

Viola section *Melanium* (Violaceae) in Italy. New data on morphology of *Viola tricolor*-Group

ANNA SCOPPOLA¹, EDDA LATTANZI²

¹ Dipartimento DAFNE, Università della Tuscia
Via San Camillo de Lellis s.n., 01100, Viterbo (Italia)
scoppola@unitus.it

² Dipartimento di Scienze Ambientali, Sapienza Università
Piazzale Aldo Moro 5, 00185, Roma (Italia)
eddalattanzi@gmail.com

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Viola Sez. *Melanium* in Italia. Nuovi dati sulla morfologia del gruppo di *Viola tricolor* — Su materiale proveniente da varie località italiane relativo a specie del gruppo di *Viola tricolor* (Sezione *Melanium*) sono stati studiati i principali caratteri morfologici. Ulteriori, importanti, caratteri diagnostici trascurati nelle Flore attuali sono stati individuati ed evidenziati con dati sperimentali *in situ* e *ex situ* sulla base dello studio di *exsiccata* e di approfondite ricerche bibliografiche. A tal fine sono state effettuate misure di sepal, corolla, petali, sperone, peduncolo fruttifero su fiori ben sviluppati di piante a diverso livello di sviluppo. Si presentano immagini ad alta risoluzione dei caratteri diagnostici relativi a stamma, *labellum* e posizione dell'apertura stigmatica, di stipole e relative foglie prelevate nella parte inferiore, media e superiore del fusto. Esse forniscono un ulteriore strumento per una corretta identificazione delle entità di questo difficile gruppo. Una tavola sinottica mette a confronto i caratteri utili per una corretta identificazione di: *V. kitaibeliana*, *V. hymettia*, *V. parvula*, *V. arvensis* subsp. *arvensis* e *V. tricolor* subsp. *tricolor*. Sono stati controllati e, in alcuni casi, revisionati *exsiccata* di numerosi Erbari (APP, CAT, CLU, FI, GOET, IS, LEC, RO, SIENA, TO, TSB, UTV, Herb. Bartolucci, Herb. Lattanzi, Herb. Lavezzo). La distribuzione italiana è stata quindi aggiornata con nuovi dati per Umbria e Puglia. La presenza di *V. hymettia* viene confermata per il settore tirrenico antiappenninico (Lazio), dove la specie è molto frequente soprattutto nei dintorni di Viterbo, e per le Murge tarantine. Sono state osservate nell'Italia centrale forme intermedie di *V. arvensis*/ *V. tricolor* da considerare come forme di transizione o di origine ibrida, chiaro indizio di una elevata variabilità. Attualmente non è possibile confermare la presenza in Italia di *V. arvensis* subsp. *megalantha*.

Key Words: identification key, Italy, morphology, new records, *Viola* section *Melanium*.

Violaceae is a medium-sized cosmopolitan family of perennial, rarely annual, herbs or shrubs, which are typical of temperate-mountainous regions. It contains approximately 900 species belonging to 22 genera. In the flora of Europe and Italy, the family is represented only by its largest genus *Viola* L. while the remaining ones are mainly found in tropical and subtropical areas (Valentine et al., 1968; Heywood, 1993). The genus counts in Italy 59 units belonging to 46 species of which 18 are endemic (Conti et al., 2005).

Among the *Viola* species, there are no more than 10 annuals and most of them belong to the *Melanium* Ging. Section, closely related to *Viola tricolor*; the common pansy; they have the widest distribution of all the pansies (Clausen, 1926). In Italy, according to Conti et al. (2005), the annual units are *V. kitaibeliana* Schultes, *V. hymettia* Boiss. & Heldr., *V. parvula* Tineo, *V. arvensis* Murray s.l. and *Viola tricolor* L. subsp. *tricolor*. *V. tricolor* subsp. *saxatilis* (A.F.W. Schmidt) Jan, being pluri-annual and grow-

ing on meadows and screes, forms a transition between hilly/lowland annual and montane/sub-alpine perennial species.

The multiple references of *V. kitaibeliana* / *V. hymettia* for some Italian regions emphasize the difficulty in identification of these two species and their correct distinction from *V. arvensis* (Ballelli, 1987; Lainz, 1992; Corazzi, 1997; Amat, 1998; Scoppola, 2005; Bartolucci & Iocchi, 2007; etc.). The problem emerges from the distribution in Italy of the less frequent and more localized pansies of the group (Conti et al., 2005), and leads us to suppose wrongness in interpretation owing to the presence of extreme morphological forms and/or hybrids (Valentine et al., 1968). The recent discovery of the rare *Viola hymettia* in many places of the Tyrrhenian Antiapennine volcanic sector (Scoppola, 2005; Magrini et al., 2006; Anzalone et al., 2010; *exsiccata* in UTV *Herbarium*) and in Puglia (Carruggio et al., 2008 and revised *exsiccata* in LEC), presents us with the opportunity to review this group. The review is carried out through direct observation of fresh specimens and analysis of relationships between floral and/or vegetative organs, the stipule shape being one of the most important vegetative characters in the classification of *Viola* species (Erben, 1985).

The aim of this first paper is to present a detailed morphological description of *Viola kitaibeliana*, *V. hymettia*, *V. parvula*, *V. arvensis* subsp. *arvensis* and *V. tricolor* subsp. *tricolor*; useful for the identification of the Italian species. In addition to this, the paper also seeks to discuss the taxonomic identities and differences among them, by undertaking the comparison with some transitional or intermediate forms. With regards to *V. arvensis* subsp. *megalantha* Nauenb. we are not able to verify this matter for lack of fresh material. Chorological and ecological data will be also provided, since the distribution and auto-ecology, particularly of *V. hymettia* / *V. kitaibeliana* is still critical (Espeut, 1998; Bartolucci & Iocchi, 2007). This paper will not cover other topics, such as pollination mechanisms and pollen-grain forms or cytological investigation, providing instead a new identification key.

Taxonomy

The systematic treatment of the *Viola* section *Melanium* is interpreted in a different ways by authors in Italy and Europe (Mezzena, 1958; Erben, 1985;

Nauenburg, 1991; Espeut, 1999a,b). Their delimitation, due to variability, close relationship and hybridisation, is discussed by different authors, among them Clausen (1921), Kristofferson (1923), Pettet (1964).

According to the systematic criteria and the nomenclature of Gams (1926) and Mezzena (1958), the units under review are set into the Sect. *Melanium* Ging., Subsect. *Elongatae* (= *Caudiculatae*) W. Roessler., and in the *Viola tricolor* group or collective species, assigned by Espeut (1999a) to the series *Tricolores* (W. Becker) Espeut (including both *V. tricolor* L. and *V. arvensis* Murray with all their sub-forms) and subdivided into subseries: *Parvulae* (Klokov) Espeut, *Tricolores* (W. Becker) Espeut, *Arvensis* (Drabble) Espeut and *Kitaibeliana* (W. Becker) Espeut.

As is widely reported in the literature, the *Melanium* Section is a morphologically well-defined group of species. They constitute a derived and monophyletic group and have very close relationships with each other, as shown by the reduced genetic variation compared to the other sections of *Viola*, since these are believed to originate from hybridisation events (Clausen, 1927; Küpfer, 1971; Davis, 1988; Erben, 1996). Many taxonomic studies on specific species complexes are published during the twentieth century based largely on morphology, chromosome number and molecular phylogenetic analysis (Clausen, 1927, 1931; Nauenburg, 1991). Each species is able to cross with a number of others, irrespective of their chromosome number, resulting in at least partially fertile hybrids (Kristofferson, 1923). *V. tricolor* and probably *V. arvensis* occupy a central position in the *Melanium* section, forming hybrids with almost all the species of the group (Clausen, 1926).

The majority of them are herbaceous and caulescent; the leaf arrangement is alternate; leaves consist of lamina, petiole, leaf-like stipules deeply divided as well as entire. Flowers have long pedicels with 2 small bracts in the upper third. They are frontally flattened with upwards turned side petals, lower petal enlarged with a yellow spot on the proximal part (the honey-guide) and a well-developed spur of variable length. The stigma has a characteristic capitate or globose shape with an evident opening to the cavity (chamber in Clausen, 1922). A ventral stylar flap (*labellum*) may be present or absent under the opening to the cavity. This *labellum* is a portion of the stigma and is inconspicuous but very important biologically, since it determines whether the plant is self pollinating or not

(Clausen, 1931). Cleistogamy has not been reported for members of the *Melanium* section (Herrera, 1993), although it occurs in most species of the genus, and these flowers are sternotribic (Beattie, 1974). *Viola* species produce several pollen morphs, but the proportions of these morphs strongly differ from one species to another (Gams, 1926; Erdtman, 1966; Dajoz et al., 1995; Dajoz, 1999; Hildebrandt et al., 2006).

The small-flowered species of the group (petals shorter than sepals) are autogamous, as *V. arvensis*, *V. kitaibeliana* and *V. parvula*, the only *Melanium* species without *labellum* or with a very small one. All large or relatively large-flowered species or subspecies (petals larger than sepals), such as *V. hymettia*, *V. tricolor* and its hybrids with large flowers, have a *labellum* which prevents spontaneous self pollination (Kristofferson, 1923; Clausen, 1926; Pettet, 1964; Nauenburg, 1990). The fruit is a multi-seeded capsule which opens lengthwise from the top. Seeds are ovoid, smooth, and pale to dark brown in colour; they are dispersed by the ants and germinate after 4 weeks (Gams, 1926).

Nomenclature, *typus* and main synonyms of the species concerned are listed as follows. Further information on typification of the linnean species *V. tricolor* are given by Jarvis (2007) and Nauenburg (1991).

Viola kitaibeliana Schultes in Roemer & Schultes, Syst. Veg. 5: 383 (1819)

TYPUS: *In Pannonia*, Kitaibel (M)

V. tricolor var. *hirta* Ging. in DC. Prodr. I: 304 (1824)

V. tricolor L. var. *kitaibeliana* (Schultes) Boiss., Fl. Or. 1: 466 (1867)

V. arvensis Murr. var. *Kitaibeliana* (Roem. et Schult.) Halácsy (De), Consp. Fl. Graec. 1: 145 (1901)

V. tricolor subsp. *Kitaibeliana* Schinz u. Kell., Fl. Schweiz (ed. III), 1: 366 (1909)

V. Kitaibeliana Roem. et Schult. var. *typica* W. Bckr., Beih. Bot. Centralbl. 26, II (3): 338 (1910)

2n = 16 (Erben, 1985)

Viola hymettia Boiss. & Heldr. in Boiss., Diagn. Pl. Or. Nov. ser. 2(1): 57 (1853)

LECTOTYPUS: *In monte Hymetto Atticae, non rara, alt. 2000-3000 (ft)*, 3-15 Apr 1852, Orphanides (Th. Orphanides, Fl. Graeca exs. Nr. 120) (M)

V. tricolor L. var. *hymettia* (Boiss. & Heldr.) Boiss., Fl. Or. 1: 466 (1867)

V. arvensoides Strobl, Österr. Bot. Zeitschr. 27: 224 (1877), Typus: *in regione inferiore montis Aetnae, solo vulcanico*, 31.3.1874, Strobl (M)

V. tricolor var. *arvensoides* (Strobl), Cesati, Passerini, Gibelli, Comp. Fl. Ital. 2: 807 (1886)

V. Kitaibeliana var. *longeborgneana* W. Bckr., Viol. exs.: 180 (1906)

V. Kitaibeliana Roem. et Schult. var. *typica* W. Bckr. f. *hymettia* (Boiss. et Heldr.) W. Bckr., Beih. Bot. Centralbl. 26, II (3): 339 (1910)

V. tricolor L. subsp. *minima* Gaudin var. *Kitaibeliana* (Römer et Schultes) Ledeb. subvar. *Hymettia* Boiss. et Heldr.) W. Becker, Gams in Hegi & al., Ill. Fl. Mitteleur. 5(1): 601 (1926)

2n = 16 (A. Schmidt, 1964)

Viola parvula Tineo, Pl. Rar. Sic. Pugill.: 5 (1817)

TYPUS: *In Nebrodibus. Sulla Curma grande*, Tineo (G)

V. tricolor L. var. *o bellioides* DC., Prodr. I: 304 (1824)

V. tricolor var. δ *parvula* (Tineo) Presl, Fl. Sic. 1: 134 (1826)

V. parvula Ten., Syll. Pl. Vasc.: 118 (1831), non Tineo. Typus: *in nemoribus Calabriae: Aspromonte* (NAP)

V. tricolor var. *x minima* Bertol., Fl. Ital. II: 719 (1835)

V. tricolor L. subsp. *minima* Gaudin var. *Kitaibeliana* (Römer et Schultes) Ledeb. subvar. *pygmaea* Rouy et Foucaud, Gams in Hegi & al., Ill. Fl. Mitteleur. 5(1): 601 (1926)

2n = 10 (Erben, 1985)

Viola arvensis Murray, Prodr. Design. Stirp. Götting.: 73 (1770)

LECTOTYPUS: *Basel, inter segetes* C. Bauhin, «*Viola Martia fol(iis) obl(ongis)* 6: 200» (BAS)

V. tricolor L. var. *arvensis* (Murray) Wahlenb., Fl. Suec. (1824), non DC. (1824)

V. tricolor L. subsp. *arvensis* (Murray) Gaudin, Fl. Helv. 2: 210 (1828)

V. arvensis Murr. subsp. *communis, sublilacina, patens, curtisepala* Wittr., Acta Horti Berg. 2(1)1: 81, 84, 85, 87 (1897)

2n = 34 (Clausen, 1921)

Viola tricolor L., Sp. Pl. 935 (1753)

LECTOTYPUS: Herb. Linn. n. 1052.21 (LINN)
(Banerjee & Pramanik in Jain & al. in Fasc. Fl. India
12: 36 (1983))

V. tricolor var. *vulgaris* Reichenb., Fl. German. Ex-
curs. 2: 710 (1832) non W.D.J. Koch (1837)

V. tricolor subsp. *genuina* Wittr., Acta Horti Berg.
2(1): 56 (1865)

V. tricolor subsp. *vulgaris* (Reichenb.) Oborný, Fl.
Mähren 4: 1142 (1886)

2n = 26 (Clausen, 1921; Miyaji, 1929; Merxmül-
ler, 1974)

Materials and methods

Flowering and fruiting specimens of *V. hymettia*,
V. kitaibeliana, *V. tricolor*, *V. arvensis* and their sub-
forms are collected from February 2008 to June 2011
in several Italian localities, mainly in the Lazio region
given its field richness and variability; for the collect-
ing localities see Table 1 and the Appendix.

The phenology of some populations in Viterbo
environments is constantly observed so as to collect
different stages of plants. More than 100 specimens
belonging to these *taxa* are used to conduct morpho-
logical studies and to provide material for prelimi-
nary cytological investigation. Several of these have
been cultivated *ex situ* for further observations (par-
ticularly *V. hymettia* and *V. tricolor*) and seeds stored
in the Tuscia Germplasm Bank (Viterbo University).
The seeds are dehydrated at RH=15% and T=+15°C
to reach a relative humidity percentage, of approxi-
mately 5%, and are stored in a freezer at around
-20°C (Magrini et al., 2012).

Many specimens are dried according to standard
herbarium techniques and preserved in the Herbari-
um UTV. High resolution digital images of floral
details, leaves and stipules from fresh material, useful
in comparing species, have been acquired. Additional
studies using outline and multivariate analysis meth-
ods are in progress.

The species delimitation is also made by means of
a critical examination of specimens selected among

Table 1 – Sites where wild *Viola* populations are studied in the field and specimens are collected for cultivation (listed in a N-S sequence).

Localities (and provinces)	UTM coordinates (datum: WGS 1984)		Elevation (m a.s.l.)	Species
Paesana (Cuneo)	32 363,300mE	4,949,200mN	614 m	<i>V. tricolor</i>
Chialvetta, Acceglio (Cuneo)	32 340,800mE	4,923,700mN	1500 m	<i>V. tricolor</i>
Colonna, Bomarzo (Viterbo)	33 271,600mE	4,708,700mN	219 m	<i>V. arvensis</i> transitional form
Bassano in Teverina (Viterbo)	33 279,200mE	4,705,100mN	70 m	<i>V. kitaibeliana</i>
Riello, Viterbo (Viterbo)	33 260,300mE	4,701,200mN	315 m	<i>V. hymettia</i>
M. Palanzana (Viterbo)	33 265,800mE	4,698,900mN	500-650 m	<i>V. hymettia</i> , <i>V. arvensis</i> , <i>V. tricolor</i> and transitional form
Asinello, Viterbo (Viterbo)	33 258,100mE	4,698,600mN	250 m	<i>V. hymettia</i>
Castel d'Asso, Viterbo (Viterbo)	33 257,600mE	4,697,600mN	243 m	<i>V. hymettia</i>
Petrignano, Viterbo (Viterbo)	33 259,400mE	4,693,700mN	360 m	<i>V. hymettia</i>
S. Martino al Cimino (Viterbo)	33 264,100mE	4,693,200mN	550-772m	<i>V. arvensis</i> , <i>V. tricolor</i>
Vetralla and its environs (Viterbo)	33 252,900mE	4,686,800mN	199 m	<i>V. hymettia</i>
Acquaforte, Vejano (Viterbo)	33 261,500mE	4,678,000mN	336 m	<i>V. tricolor</i> . and transitional forms
La Mola, Oriolo Romano (Viterbo)	33 260,100mE	4,672,800mN	317 m	<i>V. tricolor</i>
Barisciano (L'Aquila)	33 383,900mE	4,686,900mN	940 m	<i>V. kitaibeliana</i>
F.ta Acque Albule, Tivoli (Roma)	33 311,400mE	4,648,600mN	105 m	<i>V. kitaibeliana</i>
Monti Affilani, Arcinazzo (Roma)	33 348,800mE	4,636,400mN	1200 m	<i>V. arvensis</i>
M. Trave, Ferentino (Frosinone)	33 351,113mE	4,614,100mN	326 m	<i>V. kitaibeliana</i> transitional form
Iscatara, Roseto Valfortore (Foggia)	33 511,100mE	4,578,300mN	980 m	<i>V. arvensis</i> transitional form

the *exsuccata* of APP, CAT (online *Herbarium*), CLU, FI, IS, LEC, RO, SIENA, TO, TSB, UTV, *Herb. Bartolucci*, *Herb. Lattanzi*, *Herb. Lavezzo*, as well as online specific *exsuccata*. However, for proper identification, scanned images of clearer specimens (characters of flowers and stipules/leaves) are made, whilst photos of living material are provided. Protologues and the main literature are consulted; in particular the identification keys of Gams (1926), Valentine et al. (1968), Oberdorfer (1979), Merxmüller (1982), Raus (1986), Espeut (1999a, b), Blaxland (2004), the studies of Clausen (1921, 1922, 1926) as well as Erben (1985), and the plates of Wittrock (1897).

Results

Diagnostic characters

The comparative study focuses mainly on the characters of flower. For a detailed description of the flower construction and the differences between *V. tricolor* ($2n=26$) and *V. arvensis* ($2n=34$), see mainly Wittrock (1897), Clausen (1922), Kristofferson (1923), Ross-Craig (1950) and Pettet (1964); more recently for *V. hymettia* and *V. kitaibeliana*, both with $2n=16$, Erben (1985) and Espeut (1999a,b) give more diagnostic characters. They also point out intermediate forms to which they assign the status of species, thus emphasising their affinity, namely *V. phytosiana* Erben ($2n=24$) from central and southern Greece, and *V. roccabrunensis* Espeut ($2n=48$) from Var department (France).

At present, there is no comparative study of the floral and vegetative characteristics of all the investigated species, with the exception of the appended key to the annual violas of Turkey (Blaxland, 2004) and the already cited Merxmüller's handling in *Flora d'Italia* (1982). With this in mind, we firstly present the following remarks, both derived from our observation on fresh material and *exsuccata* and from the main literature.

– Flowers. In accordance with Kristofferson (1923) and Erben (1985), in all the species analysed we observe an increasing reduction of the flower size from the lower to the upper parts (in *V. arvensis* and *V. tricolor* also from the main axis to the branches). The characters concerning size, shape, and colour of the first or the late flowers are not worthy of consideration, the late ones being always smaller, clearer and with a higher ratio length/width. Early flowers show colours brighter than

the late flowers due to seasonal conditions. Indeed *V. hymettia* and *V. kitaibeliana* show colours brighter than *V. arvensis*, since they have on average a phenology of approximately 1-2 months in advance, but the colour of the late flowers of *V. hymettia* becomes similar to that of *V. arvensis* (Fig. 1). As observed by Pettet (1964) and reported by Oberdorfer (1979), in the flowers of *V. tricolor* there is an evident colour change which occurs as the flower unrolls, therefore it must be identified upon well developed flowers.

The sepals' shape and size, neglected characters given in some keys (Merxmüller, 1982; Muñoz Garmendia, 1993), are also useful features. In this case measures must be taken mainly on lower lateral sepals (Fig. 1, 2).

The position of the opening to the stigmatic cavity (stigmatic orifice), the labellum and the pollen magazine observed on fresh material are essential (Clausen, 1921, 1931; Kristofferson, 1923; Beattie, 1974). The opening to the stigmatic cavity, when observed in the whole flower, appears down-backwards or forwards turned, while, when observed in the stigma from a front view, it is on the anterior or superior side.

Finally, the presence/absence of a dark spot on the anterior part of the style is easier to identify on fresh material when compared to dry material (Fig. 3). However, in accordance with Clausen (1921, 1922) it is not always a suitable diagnostic character.

– Bracts. All of these species have evident bracts on the upper third of the peduncle. The variation of their position proves to be a good character, as pointed out by Blaxland in his key (2004), mainly on specimens which are hardly recognisable in fruit or pressed. We observe that the distance between the flower and the bracts increases according to the sequence *V. kitaibeliana* / *V. hymettia* / *V. arvensis* / *V. tricolor*. In *V. kitaibeliana* the bracts are just below the flower, in *V. tricolor* generally at about 1/3 and, at least in the fruiting peduncle, they are separated.

– Leaves. Leaf characters are generally of little value (Pettet, 1964). Indeed, size and shape vary to a high degree depending on leaf position, external conditions (light/shadow, warm/cold, dry/humid, poor/rich soil, etc.), plant size and age (Kristofferson, 1923; Nauenburg, 1990). Leaves are elliptic, ovate-oblong, oblong-lanceolate to lanceolate, shallowly crenate or crenate-serrate to entire. Their gradual narrowing and the decreasing of the petiole are clearly evident both in fresh and dry material (Fig. 4).

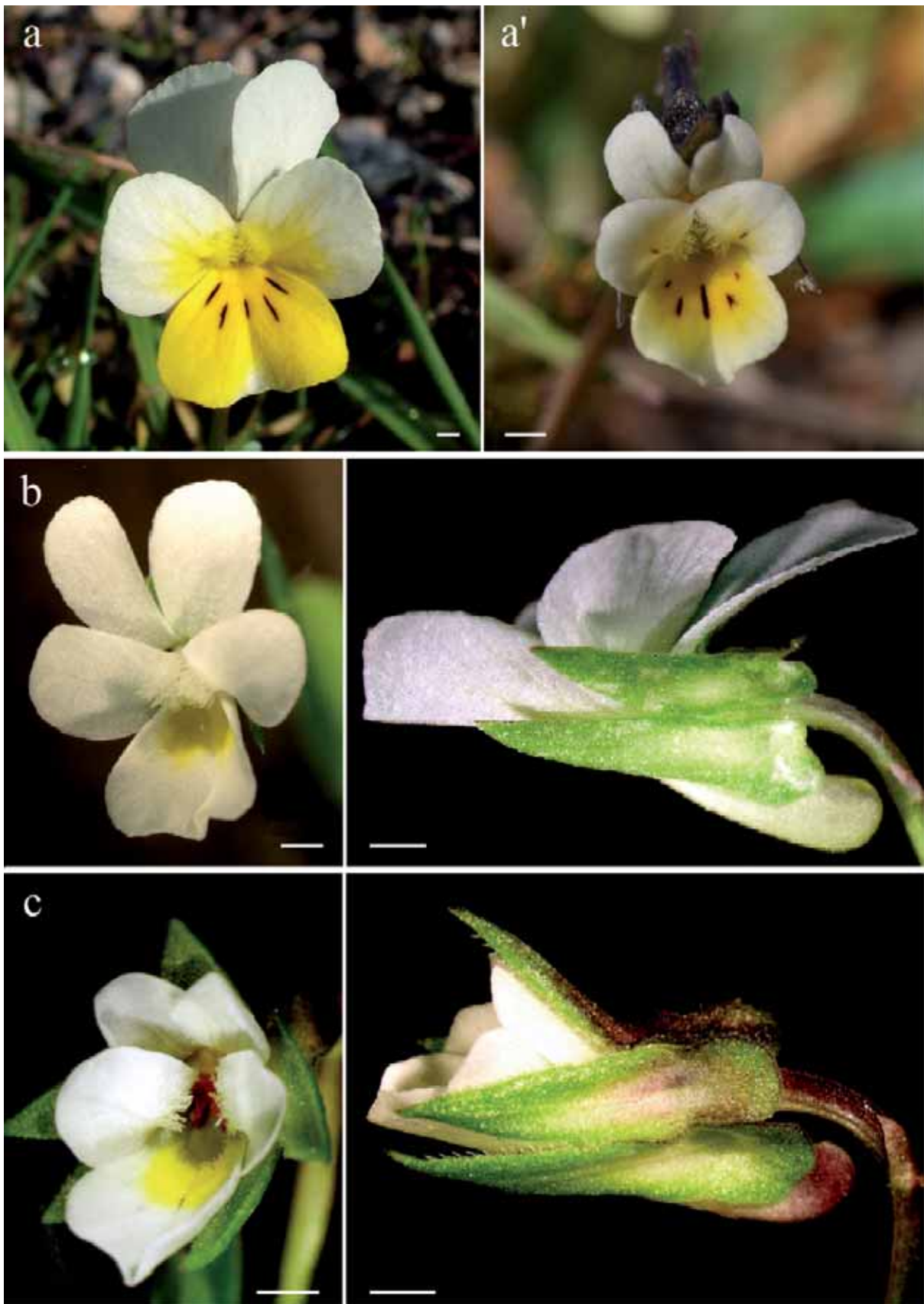


Fig. 1 – Comparison between flowers: *V. hymettia* first flower (a), last flower in front and lateral view (b); *V. kitaibeliana* first flower (a'), last flower in front and lateral view (c) (bar = 1 mm).

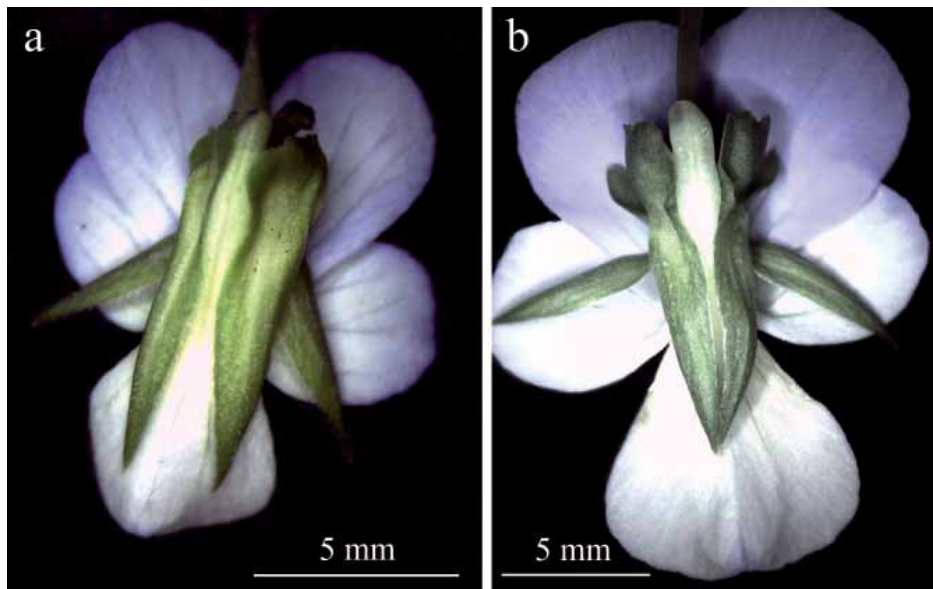


Fig. 2 – Flowers in underneath view of (a) *V. arvensis* (first flower), (b) *V. tricolor*. Note the ratio corolla/calix.



Fig. 3 – Stigmas of: (a) *V. kitaibeliana*, (b) *V. hymettia*, (c) *V. arvensis* and (d) *V. tricolor* in front and lateral view. Note the presence/absence of the stylar dark spot, the position of the entrance to the stigmatic chamber and the size of *labellum* (bar = 1 mm).



Fig. 4 – Lower, median, upper leaves and stipules of: (a) *V. kitaibeliana* (Barisciano, L'Aquila), (b) *V. hymettia* (Vetralla, Viterbo), (c) *V. arvensis* subsp. *arvensis* and (d) *V. tricolor* subsp. *tricolor* (M. Palanzana, Viterbo).

Leaves and stipules develop their typical shape after a given vegetative period (Erben, 1985). Therefore, only the median leaves on the main axis have to be compared, not the extremes or those growing on weak branches. This variability in *V. arvensis* and *V. tricolor* is mainly linked to seasons and ecological conditions, while in *V. hymettia* and *V. kitaibeliana* the lower, median and upper leaves are gradually different and their shape is independent of ecological conditions, thus their variation always emerges (eterophyllous species) (Fig. 5).

Plants collected too early or on poor/too dry soil can show just lower leaves, while strongly developed plants growing on rich soil produce median (and upper) larger sized leaves, due to their annual habit. We have actually remarked that some *exsiccata* of poorly developed specimens of *V. hymettia* / *V. arvensis* were incorrectly identified as *V. kitaibeliana* and that the *exsiccata* of strongly developed specimens of *V. hymettia* were attributed to young individuals of *V. tricolor*. Therefore, abnormal or undeveloped specimens, both in dry and living material, are not identifiable and should first be cultivated.

We consider that the number of the broad teeth on lower leaves margin is a useful character through which to distinguish the *V.k* - *V.hy* from *V.a* - *V.t*

group, the former having the lower leaves with fewer teeth (Fig. 4); *V. parvula*, the closest species to *Viola kitaibeliana*, differs from the others in the almost entire leaves, apart from the longer hairs. In specimens of *V. kitaibeliana* strongly branched and with habits similar to *V. arvensis*, the features 'median leaves round at apex' and 'lateral margins shallowly crenate to entire' are useful in differentiating the former from the latter.

– Stipules. We confirm that the stipules provide a clear tool with which to distinguish *V.a* - *V.t* from *V.k* - *V.hy* group; in the middle of the stem they reach the largest development and the greatest range of division (a particular feature of each species), and decrease on the top. In all of the 5 species, the stipules of the lower leaves are small, partially lobed if at all, and sometimes are completely lacking. The others are deeply divided, varying in the different species from pennately- to palmately-lobed. In the median and upper stipules of *V.k* - *V.hy* the mid-lobe is always similar to the corresponding leaf (Fig. 4a, b). To distinguish *V. tricolor* from *V. arvensis*, the characters of leafy/not leafy and crenately notched/entire of the mid-lobe are quite important (Fig. 4c, d): they are ovate-lanceolate to lanceolate, not leafy and crenately notched to entire in *V. tricolor* subsp. *tricolor*. Their

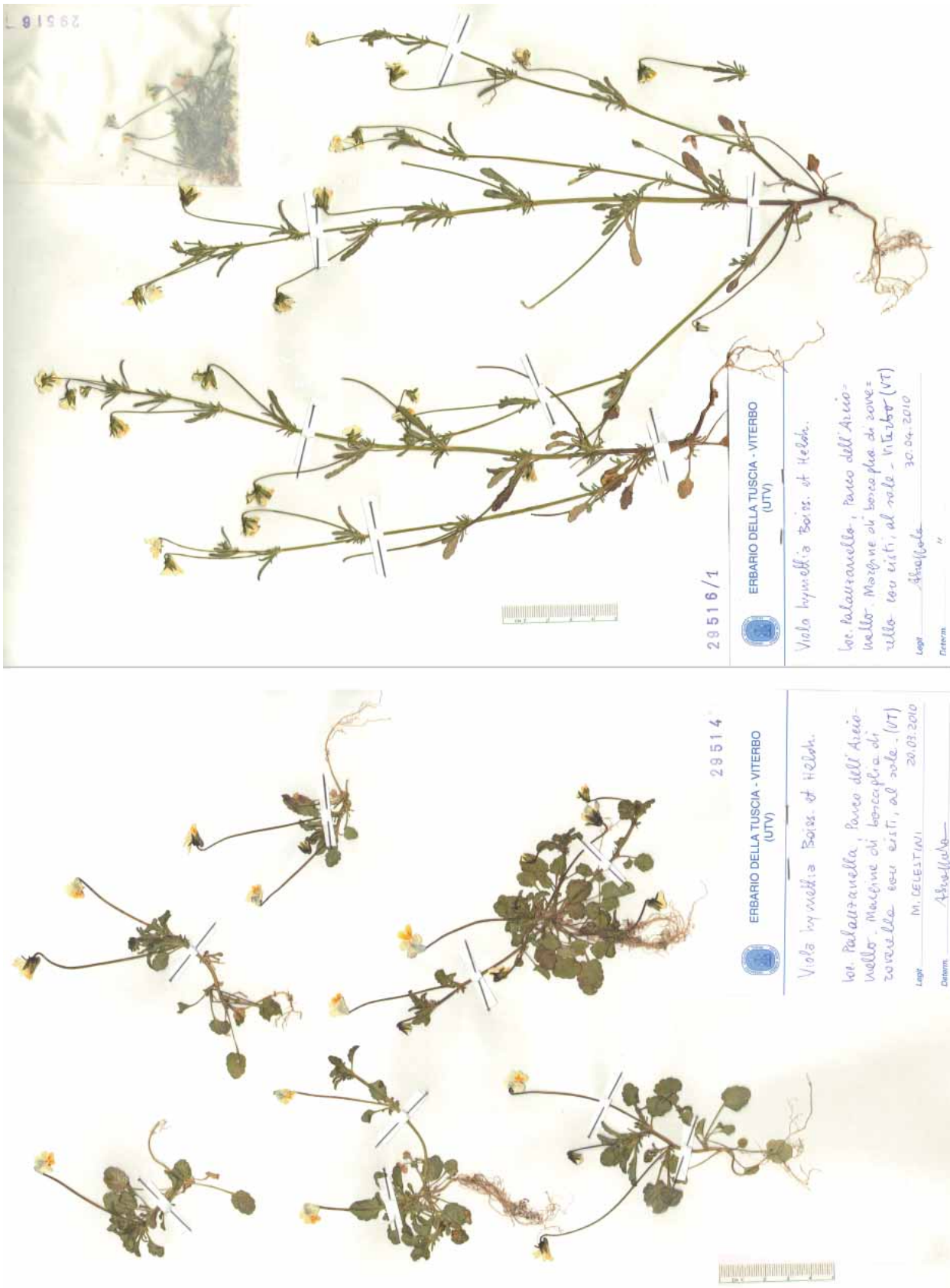


Fig. 5 – UTV Herbarium specimens of *V. hymettia* collected on March (a) and April (b) 2010 in the same station in Viterbo environs.

variation is evident if observed on adequate portions of stem mainly on fresh material or good *exsiccata* of well developed specimens.

Further detailed information is given by Erben (1985). Here we have only taken into account this variability in order to recognise some intermediate forms, as the topic will be dealt with using outline and multivariate analysis methods.

Synopsis of the main floral features

A detailed synopsis of the main floral features of the investigated *taxa*, useful for a suitable identification, has been framed (Table 2).

Our data points out both a variation in natural populations of all species and the probable presence of some intermediate forms whose exact limits have often been confused, not only in the past (Pettet, 1964; Merxmüller, 1982; Lainz, 1992; Espeut, 1998; Bartolucci & Iocchi, 2007, mostly revised *exsiccata*). In fact, quick diagnoses of species are mostly founded only on corolla/calyx or upper petals/upper sepals ratio. On the contrary, the two groups of *taxa*, *V. tricolor* - *V. hymettia*, having ratio corolla/calyx equal to 1,3-2,1, and *V. arvensis* - *V. kitaibeliana* - *V. parvula*, having ratio corolla/calyx equal to 0,7-1,2, are well distinguished by some other characters, not obvious but settled. Among them, in order to separate *V. kitaibeliana* from *V. hymettia* and *V. arvensis* from *V. tricolor*, we especially mention: 1) lateral petals shape and ratio lower half / upper half petal; 2) lower petal shape and ratio length/ width (Fig. 1).

In specimens analysed, the flower of *V. parvula* is well distinguished on both corolla inconspicuous and clearly smaller than calyx and the spur completely hidden between the calycine appendages. To clearly separate *V. kitaibeliana* from *V. arvensis* (as normally understood) the sepals shape and size are noteworthy characters: ovate-lanceolate to lanceolate, 3-6 mm long in *V.k* and narrowly lanceolate-acute, 6-12 mm long in *V.a*.

The character presence/absence of the dark spot does not substantially distinguish *Viola tricolor* from *V. arvensis*. Having said this, together with other specific characters, it identifies the more typical forms of the former, while its occurrence excludes references to *V. hymettia* or *V. kitaibeliana*. It is evident even in poor specimens.

In *V. hymettia* and *V. tricolor*, the stigmatic opening is obliquely up-wards directed and this feature is

highlighted by the high position of the *labellum* in side view (Fig. 3b, d); in *V. kitaibeliana* and *V. arvensis* it is forward-lightly oblique directed with a lower *labellum* when visible (Fig. 3a, c). We retain that this overlooked character is systematically important in *V.k* / *V.hy*, as reported in previous literature for *V.a* / *V.t* (Wittrock, 1897; Clausen, 1922, 1931; Kristofferson, 1923). Recently Espeut (2004) shows this peculiar feature in a detailed (in lateral view) of the plate concerning his *V. roccabrunensis*, a unit of the same subseries *Kitaibeliana*. Comparing it with our data, Espeut's species has the same stigmatic opening position and *labellum* of *V. hymettia* from which it is distinguished mostly by the different chromosome number ($2n=48$).

Morphological characters of flower and stipule shape appear to be more useful features to distinguish these units, rather than the size/colour of petals. In Italian *V.a/V.t* populations of M. Trave (Frosinone), Colonna, Bomarzo (Viterbo) and Iscatara, Roseto Valfortore (Foggia) we find clear transitional characters in the *labellum*, stigmatic cavity and shape of pollen magazine; in the population of Acquaforte, Vejano (Viterbo) we find clear intermediate characters in the shape of the stipule mid-lobe.

Besides, a preliminary cytological analysis of some material (A. Gennaro unpublished data) highlights only chromosome numbers of $2n=34$ (*V. arvensis*) and $2n=26$ (*V. tricolor*) while in Pettet (1964) putative hybrids in mixed *V.a* - *V.t* population are found to have $2n=30$. Therefore, the evidence of natural inter-specific hybrids in our material must still be verified by a cytological approach. On this matter, further investigations are in progress. However, any doubt about such plants could also be solved by analysis of the pollen morphology (Pettet, 1964; Nauenburg, 1990; Espeut, 1999a).

Distribution and ecological remarks

In the following topic the details on the Italian distribution refer to the Italian Checklist (Conti et al., 2005) which is updated with our data (see also Appendix).

Viola kitaibeliana, a Mediterranean-Caucasian species which extends to central Europe (Werner, 1988; Espeut, 1999b; Vollrath, 2011), is a component of early stages of grassland, stony slopes and screes such as *V. parvula*, but is found also on fields and other open places, from 0 to approximately 1850

Table 2 – Main diagnostic characters of the flower in annual Italian species of Viola tricolor-Group.

	<i>Viola kitabeliana</i>	<i>Viola hymettia</i>	<i>Viola parvula</i>	<i>Viola arvensis</i> subsp. a.	<i>Viola tricolor</i> subsp. t.
Sepals:	3-6 mm	4-6 mm	4-9 mm	6-12 mm	7-14 mm
colour	green or suffused of violet	green or suffused of violet	green-violet	green	green
Corolla (front view):	4-10 x 3.5-6 mm	9-16 x 7-14 mm	3-7 x 3-5 mm	8 - 15 x 5.5-11 mm	13-25 x 10-20 mm
shape	small, somewhat concave or cup-shaped	with spread-out and flattened limbe	very small, inconspicuous	lightly angled forward	with large petals and flattened limb
colour	creamy yellow, almost total suffused of violet	creamy and yellow, often suffused of violet	creamy white	pale creamy to bluish-white	particolored, bluish or violet to creamy
ratio length/ width	1.2-1.3	1-1.2	1-1.4	1.2-1.7	1.2-1.5
ratio corolla/calyx	0.8-1.1	1.4-2	0.8-1.1	0.7-1.2	1.3-2.1
Upper petals:	2.8-5 x 1.3-2.3 mm	6.4-10.2 x 3.2-9 mm	2.2-5 x 1-2.5 mm	2.5-6.8 x 2-4 mm	7.5-13 x 4.5-10.5 mm
shape	obovate	round - obovate	narrowly obovate	obovate	obovate
ratio length/ width	1.7-2.2	1.3-1.6	1.5-2.2	1.1-1.9	1.2-1.8
Lateral petals:	4-5.4 x 1.8-2.8 mm	6.8-9.5 x 4-8 mm	2.5-6 x 1.2-3.5 mm	5-8 x 2-4.2 mm	7.5-13x3.5-8.5 mm
shape	narrowly obovate	round-obovate	narrowly obovate	narrowly obovate	obovate
ratio length/ width	2-2.5	1.2-1.7	1.5-2.5	1.7-2.5	1.3-2.1
ratio lower half / upper half petal	0.9-1.4	0.5-0.7	0.9-1.9	0.7-1	0.3-0.6
Lower petal (including spur):	5-9 x 2.2-3.5 mm	8-14.5 x 5.8-9.3 mm	4-7.5 x 1.5-3.9 mm	7-15 x 4.3-6.5 mm	11-20x5-13 mm
shape	narrowly rectangular	obcordate - triangular	trapezoid	narrowly rectangular	ovate-triangular
ratio length/ width	2.5-3	1.5-2	2-3	2.1-3	1.4-1.9
Spur:	1.8-2.8 mm	3-4.1 mm	0.9-1.5 mm	2-4 mm	3.2-5.5 mm
shape	slender, lightly upward-curving, visible part longer than wide	thick, obtuse, visible part shorter than or as long as wide	thick, very short, usually completely hidden between the calycine appendages	short, rounded, equalling or longer than calycine appendages	Slender, longer than calycine appendages
colour	violet	violet or creamy yellow	creamy white	creamy white suffused of violet	white-greenish, lightly suffused of violet
medium diameter (thickness)	0.7-1.2 mm	1.6-2.3 mm	1-1.8 mm	0.8-1.6 mm	1-1.8 mm
ratio length/ medium diameter	1.8-3	1.3-1.8	0.8-1.2	2.1-3.5	2.4-4
Guide lines: (striae nectareae)	present, inconspicuous or absent	present, occasionally absent in upper flowers	present, inconspicuous	present, unbranched, occasionally absent in upper flowers	present, unbranched or branched
Pollen magazine: (horreolum pollinis)	open	closed	not seen	open, almost open	closed
Stylar dark spot:	absent	absent	absent	usually absent	usually present
Entrance to stigmatic cavity (front view): (orificium stigmaticum)	in front	upward (lightly obliquous)	not seen	in front (lightly obliquous)	upward (lightly obliquous)
Stylar flap: (labellum stigmaticum)	absent	present but scarcely protruding	absent	present, small	present, well developed
Fruiting peduncle:	15-60 mm	20-90 mm	10-40 mm	45-95 mm	70-100 mm
ratio peduncle /corresponding leaf	1.5-3 (4.5)	2.5-5 (6)	1.6-3.5	1-2.5	1.8-3.3
Flowering:	II-V	(0)II-IV	III-VI	III-X	IV-VIII

m a.s.l. In Italy it has a disjointed distribution from the Alps (Aeschmann et al., 2004) to Sicilia but, for the latter, in CAT many specimens identified as *V. kitaibeliana* are to be assigned to *V. hymettia*. Literature data only refers to a Lojacono specimen, sub *V. arvensis* var. *madoniae* Lojac., collected in 1909 (Valentine et al., 1968; Giardina et al., 2007). No recent data is available for Veneto and Calabria whilst a new record is quoted for Umbria (Ballelli et al., 2006).

Viola hymettia, an SE-European species which is widespread mainly in Greece and the Aegean Islands, is an early element of stony pastures, dry open habitat and scrub fringes, occurring from 200 to 800-1000 m a.s.l. (Merxmüller, 1982; Erben, 1985; Raus, 1986; Davis et al., 1988; etc.). In Italy its distribution area is limited to Abruzzo, the Southern Peninsula and Sicilia (Conti et al., 2005), actually extended to the Tyrrhenian Antiapennine volcanic sector (Lazio) (Fig. 5) and Murge tarantine (Puglia) (Scoppola, 2005; Carruggio et al., 2008). Therefore, in the former, the species has already been collected by Macchiati in 1885 on 'Poggi della Palanzana' and identified as *V. biflora* (FI) then considered as *V. arvensis* (Macchiati, 1886; 1888); for Leucaspide (Taranto) W. Becker had already quoted it (Becker, 1910) and in LEC specimens identified as *V. arvensis* are to be assigned to it. Some distribution data is still doubtfully reported for southern Italian regions (Merxmüller, 1982). Indeed the occurrence in Calabria could not be confirmed (L. Bernardo *in verb.*) but in CAT recent specimens from Sicilia identified as *V. kitaibeliana* are to be assigned to *V. hymettia*. At present, we have not found any clear *V. kitaibeliana* - *V. hymettia* intermediates but some specimens in APP could be referring to these forms. However, a correct revision can be made exclusively on fresh material and field investigation is required.

V. hymettia, unlike *V. kitaibeliana*, proves to be mainly acidophilous-subacidophilous species. In the Tyrrhenian Antiapennine sector, both species grow in places not far from each other, but while the former grows on the pyroclastic system (Viterbo and its environs, Mt Palanzana, Vetralla and its environs, Barbarano Romano, etc.), the latter grows on travertine layers (Bassano in Teverina). Different opinions have been expressed mainly due to inexact identification of specimens.

Viola parvula is a Mediterranean mountainous and S. European element which inhabits scree and

open grassland with rocky outcrops usually above timberline, between 1400 and 2600 m a.s.l. but occasionally descending to 1000 m (Valentine et al., 1968; Delipavlov, 1979; Raus, 1986; Muñoz Garmendia, 1993; Tashev, 2003; etc.); at present in Italy is recorded for Calabria and Sicilia, the data for Basilicata refer to Gavioli (1947).

Viola arvensis subsp. *arvensis*, the most frequent *Viola* of the group, is a weed of fields linked to open scrubland and synantropic habitat from 0 to 1500-1800 m a.s.l., almost throughout Europe (Valentine et al., 1968; Muñoz Garmendia, 1993; Aeschmann et al., 2004; Vollrath, 2011). It is regarded as an archaeophyte naturalised throughout almost the whole of Europe (Gams, 1926). Being a Mediterranean-Eurasian element, it is widespread throughout Italy as confirmed by the copious specimens studied. Although specimens in LEC are revised as *V. hymettia*, plants of *V. arvensis* are personally observed in Monti della Daunia (Iscatara, Roseto Valfortore).

Viola tricolor subsp. *tricolor* occurs most frequently in meadows, cultivated ground and synantropic habitat linked to woodland and semi-natural land. Being a European element, it is common in most of Europe but rare in the south and only on mountains or in deep/rich soil. In Italy this pansy, rare or lacking in the southern regions until now, becomes more frequent northward (Valentine et al., 1968; Haeupler & Muer, 2007). According to Merxmüller (1982) the distribution area was limited (southwards) to Toscana, mostly because of confusion with other species of the group. Updated information has mainly widened the distribution southwards (Conti et al., 2005, 2007; Peccenini et al., 2007); the gap in Umbria is filled by a specimens collected at Alviano (Terni) in 2007 by A. Temperini (UTV!). In late spring and early summer *V. tricolor* (and its forms) is the most common species in the Tyrrhenian Antiapennine volcanic sector, due to its acidophilous and mesophylous habit, frequently showing large multistemmed individuals and flowers with the creamy colour prevailing. Generally it occurs in the same places as *V. hymettia*, heliophilous species, earlier and locally more frequent than that.

Both in living material and specimens, *V. arvensis* transitional forms *vergentes* to *V. tricolor* have been found (i.e. Bomarzo and Roseto Valfortore specimens). Besides, the observation, in field and under cultivation, of specimens of Vejano and M. Palanzana

(Viterbo) have confirmed the natural occurrence of intermediate morphological forms of *V.a* - *V.t* in Italy as well. Such forms are already known in the literature as varieties or natural hybrids (Clausen, 1922, 1926, Gams, 1926; Pettet, 1964; Valentine et al., 1968; Oberdorfer, 1979; Stace, 1991; etc.). In Italy, the occurrence of natural hybrids is clearly evident when looking at some specimens of *V. arvensis* Murray subsp. *megalantha* Nauenb. (Trieste Herbarium, TSB) revised by Erben in 2003 as *V. arvensis* Murr. x *V. tricolor* L.

The *exsiccata* personally revised especially from APP, Herb. Bartolucci and UTV, confirm, as well, a great variation pattern of these two species in central Italy and the occurrence of morphological intermediates or hybrids, but show a prevalence of pure combinations over the intermediate types as seen by Clausen (1926) (see Appendix).

V. arvensis and *V. tricolor* normally do not grow together, and find their optimal development conditions in different habitats, as shown by specimens labels and reported in the multiple references: *V. tricolor* occurs most frequently on acid-subacid soils in fringes, forest mantles and some synantropic habitat linked to woodland and semi natural land, whereas *V. arvensis* is linked to ephemeral habitat mainly occurring in fields, open scrubland and synantropic places. Such ecological features are thought by Clausen (1922) to be sufficient for preventing hybridisation. In actual fact, our field data confirms the occurrence of intermediate forms only where they are scattered throughout *V. tricolor* and *V. arvensis* which grow in habitat contiguous.

In our opinion, the presence and distribution in Italy of *V. arvensis* L. subsp. *megalantha* Nauenb. (Melzer, 1997; Poldini et al., 2001; Conti et al.,

2005) is still problematic. Nauenburg (1990), in the distribution area of this unit, records two Italian places: Alagna (Val Sesia, Piemonte, 1903, Bicknell, in Herb. W. Becker, Z) and Eppan/Appiano (Trentino-Alto Adige, 1960, Vollrath, in Hb V); Vollrath (2011), mentions only the Appiano specimen collected in 1960. Melzer (1997) cites it for Friuli-Venezia Giulia (between S. Foca and Vivaro, 1991, H. Melzer and K. Tkalcics); no recent *exsiccata* of this unit in the Torino Herbarium (TO) are known. Besides this, we are only able to verify the morphological characters of some specimens of this unit collected by L. Poldini (Friuli-Venezia Giulia, 1999-2002, Trieste Herbarium, TSB) but revised by Erben in 2003 as *V. arvensis* x *V. tricolor*.

Among our material from central Italy, at the moment, no specimen can be certainly referred to as *V.a* subsp. *megalantha* on the basis of ecological features being linked to alpine and mountain districts of central Europe (Nauenburg, 1990; Espeut, 1996; Melzer, 2005; Vollrath, 2011), but the morphological features are similar to those of Nauenburg *exsiccata* (GOET!). However, a sure identification of this unit will be attained by means of cytological investigation since the chromosome number of *V.a* subsp. *megalantha* is $2n=34$, the same as *V. arvensis* s.s. which is stated by Nauenburg (1990). The intermediate and the extreme forms of *V. arvensis/V. tricolor*, partially verified, must be referred to further units reported in the literature (Pettet, 1964; Valentine et al., 1968; Oberdorfer, 1979, Rothmaler, 2005; Vollrath, 2011) and are, for the most part, neglected by Italian Authors: *V. arvensis* subsp. *megalantha* ($2n=34$ Nauenburg, 1990), *V. tricolor* x *V. arvensis* = *V. x contempta* Jordan ($2n=30$, Clausen, 1921; $2n=40$, Fothergill, 1944; $2n=26, 28, 30$, Stace 1991).

Key to the annual species of the *Viola tricolor* Group in Italy¹

- 1 Villous with long, weak, crispate hairs at least on stipules and petioles. Leaves entire to shallowly crenate. Flowers inconspicuous. Calycine appendages clearly exceeding the spur *Viola parvula*
- 1* More or less pubescent with short, stiff hairs at least on stipules and petioles, or glabrous; long crispate hairs absent. Leaves crenate to round-toothed. Flowers more or less conspicuous. Calycine appendages not exceeding (at most) the spur 2
- 2 Calyx large, sepals narrowly lanceolate-acuminate, 6-14 mm long. Plants vigorous. Median leaves acute at apex; upper leaves round-toothed to toothed. Median stipules usually pinnatifid or pinnately lobed. Labellum present 3
- 2* Calyx small, sepals ovate-lanceolate to lanceolate, 3-7 mm long. Plants usually slender. Median leaves round at apex, upper leaves with lateral margins shallowly crenate to entire. Median stipules usually digitate. *Labellum* inconspicuous or absent (in case of different leaves, stipules or *labellum* see 5) 4
- 3 Corolla small (8-5 x 5-11 mm), as long as calyx (or rarely a little longer), usually pale creamy-yellow; lateral petals narrowly obovate, with a tuft of papillose hairs around the middle; lower petal (spur included) 7-15 mm long; spur short, rounded, equaling or longer than calycine appendages. Labellum very small (1/7-1/8 of the stigma diameter). Median stipules pinnatifid and mid-lobe leaf-like *Viola arvensis s.s.*
- 3* Corolla large (13-25 x 10-20 mm), distinctly exceeding calyx, usually blue-violet with yellow markings (especially at centre); lateral petals obovate, with a tuft of papillose hairs approximately 1/3 from base; lower petal (spur included) 11-20 mm long. Spur slender, longer than calycine appendages. Labellum large, protruding (1/4-1/6 of the stigma diameter). Median stipules pinnately lobed and mid-lobe usually differently shaped, not leaf-like *Viola tricolor s.s.*
- 4 Corolla small, cup-shaped, not or lightly exceeding calyx (on back view). Upper petals reduced, shorter than sepals; the laterals narrowly obovate, with a tuft of papillose hairs at about the middle; lower petal (spur included) 5-9 mm long, narrowly rectangular, occasionally scarcely longer than lower sepals. Entrance to the stigmatic cavity, in a front view, obliquely forward directed. *Labellum* absent. Stems scarcely branched, if at all. Basal leaves and stipules mid-lobe entire to shallowly crenate (1-2 broad teeth on each side) *Viola kitaibeliana*
- 4* Corolla flat, distinctly exceeding calyx. Upper petals longer than sepals; lateral petals obovate, abruptly narrowed at base, with a tuft of papillose hairs approximately 1/3 from base; lower petal (spur included) 8-12 (14,5) mm long, obcordate-triangular, distinctly longer than lower sepals. Entrance to the stigmatic cavity, in a front view, obliquely up-wards directed. *Labellum* present but inconspicuous. Stems mostly branched. Basal leaves and stipules mid-lobe crenate (2-3 broad teeth on each side of leaves) *Viola hymettia*
- 5 Corolla shorter or equaling calyx. Spur short, rounded, equaling or longer than calycine appendages. *Labellum* very small (1/7-1/8 of the stigma diameter), pollen magazine open or almost open, entrance to the stigmatic cavity (in a front view) obliquely forward directed *Viola arvensis s.s.*
- 5* Corolla exceeding calyx. Spur slender, to 2 times as long as the calycine appendages. Labellum large, protruding (1/4 - 1/6 of the stigma diameter), pollen magazine closed, entrance to the stigmatic cavity (in a front view) obliquely up-wards directed *Viola tricolor s.s.*

¹ *Viola arvensis* L. subsp. *megalantha* Nauenb. and intermediate forms referred to by Authors as *V. arvensis* × *V. tricolor* or *Viola* × *contempta* Jordan (*V. × tricoloriformis* Gerstl.) whose occurrence in Italy is still uncertain and thus they are not dealt with. For more detail on their diagnostic characters see Jordan (1852), Nauenburg (1990), Espeut (1996), Stace (1997), Loos (2010).

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APPENDIX

Specimina visa selecta

Most of specimens come from Italian localities; whether from other provenance, the corresponding nation is reported.

1) *Viola kitaibeliana*: CROATIA - Belej (Cherso), 17.4.1968, L. Poldini, Rev. M. Erben, 2003, TSB. ITALY - *Toscana* - Monte Cetona (Siena) presso la cima, 22.4.1996, A. Mazzeschi, SIENA. Cornate di Gerfalco, Montieri (Grosseto), 25.4.2002, F. Frignani, SIENA. *Lazio* - Roma, campo di Centocelle, marzo 1946, A. Cacciato sub *V. arvensis* Murr., RO. M. Gennaro (Roma), 2.4.2005, F. Bartolucci, Herb. Bartolucci. Acque Albule, Tivoli (Roma), 17.3.2011, A. Scoppola, UTV. M. Tancia (Rieti), 3.4.1997, G. Corazzi, RO. Nespole (Rieti), 23.5.2010, A. Scoppola, UTV. Bassano in Teverina Scalo, Centrale ENEL (Viterbo), 17.3.2011, A. Scoppola, UTV. Macchia di Anagni (Frosinone), 18.2.2007, E. Lattanzi, Herb. Lattanzi. *Abruzzo* - S. Colombo, Barisciano (L'Aquila), 26.4.2002, F. Conti, APP. Ofena, loc. 'Le Vigne' (L'Aquila), 7.4.2004, F. Conti, APP. Conca di Capestrano, Poggio della Cisterna (L'Aquila), 18.3.2004, A. Scoppola, UTV. Fossa di Monticchio (L'Aquila), 1.5.2008, F. Bartolucci, Herb. Bartolucci. *Basilicata* - Albanese (Potenza), 20.4.1993, L. Bernardo, CLU. Timpa Falconara, Terranova di Pollino (Potenza), 30.4.1999, L. Bernardo, CLU. Monte La Gattina, Moliterno (Potenza), 3.5.2004, P. Lavezzo, Herb. Lavezzo. Masseria Costa, Cersosimo (Potenza), 2.5.2004, F. Conti, D. Tinti, APP.

2) *Viola hymettia*: GREECE: In M. Hymetto prope Athenas, 4.1844, T. Heldreich, sub *V. demetria* Clementi, rev. Th. Raus 1982, FI. In monte Hymetto Atticae, 1852, T.G. Orphanides no. 120, sub *V. demetria* Clementi, rev. Th. Raus 1982, FI (*syntypus*). In Atticae montibus Hymetto, Parnassi, 4.1875, T. Heldreich no. 300, FI. ITALY - *Lazio* - Poggi della Palanzana, Viterbo, 13.2.1886, L. Macchiati sub *V. biflora*, rev. I. Segelberg 1962 sub *V. tricolor* var. *kitaibeliana* Roem., FI. Viterbo, zona Riello, 27.2.2008, A. Scoppola, UTV. M.te Palanzana, Viterbo, 20.3.2005, A. Scoppola sub *V. tricolor* L., UTV. Vetralla (Viterbo) S.P. Vetrallense, km 10,200, 8.3.2009, S. Buono, UTV. Palanzanella, Parco dell'Arcionello, Viterbo, 20.3.2010, M. Celestini, UTV (Fig. 5). *Ibid.*, 30.4.2010, A. Scoppola, UTV (Fig. 5). Barbarano Romano (Viterbo) Loc. Campecora, 25.4.2008, A. Scoppola sub *V. arvensis* Murray, UTV. Viterbo, Loc. Asinello, 28.2.2011, A. Scoppola, UTV. *Abruzzo* - Capestrano (L'Aquila), Gran Sasso - zona archeologica, 13.3.1997, A. Manzi, APP. Anversa degli Abruzzi (L'Aquila) da Castrovalva verso Colle S. Michele, 24.2.2008, F. Conti, D. Tinti, APP. Anversa degli Abruzzi, cresta sopra Castroval-

va (L'Aquila), 20.4.2008, F. Conti, A. Pollutri, APP. *Puglia* - Marangi (Lecce), 18.3.1991, S. Sabato sub *V. arvensis* Murray, LEC. Alimini Grande, Otranto (Lecce), 12.3.1999, S. Caforio sub *V. arvensis* Murray, LEC. Copertino (Lecce), 12.3.1995, L. Martina sub *V. arvensis* Murray, LEC. *Basilicata* - Lucania-Potenza, M. Ciciniello, 12.3.1922, O. Gavioli, rev. W. Becker, FI, TO. Anzi (Potenza), 18.5.1925, O. Gavioli, FI. *Sicilia* - M. Gebbia (Piazza Armerina), 20.3.2008, P. Minissale, S. Sciandrello, CAT. Mte Curma dei Laghi (Mirabella Imbaccari), 24.3.1991, G. Galesi sub *V. kitaibeliana*, CAT. C.da Sanbuco, Piazza Armerina, 1.3.2006, R. Galesi sub *V. kitaibeliana* Schult., CAT. Parco Ronza, Piazza Armerina, 9.3.2008, V. Capizzi, S. Sciandrello, CAT. Trazzera prima del Vivaio Runza, Piazza Armerina, 8.5.1994, R. Galesi sub *V. kitaibeliana*, CAT. Caltanissetta, 4.1900, H. Ross no. 213, FI.

3) *Viola parvula*: ITALY - *Calabria* - Loc. Serro Schiavo, Aspromonte (Reggio Calabria), 30.5.1999, A. Scoppola, UTV. *Sicilia* - Monte a NO di Monte Manfré (Etna), 30.4.2001, R. Galesi, CAT.

4) *Viola arvensis* subsp. *arvensis*: CROATIA - Piemontezavršje, 6.5.2001, L. Poldini, rev. Erben 2003, TSB. ITALY - *Lombardia* - Parco Ticino (Pavia), Tenuta 'Occhio', 25.5.1993, A. Scoppola, UTV. *Trentino-Alto Adige* - Dintorni di Soraga (Val di Fassa), agosto 1970, B. Anzalone, RO. *Friuli-Venezia Giulia* - Pesek, Carso Triest. (Trieste), 22.5.1964, D. Lausi, rev. M. Erben 2003, TSB. *Lazio* - Azienda Maccarese, Fiumicino (Roma), 15.6.2004, R. Testa sub *V. tricolor*; UTV. Selva del Lamone (Viterbo), vicino a 'Rosa Crepante', 26.5.1994, E. Lattanzi, Herb. Lattanzi. Orto Botanico, Viterbo, Giardino dei Semplici, 1.5.2008, A. Scoppola, UTV. M.te Navegna (Rieti), 25.5.2002, F. Bartolucci, Herb. Bartolucci. *Abruzzo* - Barisciano (L'Aquila), Valle Cupa, 15.6.2003, F. Conti, D. Tinti *et al.*, sub *V. arvensis* s.l., rev. Conti 2008, APP. M. Ocre, presso Fossa (L'Aquila), 4.5.2005, F. Bartolucci, F. Conti sub *V. kitaibeliana*, APP. *Molise* - Pizzone, Valle di Mezzo (Isernia), 9.7.1992, F. Conti, APP. *Campania* - Vallone Fontana, Ischia, 11.5.1989, S. Brullo, V. Signorello, G. Spampinato, CAT. *Basilicata* - M. Carnara, Paolo Albanese (Potenza), 2.5.2004, E. Lattanzi sub *V. kitaibeliana* UTV. Massiccio del Pollino, S. Severino Lucano (Potenza), 21.5.1994, L. Bernardo, CLU.

5) *Viola arvensis* subsp. *megalantha*: SWITZERLAND - Bern-Wabern, südl. Ortsausgang, 25.5.1984, J.D. Nauenburg, GOET (*holotypus*). Wallis, Zermatt, ca 800 m nordwestl. Ortskern., 23.6.1984, J.D. Nauenburg, GOET.

6) *Viola tricolor* subsp. *tricolor*: DENMARK - Stavan at Farstrup 14 km E of Lögstör (N Jutland), 29.6.1987, K.

and S.S. Larsen, TSB. ITALY - *Piemonte* - Sampeyre, loc. Durandi (Cuneo), 29.8.2010, E. Lattanzi, UTV. *Trentino-Alto Adige* - Strada che dal Lago di Neves porta fino a Lap-pago (Bolzano), 7.7.2001, F. Bartolucci, Herb. Bartolucci. *Liguria* - Pendici S del M. Coppigliolo, Calice al Cornoviglio (La Spezia), 2.6.2005, A. Scoppola, UTV. *Toscana* - Ai piedi della parete meridionale del Simoncello (Arezzo), 27.8.1997, V. Gonnelli, SIENA. Foresta Camaldoli, Loc. Cotozzo (Arezzo), 22.6.2000, L. Poldini sub *V. tricolor* s.l., TSB. Poggio Mozza, Montiano (Grosseto), 10.10.2008, R. Tardani, UTV. La Verna (Arezzo), 1.7.2004, E. Petrilli, UTV. *Marche* - Monte Prata, Visso (Macerata), 5.8.1999, F. Bartolucci, Herb. Bartolucci. *Umbria* - Alviano (Terni), 29.4.2007, A. Temperini, UTV. *Lazio* - Loc. Selva del Lamone (Viterbo), 7.6.1987, E. Lattanzi, Herb. Lattanzi. Bella Venere, Lago di Vico (Viterbo), 9.6.1985, F. Anitori, UTV. Colli Albani (Roma), 15.6.1984, E. Lattanzi, Herb. Lattanzi. Castelli Romani, Monte Canino (Genzano) a sopra Nemi, 23.5.1966, s. coll., RO. Lago di Nemi (Roma), 10.5.2006, A. Angelini, M. Roberti, UTV. S. Erasmo, Rocca-gorga (Latina), 17.6.2007, E. Vincenti, UTV. *Cam-*

pania - S. Gregorio Matese (Caserta), tra Campo Braga e la Palazzina, 30.5.2008, S. Magrini, UTV.

7) Hybrids: *Viola arvensis* x *Viola kitaibeliana*: ITALY - *Abruzzo* - Capestrano, Poggio della Cisterna (L'Aquila), 25.2.2007, F. Bartolucci, A. De Lorenzis, sub *V. hymettia*, rev. Scoppola 2011, Herb. Bartolucci. *Viola arvensis* x *Viola hymettia*: *Toscana* - Pitigliano (Grosseto), 15.5.2004, L. Prosperini, G. Raucci sub *V. tricolor* L., UTV. *Viola arvensis* x *Viola tricolor*: *SLOVENIA* - Veliko Gradičë, Carso, 30.4.1976, L. Poldini sub *V. arvensis*, rev. Erben 2003, TSB. ITALY - *Friuli-Venezia Giulia* - Casera Valdaier (Ligosullo), Carnia, (Udine), 25.7.1999, L. Poldini sub *V. arvensis* Murray subsp. *megalantha* Nauenb., rev. Erben 2003, TSB. Paularo fraz. di Ravinis, Carnia (Udine), 29.5.2001, L. Poldini sub *V. arvensis* Murray subsp. *megalantha* Nauenb., rev. Erben 2003, TSB. Cave del Predil (Udine), 14.7.2002, L. Poldini sub *V. arvensis* Murray subsp. *megalantha* Nauenb., rev. Erben 2003, TSB. Prealpi Carniche: M. Cerantonis (Trava, Udine), 21.5.1979, L. Poldini sub *V. arvensis* Murray, rev. Erben 2003, TSB.

Summary: Italian species of the *Viola tricolor* group, Sect. *Melanium* are examined from the morphological view-point. Additional diagnostic characters have been highlighted on the basis of *in situ* and *ex situ* experimental data, direct analysis of *exsiccata* and high resolution digital images of several *Herbaria*, check of previous international literature. Measures have been taken on well developed flowers after a given vegetative period. Diagnostic features of stigma, *label-lum*, position of opening to the stigmatic chamber and detailed photos are provided. Scanned images of stipules and corresponding leaves taken from the lower, median and upper part of the stem are also provided. These images provide clearer discrimination and correct identification of this difficult group. A synoptic table with the essential features of *V. kitaibeliana*, *V. hymettia*, *V. parvula*, *V. arvensis* subsp. *arvensis* and *V. tricolor* subsp. *tricolor* has been framed. *Exsiccata* are checked whilst some of them are revised. Therefore the Italian distribution area has been updated. The occurrence of *V. hymettia* has been verified in the Tyrrhenian Antiapennine sector (Lazio), where it is widespread mainly in the Viterbo environments, and in the Murge tarantine (Puglia). Extreme morphological variants of *V. arvensis*/*V. tricolor* and apparent hybrids between them have been reported for Central Italy, giving evidence of the great variability of the group. Up to now the occurrence of *V. arvensis* subsp. *megalantha* in our territory has not been confirmed.