. It demonstrates also the importance of the new floristic paradigm (Heywood, 2002; 2004) as opportunity to provide precise data such as photo-illustrations, ecological niche information, and accurate recording of geographical coordinates for each locality and checking the accepted name. In this context, we have initiated since 2013 a botanical research project mainly based on field surveying to spotlight on the Orchids' diversity and distribution in Kurdistan Region. In the first floristic survey on *Orchidaceae*, 10 orchids species had been found in Duhok province including one new record "*Ophrys cilicica*" for the Flora of Iraq (Véla, et al., 2013); in the second phase of this project in 2014-2015, another new record "*Orchis spitzelii* subsp. *latiflora*" has been added to the Flora of Iraq, and 8 new orchids taxa have been recorded for Duhok province for the first time which majority of records were new localities and/or rare taxa (Youssef, et al., 2015). Most of these Orchid species are found on the middle mountain zone with a climatic transition between Mediterranean and Irano-Anatolian, confirming the status of Kurdistan Region as a part of the global hotspots for biodiversity (Mittermeier, et al., 2004) but coldspot for floristic knowledge. Although many efforts have been spent in the past years, especially on orchids species, it still needs contributions to enrich the Flora of Iraq. Therefore, the present study aims to fill the gap of floristic field studies about the Flora of Iraq.

## II. MATERIALS AND METHODS

The botanical field surveys were conducted during spring 2016 in diverse locations of Duhok governorate, Kurdistan Region of Iraq. The main botanical field exploration area focused on a tetragon Duhok–Zaxo–Barzan–Kani Massi (former "Ain Nuni" according to the Flora of Iraq) situated on the northern part of Kurdistan Region of Iraq. The diversity landscape's features of this study area are characterized by a mixture of hills, cultivated plains, deep valleys, and mountain chains which are generally extending from West to East. The two fundamental areas deeply investigated are those in Hariké locality on Gara Mountain, Diralok province, and

Silé waterfall locality on Dostaka Mountain, Akre province (Fig. 1).

The taxonomical identification of Orchid species was carried out by the help of illustration photos. Initially, the identification process followed Wood (1985) and then was systematically verified according to Flora of Iran (Renz, 1978) and Turkey (Renz and Taubenheim, 1984); The Orchid works of Kretz (1998), Kretz and Çolak (2009), and Baumann, et al. (2006) have been used for systematic verification species/subspecies status. For the genus *Anacamptis*, the recent monograph of Kretzschmar, et al. (2007) was used, and for the group of *Dactylorhiza romana*, the revision of Pedersen (2006) utilized.

## III. RESULTS

The present study deals with two new records of Orchid species for the Flora of Iraq, found in two different sites thanks to the botanical field survey season in 2016. The first one is *A. papilionacea* discovered on Silé waterfall locality (Dinarta area, Dostaka mountain, Duhok governorate), and the second is *D. romana* found on Hariké locality (Gara mountain, Duhok governorate). These two species are considered new records for the Flora of Iraq because of they were never mentioned under any of their synonyms in any previous floristic literatures, that is, Renz (1978), Wood (1985), Kretzschmar, et al. (2007), Baumann, et al. (2006), and Govaerts, et al. (2017).

To accommodate a complete vision about the actual status of these two new recorded species, we have provided and discussed in details our field data and all recent published researches about these two species : Taxonomical, nomenclatural, biological and ecological data (i.e. accepted scientific name, synonyms, infraspecific identification, ecological niche, population size, geographical distribution, and conservation status) thanks to our field data and also all recent published researches about these two Orchid species.

1. *Anacamptis papilionacea* subsp. *schirwanica* (Woronow) H.Kretzschmar, Eccarius and H.Dietr., *Orchid Gen. Anacamptis Orchis Neotinea*, ed. 2: 174 (2007).

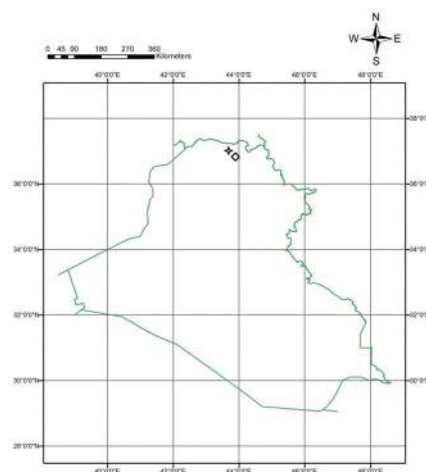


Fig. 1. Location of Orchid sites: Silé waterfall on Dostaka Mountain, Diralok province for *Anacamptis papilionacea* subsp. *schirwanica* (lozenge); and Hariké on Gara Mountain, Akre province for *Dactylorhiza romana* subsp. *georgica* (star), Kurdistan Region of Iraq.

- ≡ *Orchis schirwanica* Woronow, Izv. Kavkazsk. Muz. 4(4): 263 (1909).
- ≡ *Orchis papilionacea* subsp. *schirwanica* (Woronow) Soó, Bot. Arch. 23: 36 (1928).
- = *Orchis caspia* Trautv. in Trudy Imp. S.-Peterburgsk. Bot. Sada 2: 484 (1873).
- = *Orchis papilionacea* var. *bruhnsiana* Gruner in Bull. Soc. Imp. Naturalistes Moscou 4: 453 (1867).
- ≡ *Vermeulenia papilionacea* var. *bruhnsiana* (Gruner) Szlach., Polish Bot. J. 46: 128 (2001).

#### A. Type

The lectotypus has been designated by Kretzschmar, et al. (2007). LE, (right specimen - Pict. 17411), 02.05.1908, leg. A. Schelkownikov and G.J. Woronow. Origin: Azerbaijan, Scharodilskier ascent in the region Schemajinsk (Gouvernement Baku).

#### B. General Specific Description

It is a robust plant, having an erect stem (15-30 cm), often with 2-8 lanceolate unspotted leaves. This subspecies is mainly quite stocky with inflorescences that are rich in flowers. Its flowers have a spatula-shaped discreetly spotted crenelated lip.

#### C. Intraspecific Identification (Fig. 2)

In classical floras (for example, Flora of Turkey and Flora Iranica), this taxon was treated under the genus *Orchis*. Recently, this species has been proposed to be considered in the separated genus *Anacamptis* (Kretzschmar, et al., 2007; Véla and Viglione, 2015), but some others specialists propose to place it in another small genus *Vermeulenia* according to Löve and Löve (1972). Kretzschmar, et al. (2007) reported six subspecies mainly distributed in Mediterranean Region except one in Irano-Anatolian and eastern Caucasian Region. *A. papilionacea* subsp. *schirwanica* is given for Azerbaijan and



Fig. 2. *Anacamptis papilionacea* subsp. *schirwanica*; (a) Habitat, Silé waterfall locality, south aspect of Dostaka mountain, Akré province (Duhok governorate) Pseudosteppe grassland habitats in middle open Gall oak forest. (b) Habit. (c) Inflorescence. 09 April, 2016. (photos SamiYoussef).

Southeastern of Anatolian Turkey territories (Kretzschmar, et al., 2007; Kreutz, 1998), but its real geographical distribution area remains not exactly delimited. In the Flora of Iraq (Wood, 1985) and all other literatures (Renz, 1978; Renz and Taubenheim, 1984; Kretzschmar, et al., 2007; Kreutz and Çolak, 2009), *A. papilionacea* has never been indicated for Iraq territories. During our botanical field surveys, the researchers found *A. papilionacea* for the first time in Silé waterfall in Akré province. About the precise taxonomical identification, it can be confirmed the subspecies *schirwanica* thanks to the lip shape conform to the plants from Azerbaijan, excluding the subspecies *palaestina*, and the density of inflorescence, excluding the typical subspecies from Italy (Kretzschmar, et al., 2007). Therefore, this observation is the first report for the species in Iraq and consequently also for its subspecies. Actually, its presence in Kurdistan region of Iraq is not really surprising because it belongs to the same mountain chain extending Western Zagros until Southeastern Turkey. Hence, the research finding extends the geographical distribution south-eastward into Iraqi territories, not very far from Iranian border (<100 km). It is why it can reconsider the hypothesis of a potential presence for Iranian territories, previously rejected by Kretzschmar, et al. (2007) “due to a huge distance (>800 km) to the nearest known site” but initially evocated in Flora Iranica, northward in the Alborz mountains (Renz, 1978).

#### D. Material Examined

Four individuals were collected directly from field (Silé waterfall locality, Akré province), and two specimens among them were deposited in the herbaria of Faculty of Agriculture, University of Duhok, (acronym DPUH). Date of collection: 09/04/2016; Collector Dr. Sami YOUSSEF.

*A. papilionacea* subsp. *schirwanica* (Woronow) H.Kretzschmar; Akré; herb. Sami Youssef; DPUH no. 3629.

#### E. Environment and Geographical Distribution

This species has been found at Silé waterfall locality (36°50'43.65" N, 43°53'40.70" E), south exposure of Dostaka mountain, and Akré province Kurdistan Region of Iraq. It occurs at about 875 m. a.s.l. in pseudosteppe grassland habitats in middle open Gall oak (*Quercus aegilops*) on the piedmont of a southern slope. These herbaceous vegetation communities are essentially dominated by herbaceous plants (for example, *Bromus* sp., *Carex* sp., *Hordeum* sp., and *Stipa* sp.) and mainly geophytes species (for example, *Anemone coronaria*, *Poa bulbosa*, *Allium* sp., *Bellevialia* sp., *Muscari* sp., and *Ornithogalum* sp.) which disappear completely during summer. These pseudosteppe forests are characterized by the presence of sparse Gall oak trees and some shrubs (for example, *Rhus coriaria* var. *zebaria*, *Prunus* sp., *Juniperus oxycedrus* s.l., and *Pistacia khinjuk*). The general climate of this site is Mediterranean continental characterized by a moderate cold and rainy/snowy winter and a hot and completely dry summer. Annual rainfall in Akré is around 900/1000 mm, mean minimal temperature of coldest month around 0°C, and mean maximal temperature of hottest month

40°C (Guest and Al-Rawi, 1966; Climate Data for Cities Worldwide, 2017).

#### F. Conservation Status

In Silé waterfall locality, the researchers found only one small population with a few disperses individuals (<20) occupied a small surface area (<1 hectare). This location is threatened by high anthropogenic activities: It is frequented by a high number of tourists due to its famous and wonderful waterfall. Furthermore, this region is internationally well known by the over-collecting of the “Zebaria sumac fruit” (*R. coriaria* var. *zebaria*) used in divers traditional Kurdish dishes (Shahbaz, et al., 2015). The over-harvesting of the others wild edible plants (such as *Gundelia* sp., *Allium* sp., *Arum* sp., *Echium* sp., and *Rheum* sp.) leads to the degradation of many natural habitats. Consequently, this rare species needs an urgent planning strategy for biological conservation by regional Kurdish authorities.

2. *D. romana* subsp. *georgica* (Klinge) Soó ex Renz & Taubenheim, Notes Roy. Bot. Gard. Edinburgh 41: 271 (1983).

≡ *Orchis mediterranea* subsp. *georgica* Klinge, Trudy Imp. S.-Peterburgsk. Bot. Sada 17(1): 19 (1898).

= *Dactylorhiza flavescens* (K.Koch) Verm., Stud. Dactylorch.: 65 (1947).

#### A. Type

*The lectotypus has been designated by Pedersen (2006). Rchb.f., Icon. Fl. Germ. Helv. XIII/XIV: Pl. 62(I), 1851.*

#### B. General Specific Description

It is a robust tuberous plant (15-40 cm high). With Basal leaves lanceolate or narrowly obovate, up to 18 cm long; Inflorescence cylindrical densely flowered; bracts clear bright green, lanceolate, exceeding the flowers; Flowers mainly or only yellow color, rather small; labellum usually longer than broad, to 8 mm broad, shortly 3-lobed toward the apex; Spur narrowly cylindrical, horizontal, or slightly turned upward, slightly ascending, usually shorter than the ovary, around 1.5 longer than the lip.

#### C. Intraspecific Identification (Fig. 3)

*D. romana* with both subspecies *georgica* and *romana* has been highlighted their occurrence in Turkey territories (Renz and Taubenheim, 1984), whereas only *D. romana* subsp. *georgica* had been reported for Iranian territories (Renz, 1978). These two subspecies are well distinguished both morphologically and biogeographically: *D. romana* subsp. *romana* is a real Mediterranean element (from Italy to Turkey throughout Balkan Region) and mostly characterized by its rather large flowers with red-to-yellow color, whereas *D. romana* subsp. *georgica* is an Irano-Anatolian and Transcaucasian element (from East Turkey to Turkmenistan throughout Iran) and characterized by its rather small flowers mainly or only yellow color and with shorter spur (Renz, 1978; Renz and Taubenheim, 1984; Delforge, 2005). These

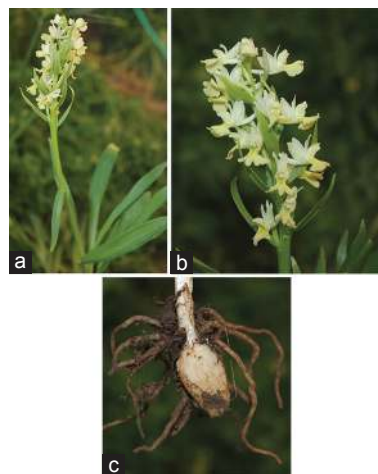


Fig. 3. *Dactylorhiza romana* subsp. *georgica*; Hariké locality, northern aspect of Gara mountain, Diralok province, 16 April 2016. (a) Habit; (b) inflorescence; (c) undivided tubercle (photos Sami Youssef).

two subspecies have never been reported in Kurdistan Region and Iraqi territories (Renz, 1978; Renz and Taubenheim, 1984; Wood, 1985; Kreutz, 1998; Delforge, 2005; Govaerts, et al., 2017). During our botanical field survey in 2016, the researchers found some specimen of *D. romana* for the first time in Hariké locality (Gara Mountain). About the taxonomical identification, we it can be confirm the *D. romana* subsp. *georgica* characterized by its rather small flowers mainly or only yellow color, and its shorter spur around 1.5 longer than the lip (Renz and Taubenheim, 1984; Delforge, 2005). Thus, it is a new record for the Flora of Iraq. Its occurrence in Kurdistan Region of Iraq is not really surprising because already known from Golistan and Azerbaijan provinces in Northwest and North of Iran (Renz, 1978) and even more from Siirt and Bitlis provinces in Southeast of Turkey (Renz and Taubenheim, 1984; Kreutz, 1998) not far from Kurdistan Region border.

#### D. Material Examined

Four individuals were collected directly from field (Hariké locality, Diarlok province), and one of them was cultivated in Montpellier (South-Eastern France). Date of collection 16/04/2016; Collector Mr. Zerevan Mergye and Dr. Sami Youssef.

#### E. Environment and Geographical Distribution

This species has been found at Hariké locality (37°01'20.97" N, 43°40'59.21" E) northern slope of Gara Mountain, Diralok province, Kurdistan Region of Iraq. It has been found in open habitat at more or less 969 m. a.s.l. dominated by herbaceous vegetation community marked frequently by the occurrence of diverse dwarf shrub (for example, *Daphne acuminata*, *Lonicera arborea*, and *Astragalus* sp.). It is just situated on the margin of Lebanon Oak (*Quercus libani*) forest zone on a secondary crest with northern exposure. It grows on relatively deep soil with a sufficient water supply in spring. The local climate is globally the same than previously described, but the topoclimate is

characterized by a shadow winter with a persistent snow (at least 1 or 2 months) and a cooler spring and summer.

#### F. Conservation Status

The observed population comprises only few individuals (<20) in a small surface of much less than one hectare. Consequently, the study can confirm that *D. romana* subsp. *Georgica* is a rare species in locations (only one at Iraq level), occupied surface area and size of population. Furthermore, this location could be potentially threatened by traditional harvesting of the edible plants. Particularly, the real threaten is concerning collecting of the tuberous testicles of Orchid species (for example, *Orchis mascula* and *Orchis anatolica*) by local people to sell it on traditional markets that will be used after made “Saleb” and ice cream “dondurma” in Turkey. By chance, as far as researchers know, this yellow-flowered *Dactylorhiza* is not collected probably because ignoring their identical properties.

### IV. DISCUSSION

#### A. Flowers Field Surveys as a Proxy Toward the New Floristic Paradigm

The floristic surveys as an old scientific concept remain the basic foundation for describing the plant biodiversity of an area and our ability to communicate about them (Heywood, 2001; 2002). It has always received considerable attention from botanists and evolutionary systematists. However, the “new floristic paradigm” emerged in the recent year is characterized by satisfaction of a wide range of users “taxonomists,” high quality outputs data, and accessibility and consistent in its methods and procedures (Heywood, 2002; 2004). This revolution development has actively participated to identify the biological conservation priorities in the megadiverse countries (Heywood, 2004; Victor, et al., 2015). From this new paradigm standpoint, the necessity of completing floristic inventories has become an evident key player to update permanently the existent floras. In this context, the Flora of Iraq, thus far, remains the basic foundation for the plant biodiversity description and to communicate about it. Despite the formidable floristic inventories of the past century (Townsend and Guest, 1966-1985), the status of the Flora of Iraq is outdated and incomplete, and it can be designated as a hotspot of biodiversity but coldspot of knowledge. The main raison for the nonachievement of this flora could be resumed by the chronic instability of the political situation. This has been aggravated by some scientific-personal interest changes in Iraq allowed to unaccomplished the mission of publication the remaining parts (volumes 6 and 7) of the Flora of Iraq (Ghazanfar and McDaniel, 2016). The strong lack in taxonomists and/or naturalists or they lack of autonomy on the field cannot allow filling the gaps of floristic data on unexplored area such as lot of the local mountains (Barzan area, Barwarya Bala, and Nerwayé areas near Turkish border). However, some important advances have been made

in the past decade insight of new contribution to the Flora of Iraq For example, divers botanical field surveys carried out and reported several new taxa and new records for Iraq (National Report on Biodiversity in Iraq, 2010; Ahmad, 2013; Véla, et al., 2013; Shahbaz, et al., 2015; Youssef, et al., 2015; Ahmad, 2016; Youssef, et al., 2017). Meanwhile, a lot of taxa remain to be discovered, which is not surprising in view of its geographical situation as a part of Irano-Anatolian hotspot of biodiversity. In regard to this particular situation, the Flora of Iraq needs an urgent completing floristic inventories to provide adequate continual updating data, and gigantic efforts should be realized to modernize the flora toward the new paradigm. In this context, the present study attributes these new data as a continuity of the updating floristic works on Orchid species list occurring in Kurdistan Region (Véla, et al., 2013; Youssef, et al., 2015) and also updating their nomenclature status (accepted names, synonyms...). In contrast, this floristic field surveys contribute to highlight the urgent need to a national program strategies for biodiversity conservation, which will play an important role to find a suitable balance between biodiversity management and decreasing the influence of the increasing anthropogenic activities (for example, over-collecting edible plants).

In this botanical field survey on Orchid species, there were two new records of Orchid species for the Flora of Iraq which was not highlighted previously (Véla, et al., 2013; Youssef, et al., 2015). In this study, both taxa are considered as very rare species, and their localities are under real or potential threaten by the increasing anthropogenic activities. To take advantage of this situation thus, the researchers could organize themselves effectively to play a key role in influencing the decision-making “governments” about the urgent biological conservation priorities.

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