

Crocus lyciotaureus KERNDORFF & PASCHE (Liliiflorae, Iridaceae) and its relatives

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Abstract: Results of molecular analyses in the genus *Crocus* clarified several phylogenetic problems. Section *Nudiscapus* presents itself now exceedingly complex and taxonomical as well as systematic corrections are necessary. This is true e.g. for many taxa previously thought to belong to series *Biflori*. One group of species turned out to be rather homogenous in respect of morphological similarities as well as geographical distribution of their members. For these we establish a new series in the genus which is called *Lyciotaurei* due to the fact that its species predominantly occur in the Lycian Taurus Mountains. Genetics, geographical distribution as well as morphological measurements are presented.

Zusammenfassung: Ergebnisse molekularer Analysen in der Gattung *Crocus* konnten einige phylogenetische Probleme klären. Die Sektion *Nudiscapus* stellte sich dabei als extrem komplex heraus, so dass taxonomische und systematische Korrekturen notwendig sind. Das gilt zum Beispiel für viele Taxa, von denen angenommen wurde, dass sie zu Serie *Biflori* gehören. Eine Gruppe von Spezies stellte sich aufgrund der molekularen Analysen als vergleichsweise homogen heraus, auch bezüglich Morphologie und geographischer Verbreitung. Für diese Gruppe führen wir die neue Serie *Lyciotaurei* in die Gattung ein, da die meisten Arten im Lykischen Taurus vorkommen. Hierzu werden Genetik, geographische Verbreitung und morphologische Messungen präsentiert.

Key words: *Crocus*, phylogeny, new series *Lyciotaurei*, new species *C. akkayaensis*, *C. katrancensis*, *C. bowlesianus*, *C. akdagensis*, *C. salurdagensis*, *C. xanthosus*.

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INTRODUCTION

Recent phylogenetic analyses of the genus *Crocus* (PETERS-EN et al. 2008; HARPKE et al. 2013) proved several infra-generic units predominantly within section *Nudiscapus* to be para- or polyphyletic. A most significant example for this is the former “*Crocus biflorus* aggregate” with more than 20 subspecies of *Crocus biflorus*. Their status cannot be accepted anymore as they turned out to occur in very different phylogenetic groups and sub-groups (HARPKE et al., in preparation). Those genetic findings also clearly indicate that several series of this section established by MATHEW (1982) either cannot be kept in their original version, e.g. series *Reticulati* (HARPKE et al. 2014), or new series have to be introduced, e.g. series *Isauri* (KERNDORFF et al. 2014), to arrive at a system of *Crocus* that closely reflects species relationships.

Consequently, the entire section *Nudiscapus* has to be reviewed. As we could show in case of *C. isauricus* (KERNDORFF et al. 2014) the actual situation in the genus is rather complex. Besides the genetic cluster which contains the species of series

Isauri there is another well-defined cluster with several species formerly thought to belong to *C. biflorus* ssp. *isauricus* sensu MATHEW (1982). As the situation is quite different now because genetic relationships are widely clarified, it is necessary to describe another series which harbours species more distantly related to *C. isauricus*. In contrary to series *Isauri*, it is a quite homogenous group (see Table 2) with an evenly distinct and rather limited geographical distribution of its species without any exclaves (Fig. 2).

In this paper we present species of the new series *Lyciotaurei* together with its type species *C. lyciotaureus*. Members of the new series are besides the already described species *C. lyciotaureus*, *C. ziyaretensis*, *C. oreogenus*, *C. beydaglarensis*, *C. calanthus*, and *C. atrospermus*, the new species *C. akkayaensis*, *C. katrancensis*, *C. bowlesianus*, *C. akdagensis*, *C. salurdagensis* and *C. xanthosus*. As we can see from our evaluated material it is possible, that more species have to be added to this series in future. Detailed genetic results concerning these findings will be published elsewhere.

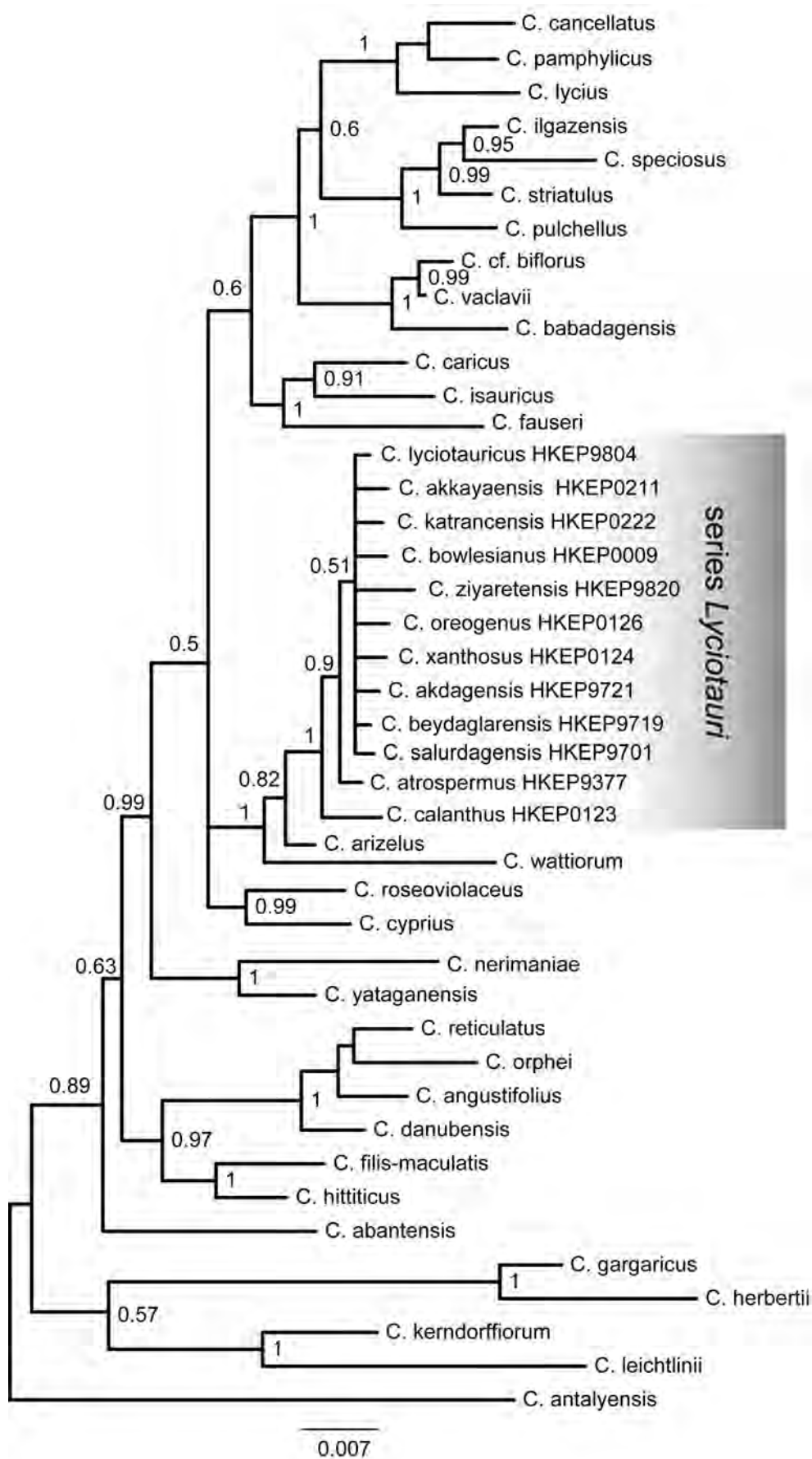


Fig. 1: Phylogenetic tree of series *Lyciotaurei* species and outgroup taxa derived from a Bayesian analysis of the ITS and ETS region (1260 bp)*.

*Numbers at nodes give posterior probabilities for the clades.

Geographical distribution

The geographical distribution of species of series *Lyciotauri* is rather limited in the south-west corner of Turkey (Fig. 2). The borders can be drawn from Fethiye northwards up to Acipayam, from there eastwards to around Burdur and then southwards to Antalya. All species inhabit a rather limited area or are confined to isolated mountain stocks meaning they are obviously endemic. Most of the species are high mountain plants occurring above 1500 m, three species, *C. lyciotauricus*, *C. beydaglarensis* and *C. calanthus* most probably belong to the Mediterranean climatic belt. The populations of series *Lyciotauri* are generally scattered and hardly more than several hundred individuals occur in spots of 0.1 km² which is a sign to us that they are most probably endangered.



Fig. 2: Geographical distribution of species of series *Lyciotauri*.

General aspects on *C. lyciotauricus* and its relatives

When we started to investigate the former “*Crocus biflorus* aggregate” in Lycia in 1997 we “stepped” on a wealth of different *Crocus* populations never seen anywhere before. At that time this situation was of course not transparent to us and only slowly the understanding grew that many things in the genus are still unknown, insufficiently or wrongly known.

In case of *C. lyciotauricus* we have to admit that its identity and systematic position in the genus was not even guessable to us at that time. This can be also said now for all the members of the new series. Between 1997 and 2001 when we looked more thoroughly on details we could recognise, that all the allegedly “*C. biflorus* subsp. *isauricus*” from several localities in Lycia were phenotypically and morphologically quite different to that one as can be seen from our published results (KERNDORFF et al. 2006). Comparing only flowers and their colour variants to distinguish taxa ended of course in a chaos due to transitional forms inside populations and between taxa. The only way out of this labyrinth was a detailed investigation of all the relevant taxonomical (morphological and phenotypical) parameters *Cro-*

cus has to offer (KERNDORFF et al. 2015, this volume) and, consequently, most of the determination problems could be solved.

A feature with relevant taxonomic parameters for determining crocuses is the seed. Seeds of crocuses are quite distinct and offer several relevant characters on a macroscopic as well as on a microscopic scale to distinguish even closely related taxa. However, taxonomically, seeds were widely neglected in the past probably due to the difficulty to compare them on a well magnified level like this is shown in Fig. 4. The magnification in those photographs is about 1:10. A detailed documentation of macroscopic as well as microscopic properties of crocus seeds for the entire genus is in preparation.

Table 1: Species of series *Lyciotauri* and their geographical distribution.

species	investigated population (HKEP)	investigated specimens at type locality	geographical distribution in Turkey ¹
<i>C. lyciotauricus</i>	9804	37	Antalya, S Lycian coastal mountains, 1000-1200 m
<i>C. akkayaensis</i>	0211	31	Burdur, Akkaya Tepesi, 1600-1700 m
<i>C. katrancensis</i>	0222	33	Antalya, Katrancık Dağı, 1600-1700 m
<i>C. bowlesianus</i>	0009	31	Antalya / Burdur, Katrancık Dağı, 1400-1500 m
<i>C. ziyaretensis</i>	9820	32	Antalya, Ziyaret Dağları 1300-1600 m
<i>C. oreogenus</i>	0126	38	Antalya, Bey Dağları, 1500-1800 m
<i>C. beydaglarensis</i>	9719	43	Antalya, SW Bey Dağları, 1000-1200 m
<i>C. calanthus</i>	0123	34	Antalya, Ak Dağ 1200-1400
<i>C. akdagensis</i>	9721	29	Antalya, E Ak Dağ, 1500-1600 m
<i>C. atrosperrus</i>	9377	34	Denizli/Burdur/Muğla, Boncuk Dağları, 1500-1600m
<i>C. salurdagensis</i>	9701	30	Antalya / Muğla, Salur Dağı, 1500-1600 m
<i>C. xanthosus</i>	0124	38	Antalya, Kofu dağ, 1400-1500 m

¹all species are most probably endemic to the mentioned region



Fig. 3: Selection of four photographs of each species at type locality to document their variability.

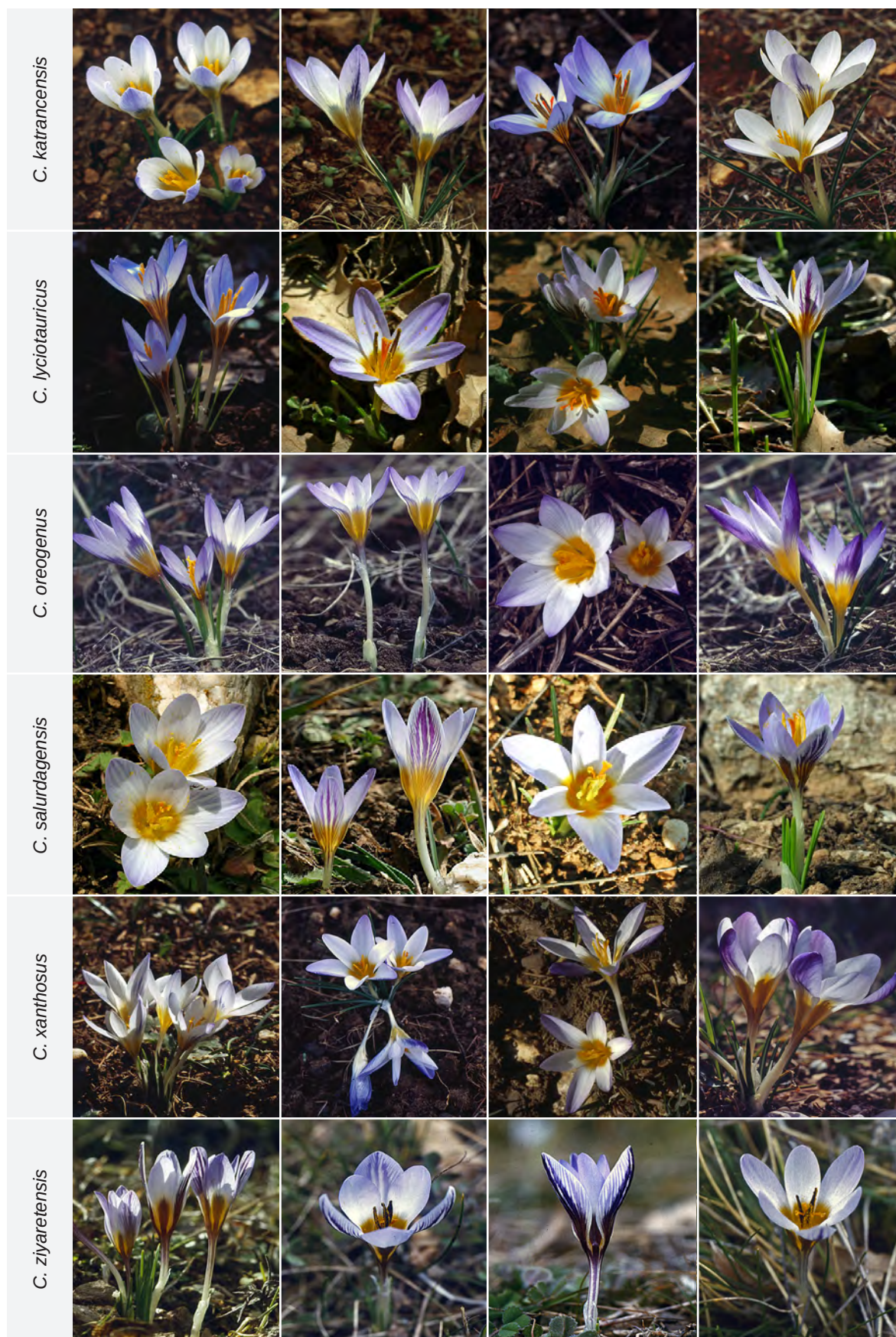


Fig. 3: Selection of four photographs of each species at type locality to document their variability, continued.

Table 2: Compilation of continuous parameters and their mean values and of phenotypic characteristics of species of the new series *Lyciatauri*.

taxon	corm tunic						color of sheathing leaves		segm prop.	true leaves					stamen and styles							
	outer	in	splits (mm)	sub-splits	neck-length (mm)	teeth on rings (length, mm)	cataphylls	bract/bracteoles		leaf-no. mean ³	col leaves	white stripe ¹	leaf-diam. (mm)	leaf-ribs no. ²	length fila (mm) ³	length anth (mm) ³	length style-bran. (mm) ³	col fila	col anth	col conn	col style	style acc. stam.
<i>Crocus</i>																						
<i>C. lyciatauricus</i>	c/m	m	>5	ab	3-5	ab	silv	silv	2.8	4.6	g gr	1/3	2	1(2)	6.8	10.1	7.1	y	y/bl/g/b	bl/g/b	or	81le
<i>C. akkayaensis</i>	c	so	>5	ab	2-3	ab	silv	silv	2.8	4.6	d gr	<1/3 – 1/3	1-1.5	2	4.1	9	3.9	c-ly	y (g/b)	c	or	75se
<i>C. katrancensis</i>	c	so	>5	ab	3-4	ab	silv	silv	3.4	4.9	d gr	1/3	1.5-2	2	6.3	9.3	4.7	ly	y	c	or	81se
<i>C. bowlesianus</i>	c	c	>>5	ab	3-5	ab	silv	silv	3	4.8	lgr-gr	1/3	1-1.5	2	6.1	8.2	4.5	y/y-or	52y/43y+ b/5b	c/y/g	or	81se
<i>C. ziyaretensis</i>	c	so	>5	ab	4-5	ab	silv	silv	3.3	4.4	gr	1/3	1.5	2	6.9	9.1	5.3	y	b	c/ly/ b at top	or	97se
<i>C. oreogenus</i>	c/m	m	2-5	r<1mm	2-3	ab	silv	silv	2.9	5.2	gr	<1/3	1-2	2(3)	6	9.1	5.8	ly-y	y	c	or	82se
<i>C. beydaglarensis</i>	c/m	so	>5	ab	4-5	ab	silv	silv	3	4.7	lgr	<1/3	1-1.5	(1)2	6.9	11.4	5.4	y	y	c/ly	or	86le
<i>C. calanthus</i>	c	so	>5	ab	2-4	ab	silv	silv	2.7	6.2	gr	>1/3	1-2	2(3)	7.6	11.2	6.3	ly/y	y	c	or	71le
<i>C. akdagensis</i>	c/m	m	>5	ab	2-3	ab	silv	silv	3.6	4.9	lgr	1/3	1.5	1(2)	6.5	8	4.5	y/or	ly	y/gr	y-or	79le
<i>C. atrospermus</i>	c/m	so	2-5	ab	2-4	ab	silv	silv	2.7	6.4	dgr	1/3	2	2	6.7	9.8	5.1	y	y	y	ly/y/ or	100se
<i>C. salurdagensis</i>	c	so	2-5	ab	3-4	r<0.5	silv	silv	2.6	7.3	lgr (sub)	1/3	1.5 (>2)	2	6.1	10.4	5.6	y	y/rarely b	c/y	(y) or	77se
<i>C. xanthosus</i>	c	so	>5	ab	3-6	ab	silv	silv	2.9	5.2	gr	1/3	1-2	2(3)	7.7	10.3	6.5	y	y	c/y	or	84le

Explanatory notes:

corm tunic: c = coriaceous, m = membranous, so = softer, ab = absent, r = rare, ma = many, f = few, dist = distant, up = on upper rings;

color of sheathing leaves: silv = silvery (skinny);

segmprop.: segment proportion (= average length of outer segments/average width of outer segments) as a rule: 2-2.5 bowl-shaped flowers, 2.5-3.5 “normal” flowers, 3.5-5 rather starry-like flowers;

true leaves: col = colour, gr = green, g = grey, d = dark, l = light, (sub) = subulate;

stamen and styles: fila = filaments, anth = anthers, conn = connectives, col = colour; colours of filaments: c = colourless, y = yellow, or = orange, d = dark, l = light; colour of anthers: y = yellow, b = black, g = grey; in case of *C. bowlesianus* the proportion is 52% yellow, 43% yellow with black tips and 5% black; colours of connectives: c = colourless, bl = blue, b = black, g = grey; colours of styles: y-or = yellow to orange, or = orange, orr = orange-red;

style acc. stam = length of style according to stamen (numbers are % of investigated specimens of a population, le = longer to equal, se = shorter to equal).

¹in dimension of the leaf-diameter

²on both sides of the groves

³average of investigated specimens

At this size, one easily can see how different they are even species belonging all to a single series. Using the photographs in fig. 4 it is possible to distinguish between colours, length, width, shapes, kind of attachment of caruncle, its size and form, the raphe, and, last but not least, different surface conditions.

The seeds of species of series *Lyciotaurei* are mostly very dark brown or blackish, at least after drying for several days outside the capsule (fig. 4). Exceptions are those of *C. akkayaensis* (beige-brown), and *C. ziyaretensis* (chestnut-brown). The size and the form of the seeds vary considerably. The largest ones has without doubt *C. calanthus* (around 4 mm long and 2 mm broad), very irregular shaped with a prominent caruncle obviously about the half of the seed, not clearly separate from the main body except for the more wavy surface. The smallest ones investigated has *C. salurdagensis* with a main body of <2 mm long and 1.3 mm broad. The caruncle is well separate and about 1/3 of the seed, the raphe almost invisible. Significantly elongated seeds of 2–3 mm length and 1–1.5 mm width have *C. bowlesianus* and *C. oreogenus*. The first one mostly rounded at the side of the caruncle, rather pointed in case of *C. oreogenus*. The raphe is in both species indistinct. Seeds of *C. akdagensis* are subglobose with a prominent caruncle and raphe. The caruncle is in most investigated species significant and well separate from the main body. The surface can be entirely wavy or with smooth parts (*C. calanthus* and *C. bowlesianus*).

MATERIAL AND METHODS

Material investigated

For molecular analysis we investigated two to five individuals per population. For morphological analyses a minimum set of taxonomically relevant parameters was selected and measured or determined in the field of 29 to 43 individuals (table 1) from populations of the type locality (table 2). In some cases for different parameters also dried material from type locality was used.

Voucher specimens of all analyzed individuals were deposited at the herbarium of the IPK Gatersleben (GAT). Additionally, several other taxa belonging to section *Nudiscapus* were molecularly investigated as out-groups.

Molecular methods

For each of the twelve type populations and the 31 out-group taxa the internal transcribed spacer region (ITS) and external transcribed spaces region (ETS) of the nuclear ribosomal DNA (rDNA) were investigated. DNA extraction, PCR and Sequencing were done according to HARPKE et al. (2014). All sequences newly obtained in this project were deposited in the EMBL nucleotide database, for sequences already published in earlier studies see HARPKE et al. (2013; 2014) and KERNDORFF et al. (2014).

Sequence alignments and phylogenetic analyses.

Sequences for all loci were manually aligned. If sequences were identical within the same population, only one sequence per population was included in the phylogenetic analysis. Mod-

eltest 3.7 (POSADA and CRANDALL, 1998) was used to test different models of sequence evolution, and the GTR + G + I model was chosen by the Akaike information criterion. Bayesian inference (BI) was conducted in MrBayes 3.2 (RONQUIST et al., 2012). In BI two times four chains were run for two million generations each, sampling a tree every 1000 generations. Converging log-likelihoods, potential scale reduction factors for each parameter and inspection of tabulated model parameters in MrBayes suggested that stationarity had been reached in all analyses. The first 25% of trees of each run were discarded as burn-in. Three independent runs of BI analysis were performed to confirm that separate analyses converged on the same result. In each of these analyses, the same topology and similar posterior probabilities (pp) of nodal support were found.

RESULTS & DISCUSSION

Species of series *Lyciotaurei* form a strongly supported monophyletic group (fig. 1). Although the phylogenetic relationships within series *Lyciotaurei* are yet poorly resolved, the tree clearly shows, that this series is separated from series *Isauri*. Indeed, the closest relatives to series *Lyciotaurei* are *C. arizelus* and *C. wat-tiorum*. Here further investigations will be carried out to clarify, if these species should be included in the series.

Morphologically, the new series presents itself as very homogenous, in contrast to series *Isauri* (KERNDORFF et al. 2014). Like in other *Crocus* series, the identification of the species of series *Lyciotaurei* is nearly impossible when it is solely based on overall appearance (flowers). However, if considering the 22 selected fairly constant morphological and phenotypic parameters (Tab. 2) and their results from investigations of a statistical representative number of specimens from type locality they can be distinguished. Therefore, these results build the backbone of the description of species and serve parameters for the determination key. Otherwise an identification of species in the genus and especially in section *Nudiscapus* is hardly possible.

An association of newly found crocuses assumed to belong to series *Lyciotaurei* solely on morphological or phenotypical parameters should be avoided. Besides an adequate molecular investigation to clarify its phylogenetic position the occurrence area of a new species should also be taken into consideration as the geographical distribution of species of the new series is obviously rather limited and without exclaves.

Taxonomical remarks

The species of series *Lyciotaurei* have the following characteristics in common: The outer corm tunics are coriaceous or coriaceous to membranous. The splits of the tunic generate predominantly large segments >5mm, less frequently only of 2–5 mm width. Sub-splits or notches are generally absent, except for *C. oreogenus* where they occur very rarely and are rudimentary. Teeth on corm tunic rings are absent though in *C. salurdagensis* very rarely short and distant teeth (<0.5 mm) may occur. Cataphylls, bracts and bracteoles are always silvery white even with age. Other considered morphological and phenotypic parameters show differences although in many cases only subtle ones but still sufficient to distinguish the species fairly easy (Tab. 2 and Figs. 3 & 4).

***Crocus* series *Lyciotaurei* series nova**Type of series: *Crocus lyciotaureus* KERND. & PASCHE

1. *C. lyciotaureus* KERND. & PASCHE, Stapfia 99: 153 (2013).
Type (holotype): GAT 7193.
Distribution: Turkey, Antalya, S Lycian coastal mountains, 1000-1200 m
2. *C. ziyaretensis* KERND. & PASCHE, Stapfia 99: 154 (2013).
Type (holotype): GAT 23080.
Distribution: Turkey, Antalya, Ziyaret Dağları 1300-1600 m
3. *C. oreogenus* KERND. & PASCHE, Stapfia 99: 155 (2013).
Type (holotype): GAT 7127.
Distribution: Turkey, Antalya, Bey Dağları, 1500-1800 m
4. *C. beydaglarensis* KERND. & PASCHE, Stapfia 95: 100 (2011).
Type (holotype): GAT 7388.
Distribution: Turkey, Antalya, SW Bey Dağları, 1000-1200 m
5. *C. calanthus* KERND. & PASCHE, Stapfia 99: 153 (2013).
Type (holotype): GAT 7149.
Distribution: Turkey, Antalya, Ak Dağ 1200-1400 m
6. *C. atospermus* KERND. & PASCHE, stat. nov.
≡ *C. biflorus* subsp. *atospermus* KERND. & PASCHE, Plantsman n.s. 2: 86 (2003).
Type (holotype): K.
Distribution: Turkey, Denizli/Burdur/Muğla, Boncuk Dağları, 1500-1600 m
7. *C. akkayaensis* KERND. & PASCHE sp. nov.
Type (holotype): GAT 7128.
Distribution: Turkey, Burdur, Akkaya Tepesi, 1600-1700 m
8. *C. katrancensis* KERND. & PASCHE sp. nov.
Type (holotype): GAT 7150
9. *C. bowlesianus* KERND. & PASCHE, sp. nov.
Type (holotype): GAT 7377
10. *C. akdagensis* Kernd. & Pasche, sp. nov.
Type (holotype): GAT 7389
11. *C. salurdagensis* Kernd. & Pasche sp. nov.
Type (holotype): GAT
12. *C. xanthosus* Kernd. & Pasche sp. nov.
Type (holotype): GAT 7126

DESCRIPTION OF NEW SPECIES**1. *Crocus akkayaensis* KERNDORFF & PASCHE, species nova**

H o l o t y p u s: Turkey, Pisidia, Burdur Province, Akkaya Tepesi, 1600-1700 m, 19.03.2002, HKEP 0211 (Gatersleben GAT 7128).

Cormus subglobosus, tunicae exteriores coriaceae, interiores clare molles; tunica separata in segmenta >5 mm, subfissurae absunt; collum (2-3 mm), constans ex triangulis latis et exter curvis origine a fissuris brevibus deorsum; annulis duris, angustis vel aliquantibus et latis, plerumque margine toto, den-

tes absunt; cataphyllae argenteae-albae; folia 4-6, plus minusve 4.6, saturate virida, glabra, numquam attingentia flores ad anthesim et vix visibilia, 2 costis in omni sulco in folio inferiore; stria alba <1/3 usque ad 1/3 diametrum folii; faux dilute lutea usque ad luteam, non prominens, glabra; perianthii tubus sine colore usque ad dilute luteum, striatus brunneolus violaceus apicem versus. Segmenta externa 15-30 mm, plerumque 22 mm longa, 5-10 mm, plerumque 8 mm lata. Segmenta interna 14-29 mm, plerumque 21 mm longa, 4-10 mm lata, plus minusve 8 mm lata. Proportio segmentorum quod attinet ad longitudinem/latitudinem segmentorum externorum: 2.8. Latera interna et externa segmentorum omnium variantia ex dilute lilacino-caeruleo colore usque ad saturate subcaeruleum-violaceum, segmenta interna intus sine macula, latera externa segmentorum internorum cum macula raveda apicem versus perianthii tubi. Latera externa segmentorum externorum saepe sine maculis, interdum cum infirma praedominata verticali nervatura cum vel sine dilute pinnatinervia cum altis tinctis coloris segmentorum. Prophyllum abest. Bractea et bracteola adsunt, argentea alba, rucutita; bractea latissima et manifesta, bracteola inconspicua. Filamenta plus minusve 4.1 mm, sine colore usque ad dilute luteum.; antherae plus minusve 9 mm, plerumque luteae, interdum cineracentes vel nigrae ad apicem, connectivum sine colore. Cinerascentes luteum. Styli plerumque aurantiaci, divisi in partes tres, non expansi apicem versus; rami stigmatici breves, plus minusve 3.9 mm longi, sine vel cum papillis paucis. Styli plerumque aequales vel breviores quam stamina (72%). Capsula et semina non visa. Chromosomatorum somaticorum numerus $2n = 10$.

Corm sub-globose, about 11-15 mm in diameter; outer tunics coriaceous, the inner ones significantly softer; tunic splits into segments of >5 mm, sub-splits absent; neck very short (2-3 mm), consistent of broadly based and outwards curved triangles originated by short splits downwards; rings hard, narrow to rather broad, mainly whole-edged, teeth absent; cataphylls silvery-white; leaves 4-6, in average 4.6, dark green, glabrous, 1-1.5 mm in diameter, never reaching the flowers at anthesis, mostly just visible, 2 ribs underneath; white stripe <1/3 to 1/3 of leaf-diameter; throat light yellow to yellow, not prominent, glabrous; perianth tube colourless to yellowish, striped brownish-violet towards the apex. Outer segments are between 15 and 30 mm but usually 22 mm long, between 5 and 10 mm mostly 8 mm wide. Inner segments are between 14 and 29 mm but usually 21 mm long and between 4 and 10 mm in average 8 mm wide. Segment proportion of length/width of the outer segments is 2.8. Inside and outside of all segments vary from a soft lilac blue to a deep bluish-violet, the inner ones are without any markings but on the outside with a greyish spot near the apex of the perianth tube. The outside of the outer ones often are also without markings but can have a faint predominantly vertical veining with or without faint featherings of a deeper tinge of the segment colour (Fig. 3). Prophyll absent. Bract and bracteole present, silvery-white, skinny; bract very broad and prominent, bracteole inconspicuous. Filaments on average 4.1 mm, colourless to light yellow; anthers on average 9 mm, mostly yellow but can have greyish to blackish upper parts, connective colourless. Pollen yellow. The styles are mostly orange, divided into 3 branches not expanded towards the end; branches short, 3.9 mm long on average, without or with few papillae. The styles are mostly equal or shorter than stamens (72 %). Capsule and seeds not seen. Chromosome number $2n = 10$.

Distribution and habitat: *Crocus akkayaensis* is most probably confined to the isolated mountain stock Akkaya Tepesi in Denizli province. It grows in open mountain steppes on basic brown calcareous soils together with *Crocus danfordiae*, *Crocus crewei*, *Crocus chrysanthus*, *Scilla bifolia*, *Colchicum*, *Juniperus*, *Crataegus*, *Alyssum*, *Pinus* etc.

Crocus akkayaensis is characterised by its comparatively short filaments (4.1 mm on average) and short style-branches (3.9 mm on average) which distinguish it from all other members of the series.

2. *Crocus katrancensis* KERNDORFF & PASCHE, species nova

H o l o t y p u s: Turkey, Pisidia, Antalya Province, Katranç dağı, 1600-1700 m, 13.03.2002, HKEP 0222 (Gatersleben GAT 7150).

Cormus subglobosus, ca. 12 mm diameter; tunicae externae coriaceae, interiores molles; tunica separata in segmenta > 5 mm; subfissurae absunt; collum brevissimum (3-4 mm), constans ex mediocribus triangulis basicis, creantes ex fissuris brevibus deorsum; annuli duri, plerumque margine toto, sine dentibus: cataphyllae argenteae-albae, foliis 3-7, plus minusve 4.9, bene exculpta ad anthesim, ita longa ut apex perianthii tubus vel longior, dilute viridus, glaber, 1.5-2 mm diameter, folia utroque latere costae 2; stria alba 1/3 folii diameter; segmenta externa 20-33 mm, plus minusve 27 mm longa, 6-13 mm, plerumque 8 mm lata. Segmenta interna 19-31 mm, plerumque 25 mm longa, 5-11 mm plus minusve 8 mm lata. Proportio segmentorum quod attinet ad longitudinem/latitudinem segmentorum externorum: 3.4. Segmenta omnia intus uniformiter dilute caerulea lilacina, raro profunde colorata sine maculis. Latera externa segmentorum intus comparate aequalia, plerumque cum macula cinerea et zona lutea prope apicem perianthii tubi propter saturate luteum colorem intus faucis, translucet. Latera externa segmentorum exterius unitarie colorata, interdum maxima ex parte maculae adsunt. Apud perianthii tubum aliquae maculae atrovioleae plus minusve intense elongatae in lineam mediam, magis magisque angustatae segmentorum apicem versus, sive faux lutea solum translucet a parte interiore. In hac re pars superna segmentorum possidens plus vel minus strias verticales dilutas. Hic casis pars superne segmentorum possidet plus minus strias verticales dilutas. Prophyllum abest. Bratea et bracteola adsunt, argentea-alba, recutita. Filamenta plus minusve 6.3 mm, dilute lutea; antherae plus minusve 9.3 mm, luteae; connectivum sine colore. Pollen luteum. Stylus plerumque aurantiacus, divisus in partes tres, expansione nulla vel paula; rami breves, plus minusve 4.7 mm longi, sine papillis. Styli antheris breviores vel aequales (81%). Capsula non visa. Semina subnigra-brunnea, sine caruncula 2 mm longa, et 1.2-1.3 mm lata. Caruncula prominens, raphe inconspicua. Chromosomatorum somaticorum numerus $2n = 12$.

Corm sub-globose, about 12 mm in diameter; outer tunics coriaceous inner ones softer; splits of tunic into segments of >5 mm, sub-splits absent; neck very short (3-4 mm), consistent of middle sized basic triangles originated by short splits downwards; rings hard, mainly whole-edged, without teeth; cataphylls silvery-white; leaves 3-7, in average 4.9, well developed, as long as the apex of perianth tube or longer, dark green, glab-

rous, 1.5-2 mm in diameter, 2 ribs underneath; white stripe 1/3 of leaf-diameter; Outer segments are between 20 and 33 mm but usually 27 mm long, between 6 and 13 mm mostly 8 mm wide. Inner segments are between 19 and 31 mm but usually 25 mm long and between 5 and 11 mm in average 8 mm wide. Segment proportion of outer segments (average length/width) is 3.4. Inside of all segments is uniformly soft bluish lilac rarely deeper coloured without markings. The outside of the inner segments is comparatively uniform but mostly with a greyish spot and a yellow zone near the apex of the perianth tube due to the deep yellow inside of the throat which shines through. The outside of the outer segments can be uniformly coloured but in most cases has some markings. Near the perianth tube one can find either dark violet blotches which are more or less intensively elongated into a median stripe which becomes more and more narrow towards the tips of the segments or only the yellow throat shines through from inside. In these cases the upper part of the segment has a more or less faint vertical striping. Prophyll absent. Bract and bracteole present, silvery-white, skinny; Filaments on average 6.3 mm, light yellow; anthers on average 9.3 mm, yellow, connective colourless. Pollen yellow. The styles are mostly orange, divided into 3 branches with no or little expansion towards the end; branches short, 4.7 mm long on average, without papillae. The styles are mostly shorter to equal compared to the stamens (81 %). Capsule not seen. Seeds blackish-brown, without caruncle 2 mm long and 1.2-1.3 mm broad. Caruncle prominent, raphe indistinct. Chromosome number $2n = 12$.

Distribution and habitat: Up to now *Crocus katrancensis* is known only from the type locality in the Katranç dağı, Antalya province. It grows in open mountain steppes on basic brown calcareous soils.

3. *Crocus bowlesianus* KERNDORFF & PASCHE, species nova

H o l o t y p u s: Turkey, Lycian Taurus, Antalya Province, Katranç Dağları, 1400-1500 m, 25.03.2000, HKEP 0009 (Gatersleben GAT 7377).

Cormus subglobosus, 11-15 mm diameter; tunicae exteriores et interiores coriaceae; tunica plerumque integra, disperse creans segmenta longiora quam 5 mm, subfissurae absunt; collum brevissimum (3-5 mm), constans ex triangulis latis basicis nascens ex fissuris brevibus deorsum; annuli duri sine dentibus, plerumque margine toto; cataphyllae argenteae-albae; folia 3-4.8-7, nunc visibilia usque ad folia attingentia flores ad anthesim, dilute virida usque ad virida folia, glabra; 1-1.5 mm diameter, 2 costis in sulco omni in folio inferiore; stria alba 1/3 folii diameter. Faux saturate lutea usque ad aurantiacam, si aurantiaca tum circumdata margine luteo, glaber; perianthii tubus sine colore usque ad dilute luteum, striatum brunneolum-violaceum apicem versus. Segmenta externa 12-28 mm, plerumque 21 mm longa, 3-9 mm, plerumque 7 mm lata. Segmenta interna 12-27 mm, plerumque 20 mm longa, 4-9 mm, plus minusve 7 mm lata. Proportio segmentorum quod attinet ad longitudinem/latitudinem segmentorum externorum: 3. Latera interiora segmentorum omnium plerumque alba vel dilute lilacina interdum saturate colorata ad apicem. Latera externa segmentorum intus aequabile colorata, saepe cum macula saturate brunnea cinerascens prope perianthii tubum. Latera externa albida vel dilute

ad saturate lilacina, plus minusve intense venosa vel pinnatifida. Nervatio vel pinnatisectum interdum subcaeruleum, violaceum vel brunneolum. Apud perianthii tubum nonumquam macula obscura fulgore radiato prolongata apices versus segmentorum. Macula aequabiliter superponens et translucens faucem luteam. Prophyllum abest. Bractea et bracteola adsunt, argentea-alba, recutita, bractea latissima, conspicua, bracteola breviora, occultata in bractea. Filamenta plus minusve 6.1 mm, saturate lutea usque ad aurantiaca; antherae plus minusve 8.2 mm, 52% luteae, 43% luteae cum apicibus luteis, et 5% nigrae; connectivum sine colore vel luteum-griseum (cinerascens). Pollen luteum. Styli plerumque aurantiaci, divisi in partes tres, cum vel sine expansione apicem versus; rami plus minusve 5.2 mm longi cum papillis paucis. Styli plerumque breviores vel aequales quam stamina (81%). Capsula non visa. Semina elongata, 3 mm longa, 1.4–1.5 mm lata, saturate brunnea, raphe et caruncula inconspicuae. Chromosomatorum somaticorum numerus $2n = 10$.

Corm sub-globose, about 11–15 mm in diameter; outer and inner tunics coriaceous; tunic mostly entire, sporadically occurring splits create segments much broader than 5 mm, sub-splits absent; neck short (3–5 mm), consistent of broadly based triangles originated by short splits downwards; rings hard without teeth, mainly whole-edged; cataphylls silvery-white; leaves 3–4.8–7, from just visible to reaching the flowers at anthesis, light green to green, glabrous, 1–1.5 mm in diameter, 2 ribs underneath; white stripe 1/3 of leaf-diameter. Throat deep yellow to orange, when orange then surrounded by a yellow edge, glabrous; perianth tube colourless to yellowish, striped brownish-violet towards the apex. Outer segments are between 12 and 28 mm but usually 21 mm long, between 3 and 9 mm mostly 7 mm wide. Inner segments are between 12 and 27 mm but usually 20 mm long and between 4 and 9 mm in average 7 mm wide. Segment proportion of length/width is 3. Inside of all segments is predominantly white or soft lilac occasionally with deeper coloured tips. Outside of inner segments is plain coloured often with a dark brownish to greyish spot near the perianth tube. Outside of outer segments is whitish or soft to deep lilac, more or less intensively veined or feathered. Veins or feathers can be bluish, violet or brownish (Fig. 3). Near the perianth tube can be a darker spot which is ray-shaped prolonged to the tips of segments. The spot is regularly superposed on the yellow throat which shines through. Prophyll absent. Bract and bracteole present, silvery-white, skinny; bract very broad, conspicuous, bracteole much narrower and hidden within bract. Filaments on average 6.1 mm, deep yellow to orange (Fig. 3); anthers on average 8.2 mm, 52% yellow, 43% yellow with black tips and 5% black; connective colourless or yellow/greyish (photograph). Pollen yellow. The styles are mostly orange, divided into 3 branches which can be with or without expansion towards the end; branches 5.2 mm long on average, with few papillae. The styles are mostly shorter to equal compared to stamens (81%). Capsule not seen. Seeds elongated, 3 mm long and 1.4–1.5 mm broad, dark brown, caruncle and raphe indistinct (Fig. 3). Chromosome number $2n = 10$.

Distribution and habitat: *Crocus bowlesianus* is of course named to honour E. A. Bowles and his work on *Crocus* and *Colchicum*. It is known up to now only from the type locality in the Katrancık Dağı, Antalya province. It grows in high mountain steppes on basic brown calcareous soils together with scattered Pines and Juniperus trees.

4. *Crocus akdagensis* KERNDORFF & PASCHE, species nova

H o l o t y p u s: Turkey, Lycia, Antalya Province, eastern Ak Dağlar, 1500–1600 m, 20.02.2011, HKEP 9721 (Gatersleben GAT 7389).

Cormus subglobosus, plus minusve 10 mm diameter; tunica externa coriacea usque ad membranaceam; interiores membranaceae; tunica separata in segmenta >5 mm, subfissurae absunt; collum brevissimum (2–3 mm), triangulorum bases ortae ab fissuris brevibus deorsum; annuli pauci, parvi ad magnitudinem mediam, duri, sine dentibus, plerumque margine toto; cataphyllae argenteae-albae; folia 4–4.9–6, plerumque commodum visibilia supra terram, interdum attingentia flores sub anthesi, dilute virida, subulata ad linearia, glabra, 1.5 mm diameter, subter 1 (2) costae; stria alba 1/3 folii diameter. Faux dilute usque ad saturate luteum, glabra; perianthium tubus plerumque sine colore, coloratus vel striatus dilute griseus violaceus apicem versus. Segmenta externa 17–32 mm, plerumque 25 mm longa, 4–12 mm, plerumque 7 mm lata. Segmenta interna 17–32 mm, plerumque 24 mm longa, 4–10 mm plus minusve 7 mm lata. Proportio segmentorum quod attinet ad longitudinem/latitudinem: 3.6. Latera interiora segmentorum omnium dilute caerulea-violacea sine maculis. Color externus segmentorum interiorum similis parti interiori, saepe autem cum zona subcaerulea prope perianthii tubum. Latera externa segmentorum exteriorum magnitudine media dilute lilacino colore ad saturate subcaeruleum-violaceum, intense in apicem versus. Latera externa segmentorum exteriorum omnium striata vel pinnatinervia subcaerulea, brunneola vel nervatura violacea. Macula fusca apud perianthii tubum abest. Prophyllum abest. Bractea et bracteola adsunt, argentea-alba, rucutita; bractea potius conspicua, occultans bracteolam angustam et brevem. Filamenta plus minusve 6.5 mm longa, saturate lutea usque ad aurantiaca; antherae plus minusve 8 mm longae, luteae, connectivum prominens, latum, sine colore usque ad luteum. Pollen luteum. Styli lutei usque ad aurantiacum, divisi in partes tres, plerumque clare expansi vel buccinati apicem versus; rami breves, plus minusve 4.5 mm longi, cum papillis paucis. Styli antheris aequales vel longiores (79%). Capsula non visa. Semina brunnea vere, subglobosa, plus minusve 2.4 mm longa, 2 mm lata. Caruncula prominens, raphe plerumque bene visibilis. Chromosomatorum somaticorum numerus $2n = 10$.

Corm sub-globose, about 10 mm in diameter; outer tunics coriaceous to membranous, inner ones membranous; tunic splits into segments of >5 mm, sub-splits absent; neck very short (2–3 mm), basis of triangles medium-sized originated by short splits downwards; rings few, small to medium-sized, hard, without teeth, mainly whole-edged; cataphylls silvery-white; leaves 4–4.9–6, mostly just visible above ground, sometimes reaching the flowers at anthesis, light green, subulate to linear, glabrous, 1.5 mm in diameter, 1(2) ribs underneath; white stripe 1/3 of leaf-diameter. Throat light to deep yellow, glabrous; perianth tube predominantly colourless, faintly coloured or striped light greyish-violet towards the apex. Outer segments are between 17 and 32 mm but usually 25 mm long, between 4 and 12 mm mostly 7 mm wide. Inner segments are between 17 and 32 mm but usually 24 mm long and between 4 and 10 mm in average 7 mm wide. Segment proportion of length/width is 3.6. Inside of all segments is a soft bluish-lilac without markings. The outside colour of the inner ones is like the inside one but often with a

bluish zone near the perianth tube. Outside of outer segments can vary from soft lilac to deep bluish-violet, intensified towards the tips of the segments. In addition all outsides of the outer segments are intensively striped or feathered with bluish, brownish or violet veins. A dark spot near the perianth tube is absent. Prophyll absent. Bract and bracteole present, silvery-white, skinny; bract rather conspicuous, hiding the narrow and short bracteole. Filaments on average 6.5 mm long, deep yellow to orange; anthers on average 8 mm, yellow, connective prominent, broad, colourless to yellow (photograph 1a). Pollen yellow. The styles are yellow to orange, divided into 3 branches which are in most cases significantly expanded or trumpet-shaped towards the apex; branches short, 4.5 mm long on average, with few papillae. The styles are mostly equal or longer as the stamens (79 %). Capsule not seen. Seeds beige-brown subglobose the main body around 2.4 mm long and 2 mm broad. Caruncle prominent raphe in most cases well visible. Chromosome number $2n = 10$.

Distribution and habitat: *Crocus akdagensis* is presently known only from several localities east of the Lycian Ak dağ where it grows in open Pine forests on rocky places in basic brown calcareous soils.

5. *Crocus salurdagensis* KERNDORFF & PASCHE, species nova

H o l o t y p u s: Turkey, Lycia, Antalya Province, Salur dağ, 1500-1600 m, 20.02.1997, HKEP 9701 (Gatersleben GAT).

Cormus subglobose, plus minusve 10 mm diameter; tunicae externae coriaceae, interiores molles sed non membranaceae; tunica separata in segmenta 2-5 mm, subfissurae absunt; collum brevissimum (3-4 mm longum), constans ex triangulis latis cum abruptis angustis in acumina externa faciens coronam parvam, annuli duri, parvi, plerumque margine toto, raro cum singulis dentibus minutis < 0.5 mm; cataphyllae argenteae-albae, folia multa 4-10, plus minusve 7.3, admodum visibilia florentia, dilute virida, subulata, glabra; in tertia supra parte plus minusve 1.5 cataphyllum extremus versus > 2 mm diameter, subter 2 costis; stria alba 1/3 diameter folii. Faux dilute lutea usque ad aurantiacam, glabra; perianthii tubus sine colore usque ad dilute luteum, dilute striatus griseus vel brunneolus sed solum apicem versus. Segmenta externa 20-35 mm, plerumque 26 mm longa, 7-14 mm, plerumque 10 mm lata. Segmenta interna 18-33 mm, plerumque 26 mm, plerumque 25 mm longa, 6-14 mm plus minusve 10 mm lata. Proportio segmentorum externorum ciciter longitudo/latitudo: 2.6. Latera interna segmentorum circiter omnium plerumque alba, raro dilute vel saturate lilacina. Latera externa segmentorum externorum alba vel lilacina-caerulea, intense striata, pinnatinnervia vel maculosa violacea. Color externus segmentorum internorum plerumque uniformiter albus vel dilute lilacinus cum macula grisea-subcaerulea vel saturate brunnea apud perianthii tubum. Prophyllum abest. Bractea et bracteola adsunt, argentea-alba, recutita; bractea lata et conspicua, bracteola brevis et occulta intra bracteam. Filamenta plus minusve 6.1 mm, lutea; antherae plus minusve 10.4 mm, luteae, raro nigrae, praecipue apicem versus; connectivum sine colore usque ad luteum. Pollen luteum. Styli aurantiaci, raro lutei, divisi in partes tres, plerumque expansi vel buccinati apicem versus; rami plus minusve 5.6 mm longi, cum papillis paucis. Styli antheris breviores

vel aequilongi comparati staminibus (77%). Capsula non visa. Semina tota subglobose ad ovata, plus minusve 2 mm longa et 1.5 mm lata, fusca ad subnigra-brunnea. Caruncula prominens, tertia pars fere longitudinis seminorum, raphe incerta. Chromosomatorum somaticorum numerus ($2n$) ignotus.

Corm sub-globose, about 10 mm in diameter; outer tunics coriaceous inner ones softer but not membranous; tunic splits into segments of 2-5 mm, sub-splits absent; neck very short (3-4 mm long), consistent of broadly based triangles abruptly narrowed into peaks which are bend outwards building a little crown-like figure (fig.); rings hard, small, mainly whole-edged, rarely with single tiny teeth <0.5 mm; cataphylls silvery-white; leaves many 4-10, in average 7.3, just visible at flowering time, light green, subulate, glabrous, in the upper third around 1.5 towards the last cataphyll >2 mm in diameter, 2 ribs underneath; white stripe 1/3 of leaf-diameter. Throat light yellow to orange, glabrous; perianth tube colourless to yellowish, faintly striped greyish or brownish but only towards the apex. Outer segments are between 20 and 35 mm but usually 26 mm long, between 7 and 14 mm mostly 10 mm wide. Inner segments are between 18 and 33 mm but usually 25 mm long and between 6 and 14 mm in average 10 mm wide. Segment proportion of outer segments (average length/width) is 2.6. Inside of all segments is predominantly white, rarely light or deeper lilac. Outside of outer segments is white or lilac-blue, intensely striped, feathered, or speckled violet. Outside colouring of the inner segments is mostly uniformly white or soft lilac only with a more or less pronounced greyish-bluish or deep brown spot near the perianth tube. Prophyll absent. Bract and bracteole present, silvery-white, skinny; bract broad and conspicuous, bracteole narrow and hidden within bract. Filaments on average 6.1 mm, yellow (Fig. 3); anthers on average 10.4 mm, yellow, rarely black, especially towards apex; connective colourless to yellow (Fig. 3). Pollen yellow. The styles are orange, rarely yellow, divided into 3 branches which are in most cases expanded or trumpet-shaped towards the end; branches 5.6 mm long on average, with few papillae. The styles are mostly shorter to equal compared to stamens (77 %). Capsule not seen. Main body of seeds subglobose to ovate, around 2 mm long and 1.5 mm broad, dark brown to blackish-brown. Caruncle prominent, about 1/3 of seed-length, raphe indistinct. Chromosome number ($2n$) unknown.

Distribution and habitat: Up to now *Crocus salurdagensis* is known only from the type locality in the Salur dağ, Antalya province. It is a high mountain species and grows in open steppes or scattered Pine forests on basic brown calcareous soils together with *Gagea*, *Euphorbia*, *Anemone blanda*, *Scilla bifolia*, *Astragalus*, *Galanthus gracilis*, *Colchicum triphyllum*, *Juniperus* (tree), *Arum*, *Crocus pallasii*.

6. *Crocus xanthosus* KERNDORFF & PASCHE, species nova

H o l o t y p u s: Turkey, Lycia, Antalya Province, Kofu dağ, 1400-1500 m 10.03.2001, HKEP 0124 (Gatersleben GAT 7126)

Cormus subglobose, circa 12-14 mm diameter, tunicae exteriores coriaceae, interiores molles; tunica separata in segmenta >5 mm, subfissurae absunt, collum 3-6 mm longum, constans ex mediocribus triangulis basicis, annuli amplitudine media, duri

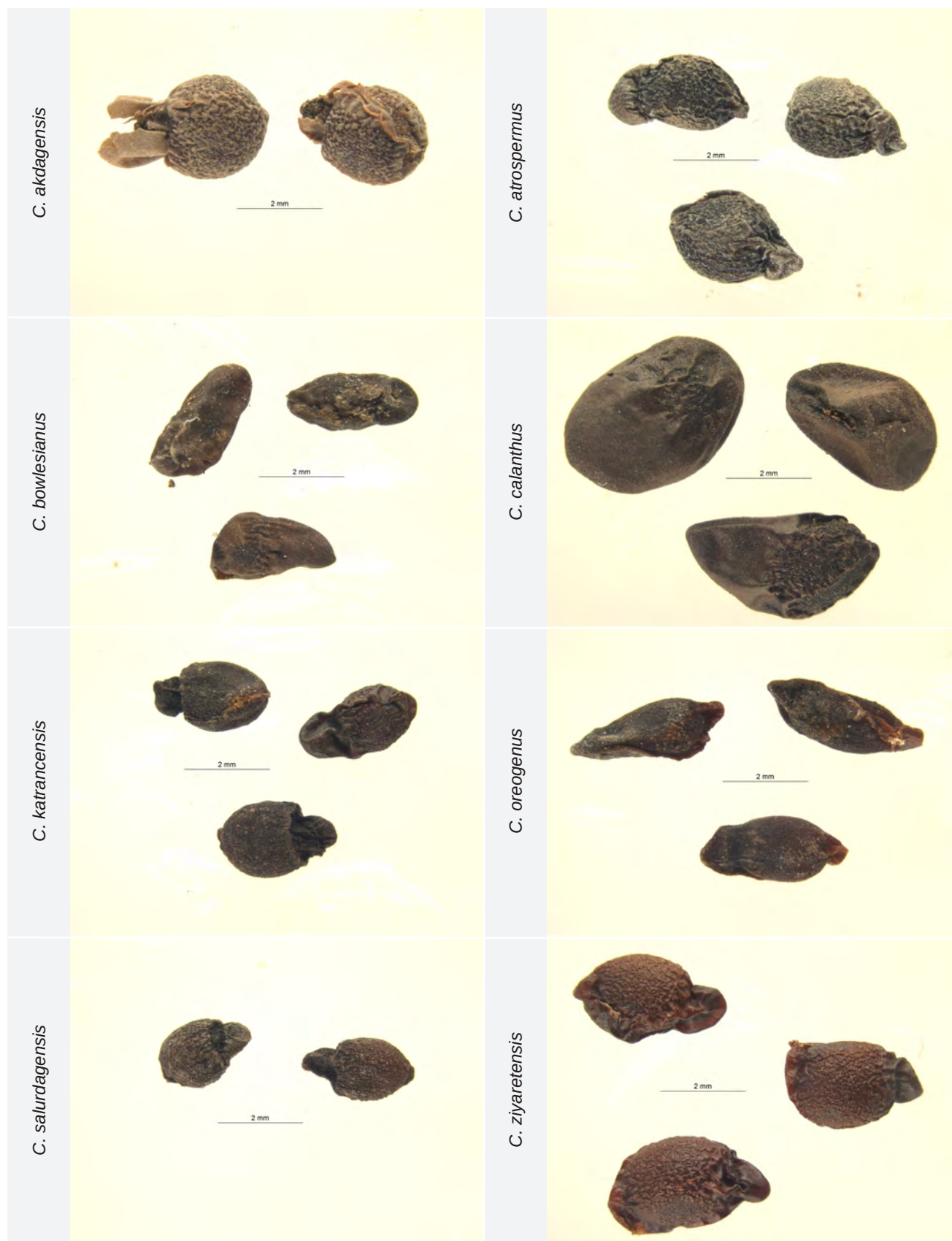


Fig. 4: Seeds of species of series *Lyciotaurei*.

Determination key for species of series *Lyciotaurei*

In the determination key below average values are used for several continuous parameters which resulted from measuring between 29 and 43 randomly selected specimens at type locality (extracts of table 2). As a consequence, one needs to measure a fairly large amount of randomly selected individuals of a population in the field to receive reliable results.

1	Number of leaves on average more than seven leaves subulate	<i>C. salurdagensis</i>
1*	Number of leaves on average between 4.4 and 6.4, leaves not subulate	2
2	Filaments short, on average 4.1 mm long	<i>C. akkayaensis</i>
2*	Filaments on average 7.6 mm long	<i>C. calanthus</i>
2**	Filaments on average between 6 and 6.9 mm long	3
3	Anthers medium sized, between 9 and 10 mm long	4
3*	Anthers on average longer than 11 mm	5
4	Segment proportion on average high (>3.5)	6
4*	Segment proportion on average lower than 3	7
5	Insides of all segments white	8
5*	Insides of all segments vary from soft lilac-blue to bluish-violet	9
6	Seeds beige-brown (subglobose, 2-2.2 mm long)	<i>C. akdagensis</i>
6*	Seeds of other colors	10
7	White stripe small (<1/3 of leaf-diameter)	<i>C. oreogenus</i>
7*	White stripe broader (1/3 to >1/3 of leaf-diameter)	11
8	Style-branches 6.5 mm and filament 7.7 mm long on average	<i>C. xanthosus</i>
8*	Style-branches 5.4 mm and filament 6.9 mm on average	<i>C. beydaglarensis</i>
9	Filaments and anthers long (7.6 resp. 11.2 mm o. a.)	<i>C. calanthus</i>
9*	Filament medium-sized (6.1 mm) anthers short (8.2 mm)	<i>C. bowlesianus</i>
10	Seeds chestnut-brown.	<i>C. ziyaretensis</i>
10*	Seeds blackish, main body ovate, 2 mm long	<i>C. atrospermus</i>
11	Leaves grey-green	<i>C. lyciotaureus</i>
11*	Leaves dark green not greyish	12
12	style according to stamen 81% shorter to equal, color of filaments and connectives mostly colorless, rarely very light yellow	<i>C. katrancensis</i>

vel molles, sine dentibus, margine toto, cataphyllae argenteae-albae, foliis 4-5.2-8, plerumque admodum visibilia nunquam superantia flores, virida, potius subulata, glabra, 1-2 mm diameter, 2(3) costis in omni sulco in folio inferiore; faux dilute lutea, glabra; perianthii tubus plerumque sine colore, dilute coloratus vel striatus griseus-brunneolus apicem versus. Segmenta externa 21-37 mm, plerumque 29 mm longa, 6-15 mm, plerumque 10 mm lata. Segmenta interna 19-37 mm, plerumque 27 mm longa, 5-12mm plus minusve 9 mm lata. Proportio segmentorum quod attinet ad longitudinem/latitudinem segmentorum exteriorum: 2.9. Latera interna segmentorum omnium alba vel dilute caerulea-lilacina, praecipue ad apicem. Color externus segmentorum interiorum plerumque similis lateribus internis, raro fuscior perianthii tubum versus. Latera externa segmentorum exteriorum variantia ab albo ad dilute lilacinum vel raro gravem caeruleum-violaceum, interdum vehementer apicem segmentorum versus. Praeterea latera exteriora segmentorum exteriorum fortasse venosa vel pinnatifida. Subtilia caerulea potius quam violacea. Macula fusca apud perianthii tubum abest. Prophyllum abest. Bractea et bracteola adsunt, argenteae-albae,

recutitae; bractea lata et conspicua, occultans bracteolam. Filamenta 6-7.7-9 mm longa, lutea; antherae 7-10.3-13 mm longae, luteae; connectivum sine colore usque ad dilute luteum. Pollen luteum. Styli aurantiaci, divisi in ramos tres, raro expansi vel buccinati apicem versus; rami plus minusve 6.5 mm longi. Styli plerumque aequales vel longiores quam stamina (84%). Capsula et semina non visa. Chromosomatorum somaticorum numerous $2n = 12$.

Corm sub-globose, about 12-14 mm in diameter; outer tunics coriaceous, inner ones softer; tunic splits into segments of >5 mm, sub-splits absent; neck 3-6 mm long, bases of triangles medium-sized originated by short splits downwards; rings medium-sized, hard or soft, without teeth, whole-edged; cataphylls silvery-white; leaves 4-5.2-8, mostly just visible or reaching but never overtopping the flowers, green, rather subulate, glabrous, 1-2 mm in diameter, 2(3) ribs underneath of both sides of the keel. Throat deep yellow to orange, glabrous; perianth tube predominantly colourless, faintly coloured or striped greyish-brownish towards the apex. Outer segments are between 21 and 37 mm but usually 29 mm long, between 6 and 15 mm mostly

10 mm wide. Inner segments are between 19 and 37 mm but usually 27 mm long and between 5 and 12 mm in average 9 mm wide. Segment proportion of length/width is 2.9. Inside of all segments is white or soft bluish-lilac especially at tips. The outside colour of the inner ones is mostly like the inside one rarely darker towards the perianth tube. Outside of outer segments can vary from white to soft lilac or rarely deep bluish-violet, sometimes intensified towards the tips of the segments. In addition the outsides of the outer segments can be veined or finely feathered bluish rather than violet. A dark spot near the perianth tube is absent. Prophyll absent. Bract and bracteole present, silvery-white, skinny; bract broad and conspicuous, hiding the bracteole. Filaments 6-7.7-9 mm long, yellow; anthers 7-10.3-13 mm long, yellow; connective colourless to light yellow. Pollen yellow. The styles are orange, divided into 3 branches which are rarely expanded or trumpet-shaped towards the apex; branches 6.5 mm long on average. The styles are mostly equal or longer as the stamens (84 %). Capsule and seeds not seen. Chromosome number $2n = 12$.

Distribution and habitat: *Crocus xanthosus* is named according to the old Lycian capital Xanthos which is not far away. It is known up to now only from the type locality in the Kofu dağı, Antalya province. At the type locality it grows in open mountain steppes on calcareous soils between rocks and in crevices together with *Pinus*, *Juniperus*, and *Quercus*.

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