First escaped populations of *Gazania ×splendens* Hend. & Andr. Hend. (Asteraceae) in Algeria

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**Abstract**

During field surveys carried out in north-eastern Algeria, the escape of *Gazania ×splendens* Hend. & Andr. Hend. was observed; it is reported here as in the process of naturalization for the first time in Algeria and continental North Africa. This hybrid of the Asteraceae family, highly appreciated and widely used in ornamentation, was discovered at a single locality on a coastal dune in the Skikda region, where it is currently colonizing disturbed habitats, in particular the edges of sidewalks. It grows on sandy soil, spreads from seeds and seems to have escaped from the countless green spaces in the region. *Gazania ×splendens* manages to cope well with summer heat and drought and has maintained itself at the site for more than three years. Field photos and a map marking the escaped populations and the cultivated populations in their vicinity are provided.

**Key words:** Arctotideae, degree of naturalization, first record, green spaces, habitat, introduced species, ornamental, spread

**Introduction**

In recent years, and in an unprecedented attempt, substantial effort has been put into botanical field work to update the knowledge of the Algerian native and alien flora (Véla et al. 2013; Miara et al. 2018; Sakhraoui et al. 2020; Meddour et al. 2020). In this context, field work by the first author has started in 2019 in the Skikda region (NE-Algeria). New surveys carried out as part of monitoring the population dynamics of potentially invasive alien species recorded in previous research (Sakhraoui et al. 2019), led to the discovery of another alien new for Algeria, i.e. *Gazania ×splendens* Hend. & Andr. Hend.

The genus *Gazania* belongs to the Asteraceae family and includes 16 species endemic to South Africa that are well adapted to arid and semi-arid conditions (Howis et al. 2009), often colonizing coastal dunes (Hesp and Mclachlan 2000).
Although *G. ×splendens* has so far solely colonized disturbed habitats in Algeria, it might in the future extend its distribution and establish in semi-natural or natural habitats. Here, we report the first escaped occurrence of *G. ×splendens* in Algeria, and provide relevant information on its biology and ecology as basis for monitoring.

**Materials and methods**

During field surveys carried out mainly in the south and east of the city of Skikda (north-eastern Algeria) between 2019 and 2023, the first author of this article discovered an escaped population of *Gazania ×splendens* in 2019. For further study, the first author executed several field surveys (at least twice per year) and re-visited the escaped population and the surroundings. The plants were photographed and the geographical coordinates of the population were recorded. An extensive literature search has revealed that this represents a new national record.

In order to collect as much information as possible relating to this recording, targeted surveys and surveys extended to the entire zone (Larbi Ben M’Hidi) were subsequently carried out on foot. The targeted surveys aimed on the one hand to verify the persistence of the taxon (i.e. if the population was present over several years) and to document population change over time and to evaluate its degree of naturalization at the site according to Pyšek et al. (2004); further, the surveys were used to record additional data mainly concerning the mode of reproduction, fruiting and germination of seeds. Further surveys were intended to identify the distribution of cultivated populations of *G. ×splendens*, and possible other escaped populations.

Finally, a bibliographic search was carried out in order to provide an overview of the alien distribution of this taxon worldwide. This was done by consulting various databases, in particular the African Plant Database (ADP 2023), Global Biodiversity Information Facility (GBIF 2023), Euro + Med Plant Base (2023) and Plants of the World Online (POWO 2023). The latter was also consulted to verify the synonymy of the studied taxon.

**Results**

**Locality and population size**

Only one locality and two occurrences with dozens of escaped individuals of *Gazania ×splendens* was recorded (Figure 1). Information about this record are detailed below.

*Gazania ×splendens* Hend. & Andr. Hend.

= *G. ×aurantiaca* Jacob-Makoy, = *G. ×splendens* variegata Burb.

The study taxon was observed for the first time on 3rd March 2019 in the city of Larbi Ben M’Hidi (Municipality of Skikda). The population consisted
of c. 30 mature individuals and more than fifty seedlings growing in sandy soil in the vicinity of a public green space arranged by the inhabitants of the city, where the plants were also cultivated. The individuals observed were 5 to 15 cm tall, and some were flowering (Table 1, Population no 1).

On 7th November 2020 about ten individuals, also of varying sizes, were observed along a sidewalk about 50 m away from the first point of observation. Mature plants and seedlings were growing in sandy soil in cracks and crevices at about fifty meters from the coastal maquis and about ten meters from a semi-natural environment where *Asparagus acutifolius* L., *Daucus carota* L. subsp. *hispanicus* (Gouan) Thell., *Dittrichia viscosa* (L.) Greuter subsp. *viscosa* and *Rubus ulmifolius* Schott grow (Table 1, Population no 2).


Targeted surveys carried out in 2022 and January 2023 revealed the persistence of most individuals recorded in the previous years, except those newly recorded in 2021, which had disappeared. These surveys also showed that this taxon is effectively resistant to summer heat and drought, as individuals exposed to full sun light observed on 19th August 2022 at the edge of the sidewalk still had green leaves after being exposed to temperatures exceeding 42 °C in July and August.
Table 1. Geographic coordinates of recorded populations (escaped and cultivated) of *Gazania × splendens* in Larbi Ben M’Hidi (Skikda, north-eastern Algeria).

<table>
<thead>
<tr>
<th>Population</th>
<th>Id</th>
<th>Habitat</th>
<th>Coordinates (DD)</th>
<th>Altitude (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Escaped</td>
<td>1</td>
<td>Roadside in the vicinity of green space cracks on the edge of sidewalk</td>
<td>36.8826, 6.9825</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td></td>
<td>36.8838, 6.98166</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td></td>
<td>36.884, 6.98121</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td></td>
<td>36.884, 6.98288</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td></td>
<td>36.8829, 6.98373</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td></td>
<td>36.8825, 6.98063</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td></td>
<td>36.8826, 6.9817</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td></td>
<td>36.8799, 6.98045</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td></td>
<td>36.8804, 6.98345</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td></td>
<td>36.881, 6.98197</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Green spaces fitted out along the roadsides and main facades of the villas</td>
<td>36.8803, 6.98206</td>
<td>51</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td></td>
<td>36.8797, 6.98191</td>
<td>47</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td></td>
<td>36.8857, 6.98961</td>
<td>49</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td></td>
<td>36.8854, 6.98619</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td></td>
<td>36.8869, 6.99256</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td></td>
<td>36.8858, 6.99192</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td></td>
<td>36.8855, 6.99511</td>
<td>56</td>
</tr>
</tbody>
</table>

Despite the extension of the surveyed area to the entire Larbi Ben M’Hidi region, no further escaped populations were detected. However, several cultivated occurrences in green spaces along roadsides (most often fitted out by the owners of the villas in front of the main facades of their dwellings) have been recorded (Figure 1).

Monitoring of the phenology of *G. × splendens* revealed that the flowering period of individuals escaped from cultivation is quite prolonged; it lasts almost the whole year. Peak flowering was observed, however, in spring from March until the end of May, when it stops during summer, to resume occasionally in autumn from September onwards; sometimes even in winter, flowers have been recorded. The escaped individuals produce flowers of various colors, some are yellow, others are pink, or even of mixed colors (Figure 2).

Monitoring has shown that *G. × splendens* manages to reproduce easily from seeds which are produced in large quantities from the beginning of June until the end of August. Hundreds of achenes have been observed at the edges of sidewalks among native herbs. However, it also reproduces vegetatively via creeping stems which can form mats, hence its ornamental use as ground cover. This reproductive strategy was observed only in a few individuals that were surrounded by bare earth. For the most part, the nature of the habitat (concrete sidewalk or road) prevented them from forming adventitious roots.

**Status of naturalization**

According to Pyšek et al. (2004), the escaped population of *G. × splendens* can be considered as being in the process of naturalization, because the self-seeding individuals are producing fruits which points at a self-sustaining
population and are gradually increasing in number. However, the time since the first record is too short to allow for a definite assessment as naturalized.

Discussion

Sources of the worldwide distribution of G. ×splendens (e.g. GBIF 2023; Euro+Med Plant Base 2023; POWO 2023) revealed the absence of records for Algeria, and also consulting specialized literature on the Algerian and African flora did not yield any records (e.g. Dobignard and Chatelain 2011; Meddour et al. 2020; ADP 2023). To our knowledge, this record is therefore the first for Algeria. However, these same sources have shown that the taxon is reported as alien in only a few regions of the world, such as Spain where it has been reported as naturalized (Laguna Lumbreras and Ferrer Gallego 2013; Verloove et al. 2019) and Italy where it has been reported as casual (Di Gregorio 2020). In the northern part of the Mediterranean, it is rather G. rigens (L.) Gaertn. which has a larger distribution since it has been reported
as casual in Turkey (Uludağ et al. 2017) and as naturalized in France (Euro+ Med Plant Base 2023), Corsica (Puddu et al. 2016), Spain (Laguna Lumbreras and Ferrer Gallego 2013; Aymerich and Sáez 2019) and Italy (Galasso et al. 2021), although—given the complex taxonomy and nomenclature of this group (see below)—it is not always obvious which taxon exactly is referred to by these authors.

In North Africa as in southern Europe, G. rigens has so far been reported as a weed or as cultivated/subspontaneous in several countries, including Madeira, Morocco, Tunisia (Dobignard and Chatelain 2011) and Libya (Véla 2013), but these records require confirmation since confusion with G. ×splendens cannot be ruled out. Anyway, neither G. rigens nor G. ×splendens has been recorded before in Algeria.

In the field, determination proved to be difficult because the individuals showed substantial morphological variability, particularly in relation to leaf shape and flower color. Laguna Lumbreras and Ferrer Gallego (2013) presented a key for the identification of Gazania specimens escaped in the Valencia area (Spain). However, these authors admitted that, in fact, escaped plants never fully correspond with their wild relatives. Ornamental subjects refer to cultivars and/or complex hybrids and our own observations confirm that Algerian plant material can hardly be ascribed to any of the wild species. We therefore assigned our plants—in accordance with Laguna Lumbreras and Ferrer Gallego’s final proposition—to G. ×splendens, under which name all ornamental plants from this genus (all of which indeed probably arose as a result of artificial hybridization) are preferably classified.

Gazania ×splendens is thus an artificial hybrid obtained from the cross between G. rigens, G. rigida (Burm.f.) Roessler and perhaps other species, all native to South Africa (POWO 2023). This hybrid is widely used in horticulture with different flower colors (Laguna Lumbreras and Ferrer Gallego 2013; Verloove et al. 2019).

Of the 13 Asteraceae species native to South Africa reported as invasive across the world (Pyšek et al. 2020), G. rigens is the only one that is considered invasive in five regions, i.e. Australia, Europe, North America, South America and Atlantic Islands (e.g. Azores, Bermuda, Canary Islands, Madeira, St. Helena). Like its parent, G. ×splendens might show, in the future, a significant invasive behaviour, especially since hybridization has been hypothesized to influence invasion through the generation of evolutionary novelty and/or increased genetic variation, either of which may provide the genetic material for rapid adaptation to new abiotic and biotic conditions (Ellstrand and Schierenbeck 2000; Rieseberg et al. 2007). Moreover, it has been shown that—despite the hybrid nature—the Algerian plant material is able to reproduce from seed.

Given the shown resistance to summer heat and drought and its ability to survive in relatively poor sandy soil, we expect that G. ×splendens might spread in the future in Algeria; in particular, coastal habitats seem to be
suitable, such as coastal rocks and cliffs that the plant colonizes in Spain (Verloove et al. 2019) and coastal dunes that its parent *G. rigens* colonizes in Italy (Galasso et al. 2021).

To conclude, we suggest that *G. × splendens* should remain under surveillance. Given the small size of the sole escaped population, removing it manually would likely be the best solution.

As long as they exist, ornamental plantations serve as a permanent source for the spread of alien plants. To minimize the risk of spread, this would in addition require the phasing out of certain cultivated species in ornamental plantations.

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**Author’s contribution**


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Web sites and online databases


