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***Dianthus haematocalyx* subsp. *phitosianus*
(*Caryophyllaceae*), a New Serpentine Endemic
from Greece**

By

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With 4 Figures

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Summary

CONSTANTINIDIS Th. 1999. *Dianthus haematocalyx* subsp. *phitosianus* (*Caryophyllaceae*), a new serpentine endemic from Greece. – *Phyton* (Horn, Austria) 39 (2): 277–291, 4 figures. – English with German summary.

Dianthus haematocalyx BOISS. & HELDR. subsp. *phitosianus* CONSTANTINIDIS, a new subspecies from Greece, is described and illustrated. It differs from all the related taxa of *D. haematocalyx* in its decumbent habit, the lanceolate to ovate cauline leaves, and the triangular awns of epicalyx scales. Its chromosome number of $2n = 30$ is reported. The new taxon appears to be a narrow serpentine endemic, growing on dry slopes sparsely covered with vegetation, or on gravel and scree close to Aliki settlement and NE Loutraki (Sterea Ellas). It occupies the southernmost known distribution range of any of its allied taxa. With respect to their distribution and geolithological preferences, the plant taxa that occur on serpentine in central Greece may be classified into four main categories.

Zusammenfassung

CONSTANTINIDIS Th. 1999. *Dianthus haematocalyx* subsp. *phitosianus* (*Caryophyllaceae*), ein neuer Serpentin-Endemit aus Griechenland. – *Phyton* (Horn, Austria) 39 (2): 277–291, 4 Abbildungen. – English mit deutscher Zusammenfassung.

Dianthus haematocalyx BOISS. & HELDR. subsp. *phitosianus* CONSTANTINIDIS wird als neue Unterart aus Griechenland beschrieben und illustriert. Sie unterscheidet sich von allen anderen verwandten Taxa von *D. haematocalyx* durch ihre

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Dedicated to Prof. Dr. Dimitrios PHITOS (Patras) on occasion of his award of Professor Emeritus.

niederliegende Wuchsform, ihre lanzettlichen bis eiförmigen Stengelblätter und ihre dreieckigen Grannen der Hüllschuppen. Ihre Chromosomenzahl von $2n = 30$ wird dargestellt. Das neue Taxon ist anscheinend ein strenger Serpentin-Endemit, der auf trockenen Hügeln mit spärlicher Vegetation oder auf Kies und Geröllhängen in der Nähe von Alikí und Loutraki (Stereá Ellás) wächst. Die neue Unterart nimmt den südlichsten Teil des Areals von *D. haematocalyx* s. l. ein. Die Pflanzentaxa, die auf Serpentin in Zentralgriechenland vorkommen, können hinsichtlich ihrer Verbreitung und geolithologischen Präferenzen in vier Hauptkategorien klassifiziert werden.

Introduction

The genus *Dianthus* is particularly well represented in the Mediterranean area with a total of c. 135 species (GREUTER & al. 1984). The vast number of species and the fact that certain of them have been further divided into numerous subspecies indicate that the Mediterranean area acts as an evolutionary centre for the whole genus. Owing to considerable morphological plasticity and ecological adaptation some groups of *Dianthus* are taxonomically difficult and good morphological characters allowing accurate determination may be scarce.

In Greece, a recent revision of the genus (STRID 1997) resulted in a total of 44 species and a further 7 species dubiously or incorrectly reported. The most extreme examples of morphological variation are exhibited by the chasmophytic and narrowly endemic groups of *Dianthus fruticosus* L. and *D. juniperinus* SM., each of which encompasses eight subspecies (RUNEMARK 1980, TURLAND 1992). Such a pronounced infraspecific differentiation is supposedly facilitated by insular isolation, palaeogeographical events and adaptive radiation. Although most of the Greek *Dianthus* taxa show a wider distribution, some 14 species out of 44 are considered endemic or are presumably endemic (STRID 1997).

Certain serpentine areas of Greece have recently been visited in order to examine plant diversity, regional or narrow endemism, species phyto-geography and specific ecological traits associated with the geological substrate. These areas have a patchy distribution in Greece, but are mainly concentrated in the northwest. A visit to one of the smallest serpentine areas of Stereá Ellás (East Central Greek mainland) in 1998 resulted in the discovery of a distinct *Dianthus* population, which seemed to deviate from all other Greek species. When first visited, the individuals were not in flower, but attracted attention because of their remarkably broad leaves. The area was visited again about a month later when the plants were in full flower. Soon, it was realized that this population is taxonomically related to the group of *D. haematocalyx* BOISS. & HELDR., but it falls well outside the known morphological variation of any of its four subspecies.

Material and Methods

To ascertain that our new taxon is not covered by the morphological variation of the four known subspecies of *Dianthus haematocalyx*, all the relevant specimens

kept at the Herbarium of the University of Patras (UPA) and the Herbarium of Goulandris Natural History Museum (ATH) were examined in detail. A total of fifty-two specimens was consulted. Seeds of the new taxon were collected in the field and sown in pots in the autumn. The plants were cultivated in the experimental botanical garden of the University of Patras. For karyological examination, fresh root tips were pretreated with an aqueous solution of 8-hydroxyquinoline (0.3 g/l) for 3–3.5 hours at 4 °C. For further procedure see CONSTANTINIDIS & al. 1997.

Dianthus haematocalyx subsp. *phitosianus* CONSTANTINIDIS subsp. nova (Fig. 1, 2)

Diagnosis: Herba perennis. Caules floriferi 6–22 cm longi, decumbentes vel arcuati. Folia basalia lanceolata vel late lanceolata, acuta, 12–65 mm longa, 2.0–4.5 mm lata, florendi tempore subpersistentia, plerumque sicca. Folia caulina erecta, glabra, lanceolata vel ovata, acuta, 12–30 mm longa, 3.0–7.5 mm lata, margine papilloso-scabridiuscula, subtus valde nervosa. Squamae calycinae 4(–6), exteriores lanceolatae, interiores ovatae, basi pallide scariosae, supra parte striatae, sensim longe attenuatae, calyce breviores. Calyx tubulosus vel infra medium paulo dilatatus, 16–22 mm longus, 4.8–8 mm latus (in sicco), viridis vel partim purpureus, elevate plurinervius, dentibus lanceolatis, valde acuminatis, margine scariosis. Petalorum lamina obovato-cuneata, 5–8 mm lata, supra roseo-vioacea striis purpureis notata, subtus pallida, incise dentata.

Numerus chromosomaticus $2n = 30$.

Description: Moderately to laxly caespitose perennial. Flowering stems 6–22 cm, decumbent to arcuate. Basal leaves lanceolate to broadly lanceolate, acute, 12–65 × 2.0–4.5 mm, green to dark green, rigid, scabrid, mostly withered at anthesis. Cauline leaves 4–7 pairs, evenly spaced, lanceolate to ovate, acute, 12–30 × 3.0–7.5 mm, at least lower ones papilloso-scabrid, nerves 3–5, median and marginal nerves distinct and raised; leaf sheaths c. as long as diameter of stem. Flowers solitary or 2 to 5 per stem, rarely up to 10, clusters lax. Epicalyx scales 4(–6), 8–13 mm, usually c. 1/2 to 3/5 as long as calyx and rarely more, patent to erecto-patent, outer ones resembling upper leaves, inner ones gradually passing into a 1.5–5.5 mm, narrowly to broadly triangular awn, or rarely awn rudimentary; upper part of scales striate. Calyx cylindrical or broader at lower part, 16–22 × 4.5–8 mm (in dry condition), green to suffused purple, striate; teeth narrowly triangular, acuminate, ciliolate. Petals 22–27 mm, sparsely bearded at base of limb, obovate, irregularly dentate; limb 7–10 mm, light pink with darker veins above, yellowish-gray beneath. Capsule slightly shorter to equaling calyx. Seeds black, strongly compressed, c. 2.5 mm.

Chromosome number $2n = 30$.

Typus: [Greece] Nomos Viotias, Eparchia Thivon, c. 6.6 km S of Xironomi village along road to Aliko. An ophiolitic area W of the road. Slopes with phrygana and



Fig. 1. Habit of *Dianthus haematocalyx* subsp. *phitosianus* CONSTANTINIDIS. – The specimens were drawn from dry material; in their habitat, the flowering shoots normally lie on the ground.

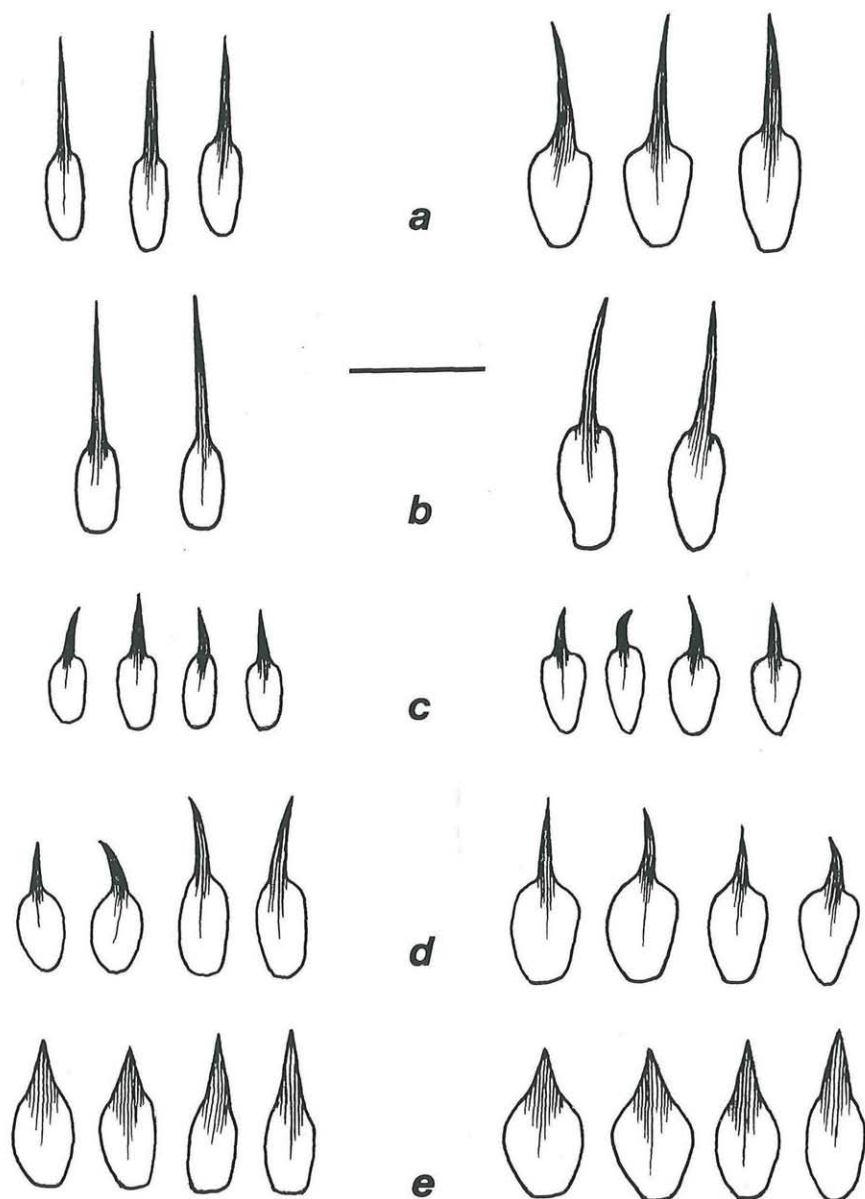


Fig. 2. Outer (left column) and inner (right column) epicalyx scales of *Dianthus haematocalyx* – a. *D. haematocalyx* subsp. *haematocalyx* – b. *D. haematocalyx* subsp. *pruinosis* – c. *D. haematocalyx* subsp. *pindicola* – d. *D. haematocalyx* subsp. *ventricosus* – e. *D. haematocalyx* subsp. *phitosianus*. – Scale bar = 1 cm.

low sparse shrubs, stony places. Alt. 320–350 m, Lat. 38°12' N, 23°02' E, 22.05.1998, CONSTANTINIDIS 7693 (holotypus UPA; isotypi B, C, UPA).

Taxonomy and Distribution

Dianthus haematocalyx subsp. *phitosianus* belongs to the group of *D. haematocalyx*, a species endemic to the S. Balkan Peninsula and hitherto known to comprise four subspecific taxa. The current taxonomy of *D. haematocalyx* (STRID 1997) reflects the views of HAYEK 1924, and subspecific rank was chosen for the evidently allopatric taxa because of the existence of intermediate forms, which occasionally make determination difficult.

D. haematocalyx subsp. *phitosianus* differs considerably from all four subspecies of *D. haematocalyx* in its decumbent to arcuate habit, the lanceolate to ovate, dark green and rigid cauline leaves which are broader than 3 mm, the broad epicalyx scales that are gradually passing into triangular awns, the evident green striations on upper parts of epicalyx scales, and the relatively broader calyx. In all other subspecies of *D. haematocalyx* the stems (when present) are ascending to erect, the cauline leaves are linear to linear-lanceolate, less than 3 mm broad, the epicalyx scales are rather abruptly passing into the subulate to narrowly lanceolate awns and the calyx is narrower. The inner and outer epicalyx scales of all subspecies of *D. haematocalyx* are presented in Fig. 3. Broad leaves may be found in the dwarf *D. haematocalyx* subsp. *pindicola* (VIERH.) HAYEK from the high mountains of N. Pindos, but they are basal, not cauline, and of a different shape. From this taxon, *D. haematocalyx* subsp. *phitosianus* differs further by its well-developed stems (absent or 6 cm at most in *D. haematocalyx* subsp. *pindicola*), and the 4–7 evenly spaced cauline leaves (0–4 in *D. haematocalyx* subsp. *pindicola*). Judging from the general habit, subsp. *phitosianus* seems to come closer to subsp. *haematocalyx*, but differs from it by the diagnostic characters.

The following key is useful in differentiating between the five subspecies of *Dianthus haematocalyx*:

1. Stems decumbent to arcuate, cauline leaves lanceolate to ovate, more than 3.0 mm broad, awn of inner epicalyx scales triangular to broadly triangular
D. h. subsp. *phitosianus*
- 1'. Stems ascending to erect, cauline leaves linear to narrowly lanceolate, less than 3.0 mm broad, inner epicalyx scales with a subulate to narrowly lanceolate awn 2
2. Laxly caespitose to caespitose, stems longer than 6 cm and at least some bearing more than one flower; calyx > 18 mm, awn of epicalyx scales usually longer than 4.5 mm
3
- 2'. Moderately to densely caespitose, stems less than 7 cm, mostly 1-flowered; calyx < 18 mm, awn not more than 5 mm
4
3. Stems green, cauline leaves linear-lanceolate, calyx cylindrical or somewhat broader at middle
D. h. subsp. *haematocalyx*

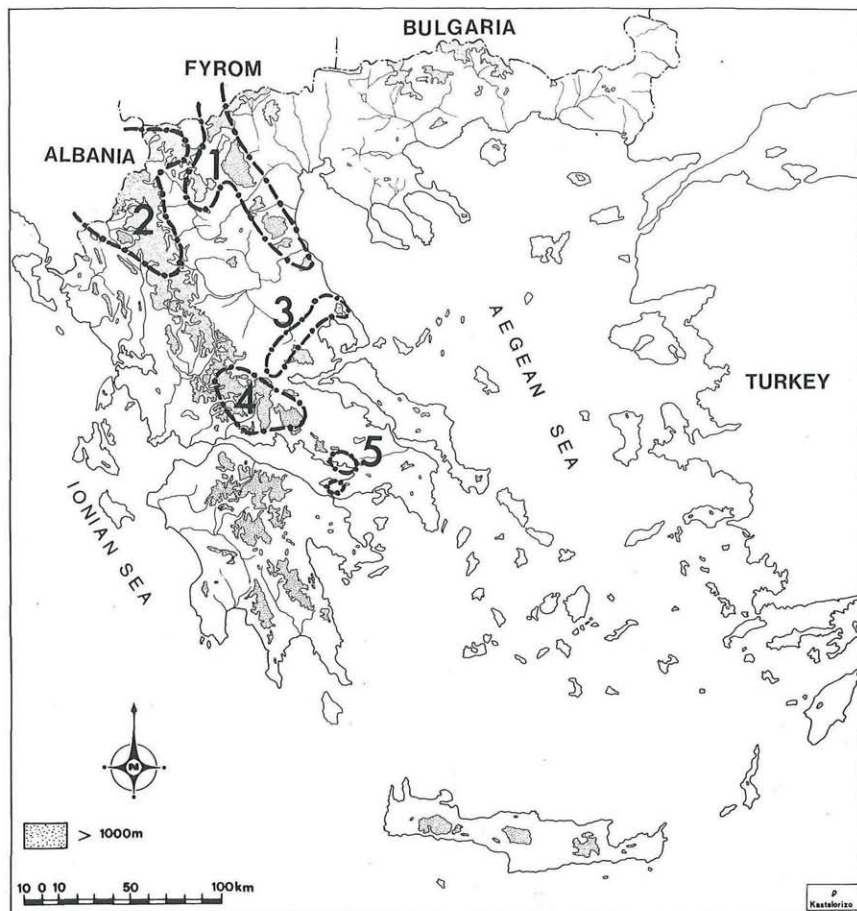


Fig. 3. Geographical distribution of the five subspecies of *Dianthus haematocalyx* in Greece. – *D. haematocalyx* subsp. *haematocalyx* (1). – *D. haematocalyx* subsp. *pindicola* (2). – *D. haematocalyx* subsp. *pruinusos* (3). – *D. haematocalyx* subsp. *ventricosus* (4). – *D. haematocalyx* subsp. *phitosianus* (5).

- 3'. Stems glaucous-green, somewhat pruinose, cauline leaves linear, calyx cylindrical, somewhat tapering at base *D. h.* subsp. *pruinusos*
4. Basal leaves broadly lanceolate to narrowly elliptic, more than 1.5 mm broad, petals usually less than 21 mm, pink-purplish above *D. h.* subsp. *pindicola*
- 4'. Basal leaves linear to lanceolate, less than 1.5 mm broad, petals usually more than 21 mm, pink above *D. h.* subsp. *ventricosus*

The geographical distribution of *D. haematocalyx* subsp. *phitosianus* is very narrow. The taxon is localized to a relatively small serpentine outcrop of Sterea Ellas close to the settlement of Aliki, the area itself not exceeding 5 km in diameter. Another small population was recently discovered NE. of

Loutraki at the lower SW. parts of Mt. Gerania. The new taxon is distributed further south than *D. haematocalyx* subsp. *ventricosus* MAIRE & PETIT., up till now the southernmost known member of the group (Fig. 3). The altitudinal distribution of the two taxa is however strikingly different: *D. haematocalyx* subsp. *ventricosus* is not reported below the altitude of 1500 m, while subsp. *phitosianus* does not ascend above 350 m.

A report of *D. haematocalyx* subsp. *pruinosis* (BOISS. & ORPH.) HAYEK from the S. part of Evvia island (NE. Karistos, CONSTANTINIDIS s.n., UPA) given by STRID 1997 should be read with caution. This specimen has short and patent eglandular hairs at the lower part of the stem and on basal leaves, sparse glands on the lower and middle part of the stem, and ciliate epicalyx scales and calyx teeth. It seems to represent a robust form of *D. diffusus* SM. and should be preferably excluded from the group of *D. haematocalyx* until more material from southern Evvia points to the contrary.

Ecology and Karyology

Dianthus haematocalyx subsp. *phitosianus* is restricted to ophiolite, at an altitude of 10 to 350 m. Although searched for, it was not found on the calcareous slopes that surround the small ophiolitic outcrop close to the settlement of Alikí or on the limestone areas of Mt. Gerania. In Alikí, the new taxon is localized and with clear ecological preferences. Plants of *D. h.* subsp. *phitosianus* grow scattered on gravel, slopes of low hills, dry shallow ravines, scree and dry streambeds. Some of these localities look bare and infertile, with *Dianthus* being the only perennial species growing in them. In some other localities, our new taxon is accompanied by a few tiny and ephemeral annual taxa like *Biscutella didyma* L., *Clypeola jonthlaspi* L. and *Rumex bucephalophorus* L. subsp. *aegaeus* RECH. fil. When it grows at the margins of phrygana vegetation it can be found together with *Aethionema saxatile* (L.) R. Br., *Anthyllis hermanniae* L., *Bituminaria bituminosa* (L.) STIRTON, *Centaurea pelia* DC., *Crepis dioscoridis* L., *Heli-chrysum barrelieri* (TEN.) GREUTER, *Papaver rhoeas* L. and *Silene corinthiaca* BOISS. & HELDR. Our observations indicate that *D. h.* subsp. *phitosianus* never enters areas with a dense vegetation cover composed either of low phrygana such as *Coridothymus capitatus* (L.) REICHENB., *Sarcopoterium spinosum* (L.) SPACH and *Euphorbia acanthothamnus* HELDR. & SART., or of scrub such as *Juniperus phoenicea* L., *Calicotome villosa* (POIRET) LINK and *Phillyrea latifolia* L. However, it easily colonizes new ecological niches like gravel margins of the asphalt road and small heaps of bare soil put aside by workers in road construction. Its main flowering period is from mid-May to mid-June, depending on local environmental conditions.

Dianthus haematocalyx subsp. *phitosianus* exhibits some different ecological traits compared to the four subspecies of *D. haematocalyx*. In

contrast to *D. h.* subsp. *phitosianus*, *D. haematocalyx* subsp. *pindicola* and subsp. *ventricosus* are taxa of high altitude, not reported below 1000 m. Their densely caespitose form, dwarf habit and low stems evidently represent ecological adaptations to the harsh mountain climate. As regards soil properties, both *D. h.* subsp. *phitosianus* and subsp. *pindicola* share a preference for serpentine soils, while *D. h.* subsp. *ventricosus* generally grows on limestone. The other two taxa, *D. haematocalyx* subsp. *haematocalyx* and subsp. *pruinosis* are taxonomically closely related. The former covers a wide altitudinal range from c. 400 to 2150 m or higher and appears on a variety of substrates, more often on limestone. The latter is a lowland taxon, collected both on limestone and serpentine (STRID 1997).

Eleven plants of *Dianthus haematocalyx* subsp. *phitosianus* originating from CONSTANTINIDIS 7756 and grown from seed were examined karyologically. They revealed a diploid cytotype with $2n = 2x = 30$ (Fig. 4a, b). The chromosomes are small, mostly metacentric, c. 0.6–1.3 μm long and rather poorly stained. Although detailed morphological observations are difficult, at least two pairs of satellites were observed in the complement (Fig. 4a, b). The same chromosome number of $2n = 30$ has been counted in the related *D. haematocalyx* subsp. *haematocalyx* (STRID & FRANZÉN 1981) and *D. haematocalyx* subsp. *ventricosus* (FRANZÉN & GUSTAVSSON 1983) from Greece. FEDOROV 1969 reports tetraploid cytotypes in *D. haematocalyx* but without mentioning subspecific status of the populations examined.

Notes on plant taxa from central Greek serpentine outcrops

The serpentine areas of central Greece form discontinuous “islands” of a variable surface extent, mostly at low altitude. Remarkable cases of edaphic endemism have been reported in these areas, with *Dianthus haematocalyx* subsp. *phitosianus* being the latest in a series of taxa showing particular ecological preferences and well-defined chorological patterns. Obviously, mainland “islands” do not exist amidst a void of vascular plant resources and are not sufficiently isolated by natural barriers from the adjacent mainland. However, evidence suggests that island biogeography theory can be applied to mainland geodaphic discontinuities, taking into consideration certain constraints (KRUCKEBERG 1991).

For practical reasons, the plant taxa growing on the serpentine outcrops of central Greece (generally not exceeding a latitude of 39°30' N) can be classified into one of the following categories:

1. Very narrow endemic taxa known from only one serpentine area.

Among them, one may mention *Bufonia euboica* PHITOS & KAMARI from central Evvia (PHITOS & KAMARI 1992), *Centaurea attica* NYMAN subsp. *megarensis* (HALÁCSY & HAYEK) DOSTÁL from the serpentine part of Mt. Gerania (CONSTANTINIDIS 1997), *Onosma stridii* TEPPER from the serpen-

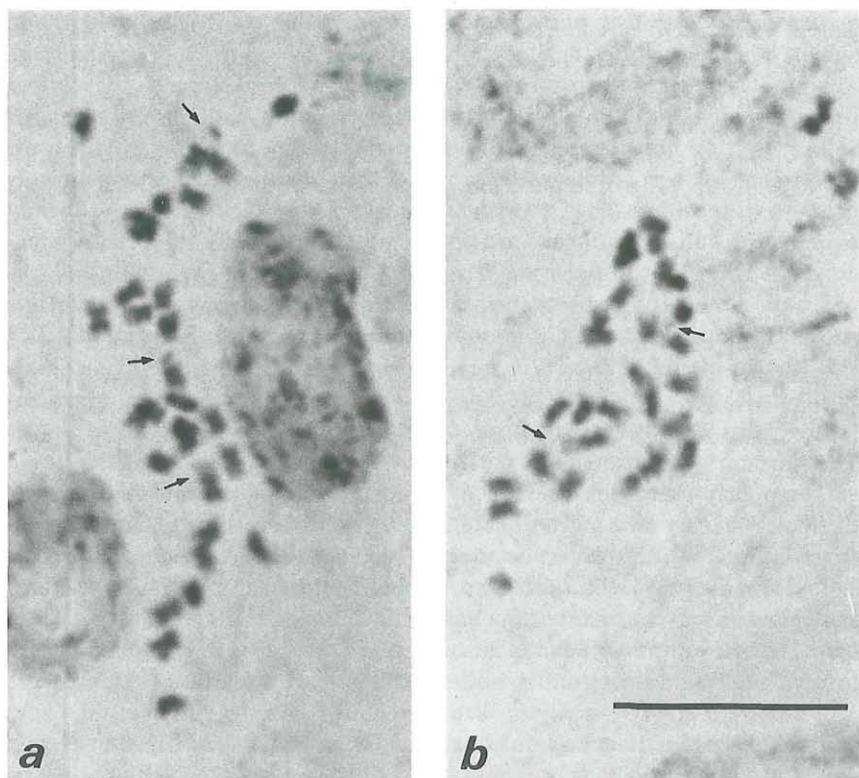


Fig. 4. a–b. Mitotic metaphase plates of *Dianthus haematocalyx* subsp. *phitosianus* with $2n = 30$. – Arrows indicate SAT-chromosomes. – Scale bar = 10 μm .

tine part of Mt. Kallidromon (TEPPNER 1988), etc. These taxa can be considered as the result of local speciation processes, and are mostly neoendemics, with their relatives distributed in surrounding areas. It is assumed that these same taxa may have found a refuge on serpentine due to the physical and chemical properties of this rock, that provide a degree of ecological separation and protection from more competitive plant species.

2. Endemic taxa with a restricted distribution to a few serpentine outcrops, generally not known to grow on different geological substrates.

Taxa like *Polygonum papillosum* HARTVIG from three localities of Sterea Ellas (HARTVIG 1989), *Silene fabaria* (L.) SM. subsp. *domokina* GREUTER from Domokos and Mt. Gerania (GREUTER 1995, CONSTANTINIDIS 1997) and *Thymus teucrioides* BOISS. & SPRUNER subsp. *candilicus* (BEAUV.) HARTVIG belong to this category. Disjunct distributions of specialized serpentine taxa may be either due to long dispersal of propagules or to fragmentation of previously more widespread populations. It should be noted

that some of these taxa have their associates (often belonging to a different species or subspecies) in a neighbouring area.

3. More widespread taxa with a special preference for serpentine.

Among them, one can mention *Cerastium ramosissimum* BOISS., *Lepotolax emarginata* (BOISS.) O. E. SCHULZ, *Notholaena marantae* (L.) DESV. subsp. *marantae*, *Thlaspi pindicum* HAUSSKN., etc. These taxa are not confined to central Greece and show a wider distribution in the Balkan Peninsula, the Mediterranean area or elsewhere. Some of them can be considered as useful bioindicators of specific geolithology. Others (e.g. *Cerastium ramosissimum*) are characterized by widely disjunct distribution areas, while the fern *Notholaena marantae* is presumably a Tertiary relict (PICHI-SERMOLLI & CHIARINO-MASPES 1963).

4. Taxa (endemic or not) that show no particular preference with regard to geological substrate.

A great variety of plant species belongs here. In certain cases the serpentine populations show adaptations that are reflected in the morphology or micromorphology of the species, e.g. changes of indumentum observed in *Vinca herbacea* WALDST. & KIT. and development of pigments in *Centaurea achaia* BOISS. & HELDR. s.l. (CONSTANTINIDIS unpubl.). These changes are covered by the collective term "serpentinomorphosis" and characterize ecotypes. Genetic adaptations may also exist (e.g. tolerance to high concentrations of heavy metals) but there are no published data on populations of Central Greece. Repeated selection of particular genotypes of widespread taxa induced by the serpentine soil should not be ruled out.

Our preliminary results obtained through the study of plant diversity over serpentine in central Greece indicate that even areas of small size covered with serpentine may be of importance to plant speciation and evolution. Serpentine taxa may further present interesting phytogeographic patterns and form populations tolerant to certain types of industrial contamination. Hyperaccumulation of metals (especially Ni) by serpentine species may be useful in phytoremediation and phytomining. For these reasons, serpentine areas often merit conservation priority. Despite the interest, only few papers have been devoted to the study of plant life on central Greek serpentines (KRAUSE & al. 1963, LAULUND 1989, CONSTANTINIDIS 1997) and further work should be conducted in the future.

Specimina Visa

Dianthus haematocalyx subsp. *haematocalyx*

GREECE: Prov. and distr. Pieria, Mts. Pieria, S.E. slopes, summit of Kteni, between Kopanes and Padhi, stony ground, 1300–1450 m, 7.8.1971, STAMATIADOU 13715 (ATH). Prov. and distr. Pieria, Mts. Pieria, S.E. slopes, between Padhi and summit

Kteni, stony ground, 1500–1700 m, STAMATIADOU 13741 (ATH). Prov. and distr. Pieria, Mts. Pieria, place named Liakoura S.W. of the summit Kteni, stony ground, 1700–1750 m, STAMATIADOU 13789 (ATH). Prov. Pierias, in ditione pagi Photina, 800–1000 m, 11.7.1976, GEORGIADIS 3003 (UPA). Prov. and distr. Pieria, E side of Mt. Olymbos, along the forest road between places Stavros and Prionia, *Pinus nigra* forest mixed with deciduous *Fagus*, *Quercus* etc., much *Pteridium* and *Juniperus oxycedrus* shrubs, limestone, 900–1050 m, 31.7.1968, STAMATIADOU 3820 (ATH). Prov. and distr. Pieria, E foothills of Mt. Olymbos, between the bifurcation to monastery “Ajios Dionissios” and the place called Prionia, dry rocky limestone ground with *Buxus sempervirens* shrubs in open mixed woodland, 1000 m, 9.7.1969, STAMATIADOU 6800 (ATH). Nomos Pierias, mons Olympos, inter locum Prionia et refugium “Spilios Agapitos”, 1400 m, 8.8.1973, PHITOS, GEORGIADIS & TZANOUDAKIS 14193 (UPA). Nomos Pierias, Ep. Pierias, mons Olympos, supra locum Prionia, 1400–1600 m, 8.8.1973, PHITOS, GEORGIADIS & TZANOUDAKIS 14092 & 14098 (UPA). Prov. and distr. Pieria, E. side of Mt. Olymbos, in ravine SE and below the refuge A “Spilios Agapitos”, steep rocky sides, screes and gravel at the bottom of the ravine, rocky grassland with *Pinus heldreichii* on the edge of ravine, limestone, 2000–2100 m, 1.8.1968, STAMATIADOU 3952 (ATH). Prov. and distr. Pieria, Mt. Olymbos, on the road from Prionia to the refuge “Spilios Agapitos”, slopes between forest of *Fagus* and the place named Magalia, stony schist with *Pinus nigra*, *Buxus sempervirens*, *Juniperus oxycedrus*, *Ostrya carpinifolia* and scattered *Fagus sylvatica*, 1450–1700 m, 26.7.1978, STAMATIADOU 20883 (ATH). Prov. and distr. Pieria, E side of Mt. Olymbos, on ascending path from Prionia to the refuge A “Spilios Agapitos”, between *Fagus* forest and the place called Paliokaliva, dry open rocky places, limestone, 1550–1850 m, 31.7.1968, STAMATIADOU 3848 (ATH). Prov. and distr. Pieria, E side of Mt. Olymbos, “Apostolidis” ravine, N of the refuge A “Spilios Agapitos”, rocky slopes, screes and gravel at the bottom of the ravine, limestone, 2050–2150, 1.8.1968, STAMATIADOU 3922 (ATH). Prov. et distr. Pieria, in latere or. montis Olimbos supra coenobium Ajios Dhionisios, in ascensu ad refugium princeps (A), in regione fontis Prionia, in clivis petrosis apricis, 1100 m, 25.7.1971, GREUTER 9667 (ATH). Mt. Olympos, N side, lower part of the Papa Rema ravine S of Vrondou, 400–500 m, 7.8.1975, STRID & HANSEN 9007 (ATH). Mt. Olympus, 2100 m, 28.7.1970, POLUNIN 11040 (ATH). Ossa, summit, 1978 m, 27–28.8.1975, POLUNIN 13838 (UPA). Prov. and distr. Kozani, N side of Mt. Vourinos (SE of Siatista), on the ascent from Mavrovouni to summit, S the place called Pigi Tsamia, dry stony grassland, open *Quercus* woodland and rocky slopes, serpentine, 1300–1500 m, 13.11.1969, STAMATIADOU 7409bis (ATH). Nomos Kozanis, mons Vourinos, ad cacumen, in saxosis ophiolithicis, 1750–1850 m, 9.7.1981, DUDLEY & al. 16949 (UPA). Nomos Kozanis, mons Vourinos, ad cacumen Tsamia, in saxosis calcareis, 1250 m, 9.7.1981, DUDLEY & al. 17051 (UPA). Nomos Kozanis, mons Vourinos, ad cacumen Tsamia, in declivibus occidentalibus, solo calcareo, 1300 m, 10.7.1981, DUDLEY & al. 16932 (UPA). Nomos Kozanis, mons Vourinos, in faucibus Forada (declives cacuminis Tsamia), in saxosis calcareis, 1200 m, 10.7.1981, DUDLEY & al. 17068 (UPA). Nomos Kozanis, mons Vourinos, ad cacumen Tsamia, in saxosis calcareis, 1250 m, 9.7.1981, DUDLEY & al. 17051 (UPA). Prov. and distr. Kozani, N side of Mt. Vourinos (SE of Siatista), on the ridge from Mavrovouni to summit, S the place called “Pigi Tsamia”, open, dry, rocky slopes and dry grassland between first and second saddle, serpentine rocks, 1450–1600 m, 31.7.1969, STAMATIADOU 6975 (ATH). Prov. Kozani./Grevena, montes Vourinos, in latere austro-orientali verticis Dherniko (Misio), in herbis et dumosis *Quercus*, *Buxi* et *Juniperi* clivi rupestris ophiolithici,

1300–1500, 26.7.1978, GREUTER 16309 (UPA). Prov. Kozani/Grevena, montes Vourinos, in summo vertice Vourinos ejusque crista septentrionali, in pratis et pascuis rupes-tribus, solo ophiolithico, 1600–1850 m, 26.7.1978, GREUTER 16327 (UPA). Nomos und Eparchia Grevena, Vourinos-Massiv, östlich von Exarhos, Sattel mit dichtem Stipa-Rasen, felsdurchragt über Serpentinegestein, 1700–1800 m, 19.8.1983, HAGEMANN, KETELHUT & WOLF 1132 (UPA). Near Anixis, S. of Grevena, 11.8.1970, POLUNIN 11345B (ATH). Prov. Kozani, distr. Eordhea, Mt. Siniatsiko, between the places named Tsilimingra and Pourkaretsa, stony calcareous ground with scattered low *Juniperus* shrubs, 1550–1750, 8.8.1972, STAMATIADOU 16183 (ATH). Prov. Florina/Pella, distr. Florina/Edhessa, at the base of Piperitsa summit, 6–7 km N.N.W of the village Ajios Athanasios, near the spring known as “Kria Vrisi Tzaka”, dry rocky pastures, limestone, 1500 m, 25.7.1985, STAMATIADOU 23108 (ATH).

Dianthus haematocalyx subsp. *phitosianus*

GREECE: Nomos Viotias, Eparchia Thivon, c. 6.6 km S of Xironomi village along road to Aliki, an ophiolite area W of the road, slopes with phrygana and low sparse shrubs, stony places, 320–350 m, 22.5.1998, CONSTANTINIDIS 7693 (B, C, UPA). Nomos Viotias, Eparchia Thivon, just W of Aliki village, stony slopes and a small ravine N of the asphalt road, phrygana with *Sacropoterium spinosum*, *Calicotome villosa*, *Helichrysum barrelieri*, ophiolithic substrate, 20–50 m, 22.5.1998, CONSTANTINIDIS 7743 (UPA). Nomos Viotias, Eparchia Thivon, c. 1 km W of Aliki village, stony slopes and a dry stream bed, ophiolithic substrate and sandstone (?), 20–40 m, 22.5.1998, CONSTANTINIDIS 7756 (UPA). Nomos Korinthias, Eparchia Korinthias, NE Loutraki, along forest road, sparse *Pinus* forest on ophiolithic substrate, 200–300 m, 2.6.1999, MAROULIS & KOKMOTOS s.n. (UPA).

Dianthus haematocalyx subsp. *pindicola*

GREECE: Prov. Kozani, distr. Eordhea, Mt. Siniatsiko, N.W. side of the summit Daout Pargos, stony and rocky ground, 1600–1900 m, 8.8.1972, STAMATIADOU 16246 (ATH). Prov. Ioannina, distr. Konitsa, SE part of Mt. Smolikas, on the ridge ENE of the plateau “Epta Vrises” (SW of Samarina), between Vrisi Gavril and Loupa summit, open rocky slopes and scree, ophiolite, 1900–2000, 25.7.1971, STAMATIADOU 13475 (ATH). Nom. Ioannina, Mt. Smolikas, Aufstieg von Pades, offene, steinige Weiderasen, Schutt- und Felsspaltenflur auf Serpentin, 2100–2637 m, 3.8.1982, WAGENITZ 4005 & HERBORG (ATH). Distr. Konitsa, montes Smolikas, in regione superiore secus ascensum a pago Samarina, in lapidosis ophiolithicis, 2350–2637 m, 17.8.1976, GREUTER 14508 (UPA). Prov. Joannina, Smolikas, Kammweg nach Osten, bis zum See, Felsen, Fels-triften, Block- und Schutthalden, Ophiolith, 2400–2650 m, 28.7.1985, BURRI & KRENDL s.n. (UPA). Nom. Ioanninon, Ep. Metsovo, Mt. Mavrovouni, SE slope, c. 9 km N of Metsovon above the road to the village Milea, rocky slope and scree, serpentine substr., 1750–1825 m, HARTVIG, BADEN & CHRISTIANSEN 6080 (ATH). Nomos Ioanninon, ad viam 3 km a vico Metsovo versus urbem Trikala, solo serpentino, 1550 m, 1.8.1981, DUDLEY & al. 18383 (UPA). Pindus Gebirge, auf der Katarahöhe, lockerer Tannen-Föhrenmischwald, Trockenrasen, 1600 m, 15.7.1978, KRENDL s.n. (UPA). Katara pass, Pindus Mts, 8.8.1970, POLUNIN 11301 (ATH). Prov. and distr. Grevena, 17–18 km N of Metsovon, area of Pirostia summit of Mt. Lingos, dry stony pastures and gentle slopes in margins of *Pinus heldreichii* forest, SE of the peak, serpentine substr., 1950–1960 m,

12.7.1979, STAMATIADOU 21303 (ATH). Nom. Grevenon, Ep. Grevenon, Mt. Smolikas, c. 2 km WSW of Samarina, ridge with serpentine rocks and screes, 2000–2080 m, 11.8.1975, HARTVIG & SEBERG 4055 (ATH). Prov. & distr. Grevena, in latere boreo-orientali verticis Kakoplevri (Salatoura) montis Livadhi (Milea), in clivis lapidosis ophiolithicis, 2150 m, 14.8.1974, GREUTER 12190 & CHARPIN 11029 (UPA). Prov. Trikala, inter pagum Metsovo et vicum Kalampaka, in loco Kampas Despoti dicto, ad viam, 20.7.1977, GEORGIADIS 1611 (UPA).

Dianthus haematocalyx subsp. *pruinus*

GREECE: Nomos Magnisias, collis Goritsa supra urben Volos, 100–200 m, 13.6.1974, KAMARI 12453 (UPA). Volos, phrygana with *Phlomis fruticosa*, 400 m, 2.6.1972, RAUS 1163 (ATH).

Dianthus haematocalyx subsp. *ventricosus*

GREECE: Prov. Viotia/Fthiotida, distr. Levadia, Mt. Parnassos, 8 km N-NNE of Arachova, 2 km WNW of the summit of Liakoura, stony plateau, 2000–2100 m, 11.8.1980, BADEN & FRANZÉN 731 (ATH). Parnassus, in latere septentrionali montis Xirolakkas, a refugio E.O.S. ad cacumen, in lapidosis calcareis, 2000–2350 m, 18.7.1977, GREUTER & al. 14774 (ATH). Nomos Viotias, Eparchia Levadias, Mt. Parnassos, the slopes N of Baidanorachi summit and S of Tris Toumbes summit, mostly open grazed areas with scree and rocky outgrowths, 1900–2150 m, 19.7.1994, CONSTANTINIDIS & VASSILIADIS 5040 (UPA). Prov. Phthiotis, mons Parnassos, W slopes of Gerondovrachos, 2100 m, 24.8.1984, TINIAKOU 1175 (UPA). Prov. Phokis/Viotia, mons Parnassos in declivibus boreo-occidentalibus cacuminis Gerontobrachos, in rupes-tribus calcareis, 2000–2100 m, 18.7.1977, GEORGIADIS 3780 (UPA). Parnassos, by refuge, 1900 m, 18.08.1975, POLUNIN 13699 (UPA). Prov. Phokis, mons Giona, ad cacumen supra pagum Kaloskopi, 2000–2300 m, 15.9.1976, GEORGIADIS 3342 (UPA). Prov. Fokis, distr. Parnassis, Mt. Vardousia, WSW of the village “Athanasios Diakos”, on SE slopes of Homiriani summit (Sinani), W and above the place called Pitimaliko (Psila Livadhia), open dry alpine pastures, limestone rocks, scree and gravel, 1650–1950 m, 14.7.1968, STAMATIADOU 3675 (ATH). Prov. Phthiotis, mons Iti, in pascuis subalpinis prope Vrissi Kalogerou, 1600–1800 m, 12.8.1980, GEORGIADIS & TZANOUDAKIS 3182 & 3215 (UPA).

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