

## *Biebersteinia orphanidis* (Geraniaceae) from southern Greece

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*Biebersteinia orphanidis* Boiss. (Geraniaceae) is the only European representative of a chiefly Asiatic genus comprising 5 species. It was long presumed extinct in its *locus classicus* on Mt. Killini (N Peloponnisos, Greece) but was recently discovered on a neighbouring mountain, Saitas. Flowering and fruiting material was collected and some of the aerial parts used for a preliminary analysis of essential oils. It was found that the quantity of aliphatic hydrocarbons was rather high (25.74%) and also that oxygenated sesquiterpenes were absent.

Key words: *Biebersteinia orphanidis*, essential oil analysis, Geraniaceae, phytogeography, southern Greece, Turkey

*Biebersteinia orphanidis* Boiss. (Geraniaceae) is a remarkable and interesting species first discovered in 1851 by Th. Orphanidis on Mt. Killini in the northern Peloponnese. A large collection (*Fl. gr. exsicc. no.* 292) must have been made as the taxon is represented in several European herbaria. Despite several searches by various botanists in the following 100 years, it was never found again in Greece and the species was presumed extinct. Heldreich and Chaboisseau made an excursion to Killini in 1887 with the express purpose of rediscovering *Biebersteinia orphanidis* and *Convolvulus libanoticus* Boiss. (syn: *C. radicosus* Heldr. & Sart.). The latter is another rare plant in Greece, at that time known only from a single specimen from Killini. In von Halácsy's obituary of Heldreich (von Halácsy 1902: 330) there is a description as follows:

“Während dieser [*Convolvulus radicosus*] auch tatsächlich zur grossen Befriedigung beider Sammler in einer Menge von Exemplaren angetroffen wurde, so dass sie vollauf genügten zur Herausgabe im Herb. graec. norm., wurde erstere [*Biebersteinia orphanidis*] vergeblich gesucht und muss bis heute noch als eine verschollene Art angesehen werden. Das Aufsuchen derselben soll hiemit den künftigen griechischen Floristen besonders an's Herz gelegt werden.”

*Biebersteinia orphanidis* was later found in central southern Anatolia where it is locally abundant in openings of *Abies cilicica* and *Cedrus libani* forest at 1 700–1 900 m. It was not seen again in Greece until rediscovered 143 years later, in June 1994 by D. Vassiliades and Th. Constantinidis on a mountain c. 20 km from the original lo-

cality. The site of the rediscovery was kept secret by them probably with the good intentions of protecting the rediscovered plants. One of the present authors (KT) was informed that their locality was Mt. Oligirtos, a range south of the *locus classicus* on Mt. Killini.

Davis (1967: 451) in his account of *Biebersteinia* in Turkey had stated that "the disjunct distribution [of *Biebersteinia*] recalls that of *Adonis cyllenea* Boiss." With this hint, what were the possibilities that where *Adonis cyllenea* exists in Greece, there might also be the remnants of a *Biebersteinia* population? Adjacent to Mt. Oligirtos was a previously unbotanized mountain, Saitas. It lies practically at the same latitude as Lefkas, near where G. Sfikas, a keen naturalist and plant photographer from Athens had rediscovered *Adonis cyllenea* (also long considered extinct) in 1976. And so it was to Saitas that KT went in June 1995 together with G. Vold from the Copenhagen Botanic Garden. There, on the northwest slopes, they found *Biebersteinia orphanidis*; this locality was quite independently discovered. More than 500 healthy plants were counted from seven dolines at altitudes between 1 410 and 1 750 m. A shepherd who had his hut in the area informed them that the area was called "Lakkes Saitas", so-called because of the numerous meadow depressions (dolines) which are filled with snow in winter (Fig. 1E). KT and G. Vold have visited Saitas on eight separate occasions since the first visit to monitor the *Biebersteinia* populations. Saitas is floristically little known and is indeed an amazing place, not least because more than 100 000 individual plants of *Adonis cyllenea* also occurred in the locality at altitudes between 1 400 and 1 800 m. When one remembers that up to the year of its rediscovery in 1976 the species was considered extinct, it was exhilarating to witness it as a rampant weed on Saitas. This area certainly holds the largest existing populations in Greece.

### Description of *Biebersteinia orphanidis* (Fig. 1A–C)

Stout perennial herb with a thick,  $\pm$  vertical, woody, pinkish rhizome producing 1–4 flowering stems. Whole plant rather viscid, with patent glandular and eglandular hairs. Basal leaves several, 15–40 cm long, broadly oblanceolate in outline, with scarious stipules, short petiole and 3-pinnatisect blade; ultimate segments lanceolate, acute, c. 1.5 mm wide. Flowering stem erect, 25–50 cm tall and 5–10 mm diam., sulcate or angular. Cauline leaves few, alternate, resembling basal ones but smaller. Inflorescence a dense, spike-like, broadly cylindrical panicle 8–17  $\times$  4–5 cm. Flowers regular, 5-merous, only opening a few at a time. Bracts narrowly ovate, shortly acuminate, much shorter than sepals,  $\pm$  scarious. Calyx inflated; sepals free almost to base, c. 15 mm at anthesis, 20–25 mm in fruit, imbricate, broadly ovate, subacute, pale green or suffused purple, glandular-hispid and softly eglandular-pubescent outside, glabrous within. Petals shorter than sepals, narrowly obovate, denticulate-fimbriate at apex, orange–pink. Fertile stamens 10, shortly connate at base; anthers yellow. Ovary deeply 5-lobed, with short gynobasic style. Fruit a schizocarp; nutlets 5 or fewer by abortion, trigonous with 1 convex and 2  $\pm$  flat sides, c. 5  $\times$  3.5 mm, subobtuse, unbeaked, ash-grey, with a network of raised veins.

*Habitat:* Deep sandy-clayey soil in dolines over limestone, usually in openings of *Abies cephalonica* forest at 1 400–1 750 m; flowering from end of April to mid-May, soon after the melting of snow. The dolines are partly covered by stands of *Pteridium aquilinum* (L.) Kuhn and *Vicia tenuifolia* Roth. but some other interesting plants occurring include *Arum alpinum* Schott & Kotschy, *Cerinth minor* L., *Corydalis* spp., *Marrubium cylleneum* Boiss. & Heldr., *Orchis pallens* L., *Ranunculus brutius* Ten., *R. psilo-*

Fig. 1. — A: *Biebersteinia orphanidis* inflorescence in May (photo N. Turland). — B: Infructescence in June. — C: Young plant in April, after melting of snow. — D: Ripe fruits in July (photo A. Strid). — E: Saitas in April, view of doline still covered with snow. — F: Goats on Saitas in June, after feeding on *Biebersteinia* leaves. Photographs by KT, except A and D.



*stachys* Griseb., *Scrophularia scopolii* Hoppe, *Valeriana tuberosa* L. and, in nitrified places, *Urtica dioica* L.

**Cultivation and conservation:** Plants raised from seed are cultivated in Patras and living plants are also in Copenhagen and London. Seed has been collected and distributed to several botanic gardens so the survival of the Greek plants in cultivation appears secure. In its natural habitat it is vulnerable to grazing, the aerial parts being bitten off by goats (Fig. 1F). The species was not rediscovered until 1994; however, it is conspicuous only in flower or fruit and in the vegetative state, almost impossible to descry from a distance, mixed as it was in a greenery of *Pteridium aquilinum* and *Adonis cyllenea* with leaves of a similar lush and "feathery" appearance. It is possible that it still occurs on Mt. Killini as does *Adonis cyllenea* which until now, was also thought to be extinct in this, its *locus classicus*. In May 1996, plants of the latter were observed growing in a small *Pteridium* patch in a doline on Mt. Killini so at least *A. cyllenea* is not extinct there (Turland, pers. comm. 1996).

## Material and methods

Plants were collected on 4 June 1995 from a population growing at 1 450 m (voucher specimens by Kit Tan & G. Vold deposited in C). 33.6 g of air-dried plant material (aerial part: vegetative parts and fruiting stems) were grossly pulverized and the volatile fraction isolated after hydrodistillation for 3 hours.

The GLC analysis was performed on a Varian 3300 Gas Chromatograph equipped with a column injector (200°C) and a flame ionization detector (250°C). The capillary columns used were DB-1 and DB-5 (30 m × 0.32 mm) and the carrier gas, He (2 m/min). The columns were maintained at 50°C for 5 mins and then heated to 250°C at a 3°C/min rate. Mass spectra were obtained from a GC-MS system operating on EI mode, equipped with a 60 m × 0.25 mm DB-5 capillary column.

The identification of the chemical constituents was based on comparison of the  $R_f$  values and mass spectra with those obtained from authentic samples and/or the NIST/NBS and Wiley library spectra.

## Results

|                              |        |
|------------------------------|--------|
| 1, 3, 5-Hexatriene, 3-methyl | 1.22 % |
| 6-methyl-5-hepten-2-one      | 1.44   |

|   |       |
|---|-------|
| Linalol                                       | 1.11  |
| α-Terpineol                                   | 0.23  |
| trans-Geraniol                                | 0.04  |
| α-Fenchyl acetate                             | 0.11  |
| α-Elemene                                     | 0.03  |
| α-Caryophyllene                               | 0.07  |
| α-Humulene                                    | 1.00  |
| Benzene, 1-(1, 5-dimethyl-4-hexenyl)-4-methyl | 13.41 |
| 4, 5 Dehydro-isolongifolene                   | 0.47  |
| α-Murolene                                    | 0.96  |
| α-Selinene                                    | 1.11  |
| Calarene                                      | 0.54  |
| Spathulenol                                   | 2.43  |
| Veridiflorol                                  | 1.01  |
| Torreyol                                      | 0.95  |
| δ-Cadinol                                     | 3.08  |
| α-Cadinol                                     | 2.49  |
| epi-α-Santalol                                | 2.25  |
| 2-Pentadecanone, 6, 10, 14-trimethyl          | 4.45  |
| Juniper camphor                               | 14.09 |
| Total   | 52.49 |
| Aliphatic hydrocarbons                        | 25.74 |

## Essential oil analysis

This is the first analysis of essential oils performed on a sample of *Biebersteinia orphanidis* from Greece. 22 compounds were identified by capillary gas chromatography and GC-MS. The chemical composition revealed a high proportion of aliphatic hydrocarbons (25.74%) and a complete absence of oxygenated sesquiterpenes. According to some workers, the affinities of the genus have previously been in doubt, e.g., palynological studies by Bortenschlager (1967) suggest that it might be better placed in the Rosaceae rather than in the Geraniaceae to which it is currently assigned. Others have suggested a separate family, Biebersteinaeaceae. A comparison of the essential oils in other members of the Geraniaceae and a discussion of the taxonomic status of *Biebersteinia* in relation to morpho-anatomical (Tutel 1983) and chemotaxonomic data is outside the scope of the present report which deals mainly with the plant's rediscovery in Greece (see also Yannitsaros *et al.* 1996). According to Davis (1967: 451), "the fruits [consisting of 5 hard nutlets, Fig. 1D] are used for making a quite palatable coffee".

The chromosome number of  $2n = 10$  was found in material from Saitas, confirming unpublished counts by Iatrou (pers. comm.) on cultivated material and by Uzal (Ph.D.-thesis, unpubl., pers. comm. 1995) on Turkish material. The same number has also been reported by Uzal in the related *Biebersteinia multifida* DC. from Turkey.

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