Bongardia chrysogonum (*Berberidaceae*) rediscovered on the East Aegean island of Chios

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Abstract. *Bongardia chrysogonum*, last observed on the island of Chios by Olivier c. 1795, has been rediscovered in 2009. This is presumably its only extant population in Europe, the nearest localities being in C and E Anatolia. Ecology, distribution and history of *Bongardia* and the related genera *Leontice* and *Gymnospermium* is discussed. The new nomenclatural combination *Gymnospermium peloponnesiacum* is published.

Key words: *Bongardia*, *Gymnospermium*, *Leontice*, Chios

Introduction

In the European flora the family *Berberidaceae*, in addition to the genus *Berberis* (spiny shrubs) and *Epimedium* (rhizomatous herbs), comprises three small genera of tuberous herbs, all confined to the south-eastern corner of the continent: *Leontice*, *Bongardia* and *Gymnospermium*. Diagnostic characters are as follows (cf. Fig. 1, all photos by A.S.):

Leontice. With basal and cauline leaves, all 2-ternate with long-stalked primary divisions. Inflorescence branched. Petals much smaller than sepals, nectariferous. Fruit conspicuously inflated, bladder-like, smooth, indehiscent. Seed(s) 1(-2), globose, 5–8 mm diam., without strophiole.

Bongardia. All leaves basal, appearing from upper part of tuber, with long flexuous petioles; lamina oblong, imparipinnate; leaflets gross-dentate at apex. Inflorescence branched. Sepals scarious, caducous. Petals longer than sepals. Fruit inflated, pleated, indehiscent. Seeds 2–3, globose, 3–5 mm diam., without strophiole.

Gymnospermium. With 1–3 basal leaves and 1 cauline leaf just below inflorescence, all ternate with stalked, obovate-elliptic, entire segments. Inflorescence a simple raceme. Petals shorter than sepals, nectariferous. Fruit 5–8 mm, subglobose, not inflated; pericarp soon rupturing and exposing the seeds (hence the name). Seeds 2–4, obovoid, with a basal stipe-like strophiole.

In Greece *L. leontopetalum* and *B. chrysogonum* are perennial weeds of ploughed fields, now vanishing as a result of deep ploughing and use of herbicides. *Leontice* is still scattered in the eastern parts of the country, including several Aegean islands, whereas *Bongardia* is exceedingly rare. Both have large distribution areas further east, ranging from Anatolia to Pakistan and C Asia; in the last-mentioned areas they also grow in semi-natural, steppe-like habitats. They were presumably introduced into the eastern Mediterranean area with early agriculture.

The Greek populations of *Gymnospermium* have a different ecology, growing in rocky subalpine habitats (open *Abies cephalonica* woodland and stony meadows) at (800-)1300–1700 m, being confined to NW and C Peloponnisos. It was first discovered on Mt Panachaiko by Halácsy in 1893, and is locally abundant on Mt Klokos some 16 km to the south-

east. Phitos (2003: 82) described Greek plants as *G. altaicum* (Pall.) Spach subsp. *peloponnesiacum* Phitos. Plants from Mt Klokos cultivated in the Göteborg Botanical Garden retain a number of distinctive features, including small size and sessile, obovate leaf segments. They are in fact very different from *G. altaicum* and best regarded as a separate species:

Gymnospermium peloponnesiacum (Phitos) Strid, comb. et stat. nov.; *G. altaicum* (Pall.) Spach subsp. *peloponnesiacum* Phitos, Fl. Hellenica, 2 (2003) 81 (type: Phitos & Kamari 19922, C, UPA).

Another *Gymnospermium* recently discovered in Albania and also cultivated in the Göteborg Botanical Garden is distinctly different in morphology and habitat and best regarded as yet another endemic species, *G. scipetarum* E. Mayer & Pulević.

The Greek distribution of *Leontice leontopetalum*, *Bongardia chrysogonum* and *Gymnospermium peloponnesiacum* is shown in Fig. 2 (prepared from the *Flora Hellenica Database*).

History of *Bongardia chrysogonum*

In *Species Plantarum* (1753: 312) Linnaeus published the name *Leontice chrysogonum*, citing older authors including Rauwolf and Tournefort. The habitat given in *Species Plantarum* was "inter Graeciae segetes". Rauwolf had apparently collected this plant near Aleppo in Syria c. 1573, and identified it with the *Chrysogonum* of Dioscorides. Tournefort may have found it on his travels in the Aegean area 1700–1702. The species was later transferred to the genus *Bongardia* C.A. Mey. Endlicher (1841) and Grisebach (1843) have been credited with the recombination *B. chrysogonum*, but the first to publish it was apparently Spach in *Histoire Naturelle des Végétaux* 8: 65 (1838). *Bongardia olivieri* C.A. Mey. and *B. rauwolfii* C.A. Mey. are synonyms of *B. chrysogonum*.

The French naturalist G.A. Olivier travelled in the Levant 1792–1798, and subsequently published *Voyage dans l'empire Othoman* (3 vols., 1801–1807). He is likely to have found *B. chrysogonum* on the island of Chios, since Boissier in *Flora Orientalis* 1: 99 (1867) cites "Hab. in cultis argillosis insularum Graeciae ad Chio (Olivier!), Astypaleam (Urv!), Rhodum (Auch!), Bithyniae (Sibth!) ...". In Olivier's publication (vol. I, chapter 26, pp. 276–297) is an account of his visit to Chios, but *Bongardia* is not mentioned and there is no specimen at Herbarium G (information courtesy L. Gautier), but possibly at P.

The record from Astipalea (SE Aegean area) long remained enigmatic. The plant was gathered by the French naval officer J. Dumont d'Urville in 1819 or 1820. In his publication *Enumeratio plantarum in Oriente lectarum* (1822) it appears under the name of *L. leontopetalum*. Boissier (loc. cit.) inexplicably changed the name to *B. chrysogonum*, and this was followed by all subsequent Floras, including *Flora Europaea* (1: 145, 1964, albeit with a question mark). In 1998, one of the authors (A.S.) had the opportunity to study d'Urville's specimen in the Paris Herbarium (P); it is indeed *L. leontopetalum*, and the only report of *B. chrysogonum* from the *Flora Europaea* area thus rested on a mistake by Boissier.

The record from Rodos (like Chios outside the Flora Europaea area) refers to a specimen collected by Aucher-Éloy in 1837 and kept in the Boissier Herbarium (G-BOIS); the label reads "Rhodes" [hand written] and "Aucher-Eloy Herbier d'Orient n° 393" [printed] (information courtesy L. Gautier). Since there is no specified locality the record has not been included in the map (Fig. 2). The species has not been subsequently found on Rodos.

The *Florae Graecae Prodromus* (1: 234, 1809) reported *Leontice chrysogonum* "prope Abydum legit Sibthorp" [Abydus is an ancient Greek city on the southeastern shore of the Hellespont, modern Çanakkale]. In the same publication *L. leontopetalum* was cited "inter segetes Graeciae vulgaris". Sibthorp's collection is apparently the basis for Boissier's "Bithyniae (Sibth!)". From Sibthorp's second journey is a record in his diary from the vicinity of Gallipoli [Gelibolu] dated 11 September 1794: "The dead stalks of *Leontice leontopetalum* were blown over the fallow fields with its round black pea-shaped seed inclosed in its inflated capsule, the reticulated case of which only remained" (cited from Lack 1999: 155). The dry infructescences of both *L. leontopetalum* and *B. chrysogonum* may be dispersed as tumbleweeds, the seeds being gradually released as the thin, papery pericarp disintegrates. *Leontice* still occurs in this area, whereas *Bongardia* is apparently extinct and not found until much further east in Anatolia (grid squares B6 and C6, fide Fl. Turkey 1: 212, 1965).

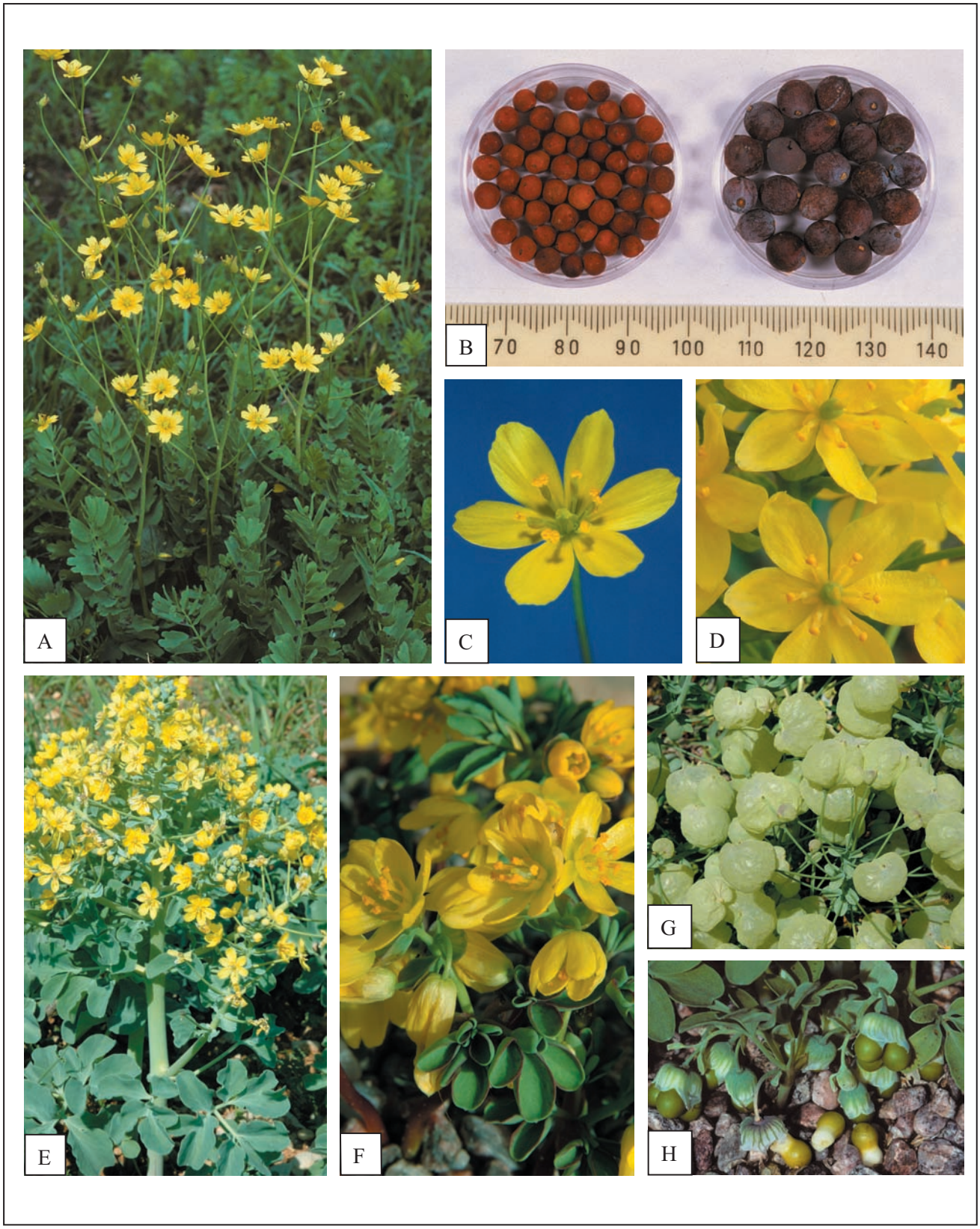
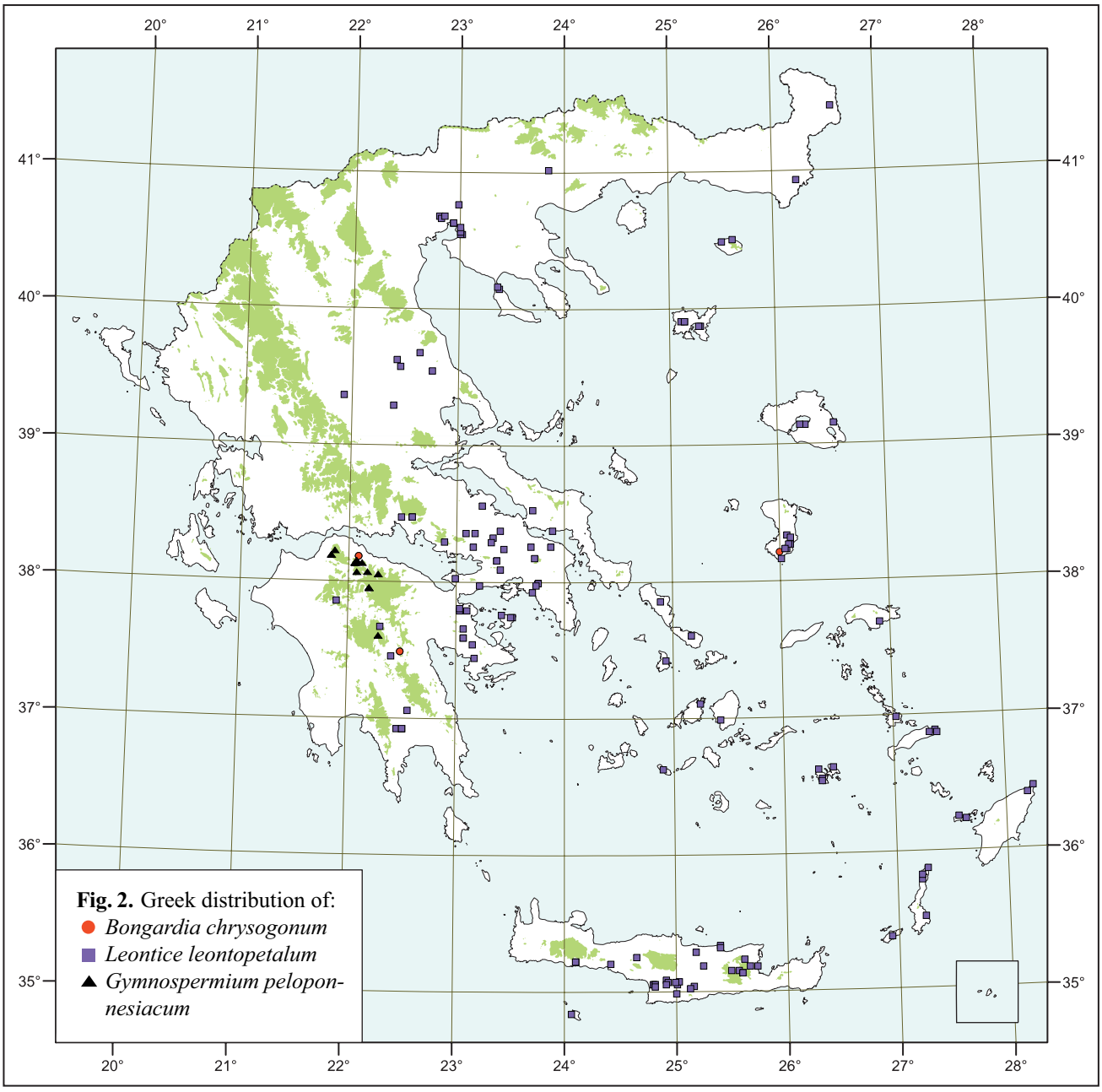


Fig. 1. The Greek species of tuberous *Berberidaceae*. **A** & **C**: *Bongardia chrysogonum* (Strid 25491, Achladea); B: Seeds of *B. chrysogonum* (left) and *Leontice leontopetalum* (right); scale in mm; **D, E** & **G**: *Leontice leontopetalum*; **F** & **H**: *Gymnospermium peloponnesiacum* (Strid 45556, Mt Klokos)



The most recent record of *B. chrysogonum* from the general area of Greece and western Anatolia was thus the gathering by Aucher-Éloy on Rodos in 1837.

Rediscovery of *Bongardia chrysogonum* in Peloponnisos

Collecting in northern Peloponnisos near the village of Achladea (nom. Achaias, ep. Egialias) on 30 March 1987, the second author (A.S.) came across a small, semi-fallow cereal field in an opening of *Pinus halepensis* forest at an altitude of c. 350 m. *Leontice leontopetalum* was locally abundant in this locality; in the field and adjacent woodland margins were several other bulbous and tuberous plants such as *Anemone apennina* subsp. *blanda*, *Barlia robertiana, Bunium ferulaceum, Crocus olivieri, Cyclamen peloponnesiacum, Euphorbia apios, Gagea peduncularis, Hermodactylus tuberosus, Muscari commutatum, Ophrys aseculapii, O. argolica, O. lutea, Orchis laxiflora, Ornithogalum nutans* and

Scaligeria napiformis. Mixed with *Leontice* were 30–40 flowering individuals of another member of the *Berberidaceae*, unknown at the time but soon identified as *B. chrysogonum*. A small herbarium collection was made and two tubers were transferred to the Copenhagen Botanical Garden where they survived for many years. An analytical line drawing of a specimen from this locality was published by Strid (1989: 41). In the following years the locality declined as the field was abandoned and gradually reverted into garigue; by 1998 both *Leontice* and *Bongardia* seemed to have disappeared altogether. They were searched for in vain in other suitable localities in the vicinity. On 23 May 1994, Kit Tan & al. found a small population of *Bongardia chrysogonum* at the edge of a fallow field near the village of Agiorgitika (nom. Arkadias, ep. Mandinias) at an altitude of 670 m, growing with *L. leontopetalum* and *Gladiolus italicus*. Only two leaves were collected, enough for positive identification. Presumably it is now extinct also in this second locality.

By the end of the 20th century, *B. chrysogonum* had thus been found and again lost as a member of the European flora.

Rediscovery of *Bongardia chrysogonum* on Chios

The island of Chios is famous for its four species of tulips, three of which (*T. agenensis, T. clusiana* and *T. praecox*) are ancient introductions now well established in terraced fields and olive groves around the villages of Agios Georgios Sikousios, Vavili, Zifias, Kallimasia, etc. The fourth tulip, *T. undulatifolia*, is native and found in semi-natural habitats as well as fields and mastic groves in the southern and south-eastern parts of the island. A number of other bulbous and tuberous plants of fallow fields are also known to occur in Chios, e.g. *Allium cyrilli, A. nigrum, A. roseum, Bellevalia trifoliata, Bunium ferulaceum, Geranium tuberosum, Gladiolus italicus* and *Ornithogalum nutans*.

On 22 March 2009, the first author (R.K.), discovered *B. chrysogonum* in the southern part of the island of Chios, along the road from Pirgi to the bay of Karinta at an altitude of 140 m. The locality is an olive grove facing NW with deep clay as well as adjacent patches of nearly flat, stony garigue. A total of c. 50 flowering individuals were observed as well as possibly four times as many sterile plants. Small samples have been deposited at LD as well as in the private herbaria of the two authors.

Woody plants observed in the outskirts of the olive grove on the first visit and on a subsequent visit in June 2009 were *Anagyris foetida, Fraxinus ornus, Phillyrea latifolia* and *Pistacia lentiscus*. Herbs and grasses included *Aegilops biuncialis, Allium pallens, Asparagus acutifolius, Brachypodium distachyon, Geropogon hybridus, Helichrysum stoechas* subsp. *barrelieri, Lagoecia cuminoides, Ononis pubescens, Salvia fruticosa, Scaligeria cretica* and *Torilis leptophylla*. Small trees and shrubs in the garigue were *Anagyris foetida, Ceratonia siliqua, Clematis cirrhosa, Fraxinus ornus, Phillyrea latifolia, Pistacia lentiscus, Pyrus spinosa* and *Quercus coccifera*. Notes were also made of the following herbs, subshrubs and grasses: *Atractylis cancellata, Asparagus acutifolius, Ballota acetabulosa, Brachypodium distachyon, B. retusum, Eryngium campestre, Fumana arabica, Geropogon hybridus, Helichrysum stoechas* subsp. *barrelieri, Hordeum bulbosum, Hymenocarpus circinnatus, Hypericum triquetrifolium, Lagoecia cuminoides, Melica ciliata, Ononis pubescens, Orchis coriophora* subsp. *fragrans, Phalaris aquatica, Plantago afra, Scaligeria cretica, Teucrium divaricatum, Tordylium aegaeum, Trifolium scabrum* and *T. tomentosum*.

Bongardia chrysogonum can thus be added to the list of lost and found species in Greece. The time span from its first discovery on Chios c. 1795 to its rediscovery in 2009 is the longest recorded so far for any species. Like other bulbous and tuberous plants of a similar habitat it is dependent on annual tilling by traditional methods. It will be uprooted by deep ploughing, killed by herbicides and gradually choked by more aggressive species if the grove is abandoned and reverts into garigue. It best hope would seem to be for the traditional mastic growers of southern Chios to adopt it as an emblem.

Additional remark

When preparing this typescript the authors were unaware of the fact that *B. chrysogonum* was observed (but not collected) on Chios in 2005 (Tan & al. 2009). The current collection thus confirms the report by Güner & Green.

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