Russian Academy of Sciences, Far Eastern Branch
Botanical Garden-Institute

botanica pacifica

A JOURNAL OF PLANT SCIENCE
AND CONSERVATION

VOLUME 9, NO. 1 2020

VLADIVOSTOK 2020

Botanica Pacifica. A journal of plant science and conservation. 2020. 9(1): 3–52
DOI: 10.17581/bp.2020.09113

Revision of the genus *Viola* L. (Violaceae) in the Russian Far East with notes on adjacent territories

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Manuscript received: 09.03.2020
Review completed: 22.04.2020
Accepted for publication: 02.05.2020

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ABSTRACT

This study proposes a revision of the genus *Viola* L. (Violaceae) in the Russian Far East and adjacent regions. It is based on the taxonomic work that Becker conducted on the Asian *Viola* (1915–1928), but also on Clausen's cytotaxonomic studies (1926–1964) that laid the foundations of the genus' phylogeny. Chromosome counts, as well as phylogenetic analyses, have allowed to specify the infrageneric taxonomy and establish relationships between some taxa of American or Asian adjacent territories. A systematic treatment based on the Biological Species Concept, associated with genetic, cytotaxonomic, and biogeographic data, allowed many systematic and nomenclatural changes, at different levels: infrageneric, specific and infraspecific. This study shows the remarkable role of the Russian Far East for the conservation and differentiation of the genus *Viola* species, and probably for the whole flora of the Holarctic Kingdom.

Keywords: Violaceae, *Viola*, Russian Far East, typifications, taxonomic novelties, nomenclatural novelties

РЕЗЮМЕ

Эспе М. Ревизия рода *Viola* L. (Violaceae) Дальнего Востока России с замечениями для сопредельных территорий. В данном исследовании предлагается ревизия рода *Viola* L. (Violaceae) на Дальнем Востоке России и в прилегающих регионах. Он основан на таксономической работе Беккера по азиатским фиалкам (1915–1928), а также на цитотаксономических исследованиях Клаузена (1926–1964), которые заложили основы филогении рода. Подсчет хромосом, а также филогенетический анализ позволили уточнить таксономию внутри рода и установить взаимосвязь между некоторыми таксонами с прилегающих территорий Америки и Азии. Систематика, основанная на биологической концепции вида, связанная с генетическими, цитотаксономическими и биогеографическими данными, позволила провести большое число систематических и номенклатурных изменений на разных уровнях: внутриродовом, видовом и внутривидовом. Исследование показывает заметную роль российского Дальнего Востока в сохранении и дифференциации видов рода *Viola* и, вероятно, для всей флоры Голарктического Царства.

Ключевые слова: Violaceae, *Viola*, российский Дальний Восток, типификация, таксономическая новинка, номенклатурная новинка

[Переведено редколлегией]

INTRODUCTION

The Pacific margin of the NE-Asia is an interesting area to study the genus *Viola* because it is located on the crossroad of two botanical zones: Circumboreal and Eastern Asiatic Regions (Takhtajan 1986). The proximity with the American continent (the Bering Strait is about 82 km wide at its narrowest point) has allowed several species, such as *V. epipsila* or *V. selkirkii,* to have an Amphi-Pacific distribution. The very large extension of boreal forest (taiga) from Scandinavia to Kamchatka has allowed forest species as *V. collina* or *V. mirabilis* to have a Pan-Palearctic area. The biodiversity hotspot of subg. *Violidium* is situated in the SE-Asia: several species, such as *V. philippica*, *V. prionantha*, *V. arcuata*, extend northwards to southeastern most region of Russia (Primorskii Territory).

Historical. The Russian Far East [RFE] is a vast territory (more than 3 million km^2, between 42° to 71°N), composed of regions of Amur Region, Jewish Autonomous Region, Khabarovsk Territory, Kamchatka Territory, Magadan Region, Primorye Territory, Sakhalin Region (Sakhalin and Kuril Islands). It was hard to explore it, but some botanists have early studied its flora. Johann Georg Gmelin (1709–1755), participated to the second Kamchatka expedition (1733–1743) and wrote *Flora Sibirica*. In 1736, he had to stop in Yakutsk, but continued to explore Siberia until 1742. Gmelin was the first botanist to describe and publish pictures of *V. dactyloides*, *V. uniflora*, *V. gmeliniana* but without giving them specific names. Linnaeus (1753) equated the last one to *V. lanceolata*; in 1819 Schultes created *V. gmeliniana* in honor of its discoverer. In 1738, Georg Wilhelm Steller (1709–1746) joined Gmelin in Yeniseysk, and then left him in 1739 to go to where he sailed for Kamchatka. He was at the origin of the discovery of plants called later *V. altaica*. (Gmelin 1769, Turczaninow 1842) or *V. monochroa*. Pallas explored Siberia from 1770 to 1773; he did not go further east than the Dahurian region. Eugène Louis Melchior Patrin (1742–1815) spent 8 years in Russia (1780–1787) and went as far as Chita [CTA]. Georg Heinrich von Langsdorff (1774–1852), went to Kamchatka in 1804–1805, then he visited Aleutians Islands (July 1805) where discovered the species that bears his name: *V. langsdorffii* Ging. Ivan Ivanovich Redowsky (1774–1807), explored Kamchatka (1807), but he died during the trip. His collections were transferred to Adelbert von Chamisso who made a scientific trip around the world (1815–1818). In 1816, Chamisso gathered in Kamchatka several violets studied by Gingins (1826): *V. canina* var. *kamtschatica* and *V. kamtschatica* were the first *Viola* described from the [RFE]; the first one is now placed under *V. sacchalinensis*, the second under *V. selkirkii*. Then, in the 19th century, several important books described this flora: Ledebour in the first Russian flora (1841–1853), Regel (1861, 1862), Maximowicz (1859, 1877). The main collectors cited for the [RFE] during this century are: Maximowicz (Amur, Ussuri regions) Radde (Amur region; discoverer of *V. amurica*, *V. raddeana*), Turczaninow, Middendorf, Stubendorff, Rieder, Kussmisscheff, Kusnetzoff, Peters, Tiling, Mertens, Maack (Ussuri region). For the genus *Viola*, the 20th century was marked by the immense work of W. Becker (cf. 1.1.1) and the remarkable genetic studies of Clausen (cf. 1.2). Studies of Juzepczuk (1949) and Klokov (1949) greatly contributed to the knowledge of *Viola* in Russia, as well as, more recently, those of Bezdeleva (1987, 2006) for the [RFE]. Chromosome counts of many *Viola* spp. from the [RFE] were published by Japanese botanists (Miyaji 1927, 1929), followed by many Korean and above all Russian botanists, Sokolovskaya, Krasnoborov, Probatova, Bezdeleva, Barkalov, Rudyka (cf. 1.3.). Recently, phylogenetic analyses (cf. 1.4) bring new information to explain the evolution and improve the systematics of this genus.

1. MATERIAL AND METHODS

Abbreviations adopted: Herbarium Code according to Index Herbariorum: http://sweetgum.nybg.org/science/ih/ ; publication titles according to Botanicon-Periodicum-Huntianum: http://fmhibd.library.cmu.edu/HIBD-DB/bpho/home.php?-link=Home; author names follow: http://www.ipni.org/ipni/authorsearchpage.do. In order to simplify the text, citations of author's names of taxa is made only in the taxonomy part (cf. 2.). Numbers of cited articles or recommendations from the International Code of Nomenclature refer to the Shenzhen Code (Turland et al. 2018).

!h = seen by the author in herbarium; **!p =** seen by the author on pictures or web; [**Afr.**] = Africa (1); [**ALT**] = Altay (3) = Republic of Altai, and Altai Territory; [**ALU**] = Aleutian Islands (3); **Amer**. = America; [**AMU**] = Amur (3) = Amur Region; **Art**. = article of Shenzhen Code; [**Asia-Temp.**] = Asia-Temperate (1); [**Asia-Trop.**] = Asia-Tropical (1); [**ASK**] = Alaska (3); **auct. ant.** = *auctorum antiquorum* (of ancient authors) misidentifications in books or in herbaria before 20th century; **B =** Botanisches Museum Berlin-Dahlem (Germany); **BAS** = Universität Basel (Switzerland); **BM =** The Natural History Museum (U.K. England, London); **BP** = Hungarian Natural History Museum (Hungary, Budapest); **BR =** Botanic Garden Meise (Belgium); [**BRY**] = Buryatiya (3) = Republic of Buryatia; **c.** = *circa* (approximatif count); **C-** = Central; [**Cauc.**] = Caucasus (2); [**CHI**] = Inner Mongolia (3) = Chinese provinces of Inner Mongolia (4), Ningxia (4); [**CHM**] = Manchuria (3) = Chinese provinces of Heilongjiang (4), Jilin (4), Liaoning (4); **comb. nov.** = *combinatio nova* (new combination); [**CTA**] = Chita (3) = Trans-Baikal Territory; [**CZE**] = former Czechoslovakia (3); **det.** = determinated by; **E-** = eastern; **e.g.** = *exampli gratia* (for example); [**E-Asia**] = Eastern Asia (2); [**E-Eur.**] = Eastern Europe (2); [**EHM**] = East Himalaya (3) = Indian states of Arunachal Pradesh (4), Sikkim (4), Darjiling (4), Bhutan (4); [**Eur.**] = Europe (1); [**FRA**] = France (3) except Corsica; **G =** Conservatoire et Jardin botaniques de la Ville de Genève, Switzerland: **G** = General collection, **G-DC =** De Candolle Herbarium (Prodromus Prodromus; Monographiae Phanerogamarum); [**GER**] = Germany (3); **GN** = species studied by phylogenetic methods; [**GRB**] = Great Britain (3); [**GRC**] = Greece (3); **HAL** = Martin-Luther-Universität (Germany, Halle); **HAST** = Biodiversity Research Center, Academia Sinica (Taiwan, Taipei); [**ICE**] = Iceland (3); **i.e.** = *id est* (that is); **incl.** = included in a species as synonym or infraspecific taxon; [**Indi.**] **=** Indian subcontinent (2); [**IRK**] = Irkutsk (3) = Irkutskaya Oblast'; [**ITA**] = Italy (3) except Sardinia and Sicilia; [**JAP**] = Japan (3); [**JAP-HK**] = Japanese Island of Hokkaido (4); [**JAP-HN**] = Japanese Island of Honshu (4); **K =** Royal Botanic Gardens (U.K. England, Kew); [**KAM**] = Kamchatka (3) = Kamchatka Territory (including Karaginsky and Commander Islands); [**KHA**] = Khabarovsk (3) = Khabarovsk Territory, Jewish Autonomous Region; [**KOR**] = Korea (3); [**KOR-NK**] = North Korea (4); [**KOR-SK**] = South Korea (4); **KPM** = Kanagawa Prefectural Museum of Natural History (Japan, Odawara); [**KRA**] = Krasnoyarsk (3) = Krasnoyarsk Territory; **KRAS** = Krasnoyarsk State Pedagogical University (Russia); [**KUR**] = Kuril Islands (3); **L** = Nationaal Herbarium Nederland, Leiden University branch (Netherlands); **LAPP** = Iter lapponicum herbarium (France, Paris); **LE** = Komarov Botanical Institute of RAS (Russia, Saint Petersburg); **LINN** = Linnean Society of London (U.K. England); **leg**. = *legatus* (collected by a botanist); **loc. clas.** = *locus classicus* (discovery place cited in protogue); **M-** = middle; **MA** = Real Jardín Botánico (Spain, Madrid); [**MAG**] = Magadan = Magadan Region; **MHA** = Main Botanical Garden of the Russian Academy of Sciences (Russia, Moscow); **MAK** = Tokyo Metropolitan University (Japan); [**M-Asia**] = Middle Asia (2): Kazakhstan (3), Kirgizstan (3), Tadzhikistan (3), Turkmenistan (3), Uzbekistan (3); [**MON**] = Mongolia (2); **N-** = northern; [**N-Amer.**] = Northern America (1); **NC-** = North-Central; **NE-** = northeastern; **n.v.** = *non vidi* (not seen by the author); **NDG** = University of Notre Dame (U.S.A. Indiana); [**NET**] = Netherlands (3); [**NNS**] = Nansei-shoto (3) = Ryukyu Islands; **nom. homon**. = *nomen homonymum* (later homonym based on a different type that was previously and validly published for a taxon at the same rank); **nom. inval. nud**. = *nomen invalidum nudum* (name without a description or reference to a published description); **nom. nov.** = *nomen novum* (replacement name); **nom. superfl.** = *nomen superfluum* (superfluous name); **nom. ut. rej.** = *nomen utique rejiciendum* (suppressed name); [**NOR**] = Norway (3); **NW-** = northwestern; **NY =** The New York Botanical Garden (U.S.A.); **P** = Muséum National d'Histoire Naturelle (Paris. France); **P0, P1, P2, P3, P4, P5, P6 =** cf. 2.3.; [**PAK**] = Pakistan (3); **PE** = Institute of Botany, Chinese Academy of Sciences (China, Beijing); **pers. com.** = personal communication; **pers. obs.** = personal observation; [**POL**] = Poland (3); **Rec.** = Recommendation of Shenzhen Code; [**PRM**] = Primorye (3) = Primorskii Krai; [**RFE**] = Russian Far East (2); **S0, S1, S2, S3, S4 =** cf. 1.7.3; **S** = Swedish Museum of Natural History (Sweden, Stockholm); **S-** = southern; [**S-Amer.**] = Southern America (1); [**SAK**] = Sakhalin (3) = Sakhalin Region (excluding Kuril islands); **SAPS =** Hokkaido University Museum (Japan); **Scand**. = Scandinavia = NOR, SWE and Finland; **SE-** = southeastern; **sect.** = *sectio*; [**Sib.**] = Siberia (2); **s.l.** = *sensu lato* (in the broad sense); [**SPA**] = Spain (3) except Canary and Balearic Islands; **spp.** = *species plurimae* (several species); **s.s.** = *sensu stricto* (in the strict sense); **stat. nov.** = *status novus* (name at new nomenclatural rank); **subg.** = *subgenus*; **subsect.** = *subsectio*; **subsp.** = *subspecies*; **SW-** = southwestern; [**SWE**] = Sweden (3); [**SWI**] = Switzerland (3); **T0, T1, T2** = cf. 2.3.; [**TAI**]= Taiwan (3); **TI** = University of Tokyo (Japan); **TO** = University of Turin (Italy); [**TVA**] = Tuva (3) = Republic of Tuva; [**UKR**] = Ukraine (3) including Moldova (4); **VLA** = Institute of Biology and Soil Science, Far Eastern Branch, Russian Academy of Sciences (Russia, Vladivostok.); **vs. =** *versus*; **W-** = western; [**WHM**] = West Himalaya (3) = Indian states of Himachal Pradesh (4), Jammu and Kashmir (4), Uttaranchal (4); [**WSB**] = West Siberia (3); **WU** = Universität Wien (Austria); [**YAK**] = Yakutiya (3) = Republic of Sakha (Yakutia); [**YUG**] = former Yugoslavia (3).

1.1. Taxonomic literature examined

Botanical inventories are generally carried out at the national level, and often depend on botanical traditions or discoveries of the country studied. Botanists in charge of these inventories, often have only partial knowledge of the variability of some taxa. Their study framework doesn't allow to always comparing national species with others described from foreign countries. Becker was the last botanist to have a world view of *Viola*. His remarkable knowledge of this genus extended from Europe to Asia, then from Australia to Oceania, and S-America. His studies were neither limited by frontiers, nor languages or botanical traditions; this is why his comprehensive view of *Viola* was so fertile and why I choose to make it the starting point of this work.

1.1.1. Becker's publications of 1915–1928

I compiled species that Becker cited for the [RFE] from the years 1915 to 1928 (Table 1). Becker (1915) treated the *Violaceae* family in *Flora Aziatskoi Rossii* (B.A. Fedtschenko, ed.). Perhaps due to a bad translation of his texts in Russian (Juzepczuk 1949 p. 351 footnote), he will publish again these same taxa described in further papers. From 1916 to 1923, Becker published six studies on Asian violets: *Violae asiaticae et australenses* and one on the group of *V. patrini* s.l. In 1925, he gave the world list of *Viola* spp. in the famous Engler & Prantl's work: *Die naturlichen Pflanzenfamilien.* Until his death, in 1928, he continued to study Asian species, and examined the major European herbaria as well as this one of Saint Petersburg (Becker 1916a p. 208). In his works, he makes often reference to the Asian and Russian floras of Ledebour (1842), Turczaninow (1842), Regel (1861, 1862), and Maximowicz (1859, 1877). His last publication concerning the [RFE] was about species from [KAM] (Becker & Hulten 1928).

1.1.2. Modern Russian authors (1949–2012)

Subsequently, Russian authors Juzepczuk (1949) and Klokov (1949) studied this genus in depth. Nikitin especially worked on European (1996) and Caucasian species (1998) but started, before his death, studies on W-Siberian countries (Nikitin & Silantjeva 2006, Nikitin 2008). He participated to the treatment in *Flora of China* (Chen et al. 2007) and typified several species in LE. Zuev (1996) studied the genus concerning Siberia. Specifically for the [RFE], I use the recent works of Bezdeleva (1987), Barkalov & Taran (2004), Bezdeleva et al. (2006), Barkalov (2009).

1.2. Systematics

Clausen (1929, 1964) was the first to propose a classification based not only on morphology, but also on biogeographic, cytological, and genetic (hybridizations) data. His experiments concern mostly European and N-American species. For some Asian taxa, using the cytological data of Miyaji (1927, 1929), he raised the group *Plagiostigma* (here subg. *Violidium*) to a monophyletic group, independent of *Rostellatae* (here subg. *Viola*). He included *Stolonosae*, *Vaginatae*, *Langsdorffianae, Diffusae*, *Adnatae*, *Boreali-Americanae* under *Plagiostigma,* and *Dischidium* under *Chamaemelanium.* I adopt this classification which was confirmed by phylogenetic studies of Yoo et al. (2005, 2007, 2010), Liang & Xing (2010), Marcussen et al. (2012, 2015). However, in agreement with results of Marcussen et al. (2012), I remove *Langsdorffianae*, *Boreali-Americanae* from subg. *Violidium* to regroup them with *Mexicanae*, *Nosphidium* and *Pedatae* in subg. *Nosphidium.*

1.3. Cytotaxonomy

The knowledge of chromosome numbers is essential to decide the taxonomic status of some taxa (cf. 1.7.4). Probatova et al. (2001) listed cytotaxonomic data of many *Viola* spp. from the [RFE]. I completed this work with other species and recent data found in indexes (Fedorov 1969, Chromosome counts database http://ccdb.tau.ac.il/) or literature. I consider that these data also may include errors in chromosome counting or species identification. Often, related taxa can be easily confused and hybrids are very frequent when some species grow together (Kuta 1981, 1991, Krahulcova et al. 1996). Counts originating from gatherings made by authors from loc. cl. are the more interesting, because they surely correspond with described taxon. Old chromosome data are often without geographical origin or, worse, come from botanical garden material where hybrids are frequent. When I was able to check geographical origins of studied plants, I mention it. In this study, the term "*dysploidy*" is only used to characterize chromosomal variations of diploid plants and, "*aneuploidy*" for those of polyploids (Verlaque et al. 1987 pp. 292–293). However, given the multiple chromosome numbers found in *Viola* $2n = 4$ to 128, it is very difficult to distinguish between diploids and polyploids, as well as between primary (x) and secondary (x') base numbers.

1.4.Phylogenetics

The first phylogenetic investigations on *Viola* were made on internal transcribed spacer (ITS) of nuclear ribosomal DNA (Ballard et al. 1999, 2000), mostly about European, N-American, and Hawaian taxa. Then, in E-Asia, several studies were based on ITS (Yoo et al. 2005, Gong et al. 2010, Liang & Xing 2010), on inter simple sequence repeats (ISSR) (Yoo et al. 2004) and many chloroplast DNA sequences: *mat*K (Yoo et al. 2007, 2010), intron of ribosomal protein gene *rpl*16 (Liang & Xing 2010, Yoo et al. 2010); exon 2 *rpo*C1 (Yoo et al. 2010), intergenic spacers *trn*L-*trn*F (Jang et al. 2006, Liang & Xing 2010, Yoo et al. 2010, Marcussen et al. 2012), *psb*A-*trn*H (Liang & Xing 2010, Yoo et al. 2010), *psb*K-I (Yoo et al. 2010), *atp*F-H (Yoo et al. 2010), *atp*B-*rbc*L (Yoo et al. 2007, 2010). Recently, Marcussen et al. (2012, 2015) use homeologs of low-copy nuclear genes: glucose-6-phosphate isomerase, the shorter of two paralogs encoding the second-largest subunit of plant RNA polymerase IV/V, shikimate deshydrogenase. For these authors these markers are more able to untangle reticulate phylogenies of allopolyploid taxa than ribosomal or chloroplast sequences. All these studies focus on infrageneric groups, only that of Jang et al. (2006) concern infraspecific taxa. However cytotaxonomic and phylogenetic results are not safe from taxa misidentifications. They are also distorted by artifacts like

Table 1. List of taxa cited by W. Becker for the Russian Far East (references from 1915 to 1928).

Taxa cited for the Russian Far East *: Becker's basionym **: Becker's comb. or stat. nov.	**1915**	**1916a**	**1916b**	**1917a**	**1917b**	**1918**	**·1921a**	**1923a**	**1923c**	**1928**	**Here included under :**
V. acuminata	x	·	·	·	·	·	·	·	·	·	**_V. acuminata_**
V. acuminata subsp. *austroussuriensis**	x	x	·	·	·	·	·	·	·	·	**_V. acuminata_ var. _austroussuriensis_**
V. acuminata var. *dentata**	x	x	·	·	·	·	·	·	·	·	**_V. acuminata_ var. _dentata_**
V. alata subsp. *verecunda***	·	x	·	·	·	·	·	·	·	·	**_V. arcuata_**
V. albida subsp. *marginata**	·	·	·	·	·	·	·	·	x	·	**_V. albida_ subsp. _marginata_**
*V. amurica**	x	x	·	·	·	·	·	·	·	·	**_V. amurica_**
*V. avatchensis**	·	·	·	·	·	·	·	·	·	x	**_V. crassa_ subsp. _avatschensis_**
V. biflora	x	·	·	·	·	x	·	·	·	x	**_V. biflora_**
V. blanda	x	·	·	x	·	·	·	·	·	·	**_V. pallens_ subsp. _hultenii_**
V. brachyceras	x	·	·	x	·	·	·	·	·	·	**_V. brachyceras_ var. _brachyceras_**
V. canina	x	·	·	·	·	·	·	·	·	·	**_V. canina_**
V. canina subsp. *montana*	·	·	·	x	·	·	·	·	·	·	**_V. canina_ subsp. _ruppii_**
*V. carnosula**	·	·	·	·	·	x	·	·	·	·	**_V. selkirkii_ var. _glabrescens_**
V. chaerophylloides	·	·	·	·	·	·	·	·	x	·	**_V. albida_ var. _chaerophylloides_**
V. chinensis	x	·	·	·	·	·	·	·	·	·	**_V. mandshurica_**
V. collina	x	·	·	·	·	x	·	·	·	·	**_V. collina_**
V. crassa	·	·	·	·	·	·	·	·	·	x	**_V. crassa_ subsp. _crassa_**
*V. crassicornis**	·	·	·	·	·	·	·	·	·	x	**_V. tokubuchiana_ var. _crassicornis_**
V. dactyloides	x	·	·	·	·	·	·	·	x	·	**_V. dactyloides_**
V. dactyloides var. *multipartita**	x	x	·	·	·	·	·	·	x	·	**_V. dactyloides_ var. _multipartita_**
V. epipsila subsp. *palustroides**	·	·	·	·	·	·	x	·	x	·	**_V. epipsila_ subsp. _palustroides_**
V. epipsila subsp. *repens*	x	·	·	x	·	·	·	·	·	x	**_V. epipsila_ subsp. _repens_**
V. epipsila var. *palustroides***	·	·	·	·	·	·	·	·	·	x	**_V. epipsila_ subsp. _palustroides_**
V. glabella	·	·	·	·	·	x	·	·	·	·	**_V. brevistipulata_**
V. gmeliniana	x	·	·	x	·	·	·	·	·	·	**_V. gmeliniana_**
V. hirtipes	·	·	·	·	·	·	·	·	x	·	**_V. hirtipes_**
*V. hultenii**	·	·	·	·	·	·	·	·	·	x	**_V. pallens_ subsp. _hultenii_**
*V. kamtschadalorum**	·	·	·	·	·	·	·	·	·	x	**_V. kamtschadalorum_**
V. keiskei subsp. *transmaritima**	·	x	·	·	·	·	·	·	·	·	**_V. pacifica_**
*V. komarovii**	·	x	·	·	·	·	·	x	·	x	**_V. sacchalinensis_**
*V. kusnezowiana**	x	x	·	·	·	·	·	·	·	·	**_V. kusnezowiana_**
V. langsdorffii	x	·	·	·	·	·	·	·	x	·	**_V. langsdorffii_**
V. langsdorffii subsp. *sachalinensis**	·	x	·	·	·	·	·	·	x	·	**_V. kamtschadalorum_**
*V. langsdorffii var. ursina***	·	·	·	·	·	·	·	·	·	x	**_V. langsdorffii_**
*V. mandshurica**	·	·	·	·	x	·	·	·	·	·	**_V. mandshurica_**
*V. mariae**	·	·	x	·	·	·	·	x	·	·	**_V. mariae_**
V. mauritii	x	·	·	·	·	·	·	x	·	·	**_V. mauritii_**
V. micrantha lus. *austroussuriensis***	·	·	·	x	·	·	·	·	·	·	**_V. acuminata_ var. _austroussuriensis_**
V. micrantha rasse *grandistipulata**	·	·	·	x	·	·	·	·	·	·	**_V. acuminata._ subsp. _grandistipulata_**
V. micrantha var. *dentata***	·	·	·	x	·	·	·	·	·	·	**_V. acuminata_ var. _dentata_**
V. mirabilis fa. *latisepala**	x	·	·	·	·	·	·	·	·	·	**_V. mirabilis_ var. _subglabra_**
V. mirabilis var. *subglabra*	x	·	·	·	·	·	·	x	·	·	**_V. mirabilis_ var. _subglabra_**
*V. miranda**	·	·	x	·	·	·	·	x	·	·	**_V. sacchalinensis_**
*V. mutsuensis**	·	·	·	·	·	·	·	x	·	·	**_V. kusanoana_**
V. orientalis var. *conferta**	·	·	·	·	·	x	·	·	·	·	**_V. orientalis_ var. _conferta_**
*V. orientalis***	x	x	·	·	·	x	·	·	·	·	**_V. orientalis_ var. _orientalis_**
V. patrinii	x	·	·	·	·	·	·	·	·	·	**_V. patrinii_**
V. patrinii fa. *hispida**	x	x	·	·	·	·	·	·	·	·	**_V. patrinii_**
V. phalacrocarpa	x	·	·	·	x	·	·	·	·	·	**_V. phalacrocarpa_**
V. phalacrocarpa var. *brevicalcarata**	x	·	·	x	·	·	·	·	·	·	**_V. pacifica_**
V. philippica subsp. *munda**	·	·	·	·	x	·	·	·	·	·	**_V. philippica_ subsp. _philippica p.p._**
V. pinnata subsp. *dissecta***	x	·	·	·	·	·	·	·	·	·	**_V. multifida_**
V. pinnata subsp. *multifida***	·	·	·	·	·	·	·	·	x	·	**_V. multifida_**
V. pinnata var. *latisecta**	·	·	·	·	·	·	·	·	x	·	**_V. multifida_**
V. prionantha	·	·	·	·	x	·	·	·	·	·	**_V. prionantha_**
V. raddeana	x	x	·	·	·	·	·	·	·	·	**_V. raddeana_**
V. rossii	·	·	·	·	·	x	·	·	·	·	**_V. diamantiaca_**
V. rupestris	·	·	·	·	·	·	·	x	·	·	**_V. rupestris_**
V. rupestris var. *glaberrima*	x	·	·	·	·	·	·	·	·	·	**_V. rupestris_ var. _glaberrima_**
V. sacchalinensis	x	·	·	·	·	·	·	·	·	·	**_V. sacchalinensis_**
V. selkirkii	x	·	·	x	·	·	·	·	·	x	**_V. selkirkii_**
V. selkirkii var. *angustistipulata**	·	x	·	·	·	·	·	·	·	·	**_V. tokubuchiana_ var. _extremiorientalis_**
V. selkirkii var. *brevicalcarata***	·	·	·	x	·	·	·	·	·	·	**_V. selkirkii_**
V. selkirkii var. *glabrescens**	·	·	·	·	·	·	·	·	·	x	**_V. selkirkii_**
*V. silvestriformis**	·	x	·	·	·	·	·	x	·	·	**_V. kusanoana_**
V. tenuicornis subsp. *primorskajensis**	·	x	·	·	·	·	·	·	·	·	**_V. variegata_ subsp. _primorskajensis_**
V. tenuicornis subsp. *trichosepala**	·	x	·	·	·	·	·	·	·	·	**_V. tenuicornis_ subsp. _trichosepala_**
V. uniflora	x	·	·	·	·	x	·	·	·	·	**_V. uniflora_**
V. ursina	·	·	·	·	·	·	·	·	x	·	**_V. langsdorffii_**
V. variegata	x	x	·	·	·	·	·	·	·	·	**_V. variegata_**
*V. variegata subsp. chinensis***	x	·	·	·	·	·	·	·	·	·	**_V. variegata_ subsp. _primorskajensis_**
V. verecunda	x	·	·	·	·	·	·	·	·	·	**_V. arcuata_**

Long Branch attraction (Perrière & Brochet-Armanet 2010). These authors limit these effects by using several out-groups and many operational taxonomic units. Results of Liang & Xing (2010) are those which best match with our taxonomic analyses, because they combine sequences with several taxonomically useful characters and chromosome numbers.

1.5. Herbarium Studies

Four herbaria were directly studied: P, G, G-DC and Espeut's collections. The others were consulted on web sites: B, BM, BR, HAL, K, KRAS, HAST, L, LINN, MA, MAK, NY, PE, WU, or through specimen pictures sent by curators of BP, LE, MAH, NDG, TI, TO, S, SAPS, VLA. Herbaria examination has allowed finding several lectotypes, to evaluate the intraspecific variability, and to verify characteristic measures given in floras. Several catalogues, books and papers were studied to trace type specimens. Russia: Bezdeleva (1987), Nikitin & Silantjeva (2006), Nikitin (2008), Byalt (2018) for LE; Japan: Akiyama & Ohba (2001) for TI; Korea: Nikitin (2004) for LE; Europe: Kirschner & Skalicky (1989), Kirschner et al. (2007), Nauenburg (1991), Nikitin (1995, 1996), Jonsell & Jarvis (2002), Jarvis (2007); N-America: Ballard et al. (2001).

1.6. Distribution data

They were found in Becker's studies, Barkalov (2009), Barkalov & Taran (2004), Bezdeleva (1987, 2006) Probatova et al. (2001), Zuev (1996), cytological papers, and in examined herbaria. I use the system of geographical units and names (Fig. 1) of Brummitt (2001), in square brackets. It is composed of four levels: (1) continents, (2) regions, (3) botanical countries, (4) basic recording units. The studied area is organized as follows: **level 1**, Asia-Temperate [Asia-Temp.]; **level 2**, Russian Far East [RFE]; **level 3**, Amur [AMU], Kamchatka [KAM], Khabarovsk [KHA], Kuril Is. [KUR], Magadan [MAG], Primorye [PRM], Sakhalin [SAK]; **level 4**, no basic recording units for the [RFE] in Brummitt'system. To provide more geographic information, I also report the floristic districts of [RFE] (Fig. 1) according to Kharkevich & Tzvelev (2003): Chukotka, Anyuy, Anadyr-Penzhina, Koryak, Kolyma, Okhotsk, Aldan, Nyukzha, Dauria, Kamchatka, Commander Is., N-Sakhalin, N-Kuril, Upper- and Lower-Zeya, Bureya, Amgun, Ussuri, S-Sakhalin, S-Kuril.

1.7. Species concept and systematic approach

A specific name has two important and inseparable functions: linguistic role and biological concept.

1.7.1. Linguistic role

The use of binomial names began during the 16th century in the botanical literature (e.g. *Viola purpurea* in Brunfels 1530) and generalized by Linnaeus (1753). The specific binomial name is always associated to a plant morphological description; it allowed botanists to exchange information more easily. During the 19th century, emerge the first nomenclatural rules for facing the disordered increasing of species names (Candolle 1867). By this way, the species becomes what is still today: a taxon that represents the basic principal rank of botanical nomenclature (Art. 2.1 and 3.1).

1.7.2. Biological concept

The article of Poulton: "What is a species?" (1904) is perhaps the first paper entirely devoted to a discussion on species concepts (cf. Mallet 2004). Mayr (2004) is however the first to give a definition through the Biological Species Concept (BSC) that the author summarizes as follows "*The species enables the protection of harmonious, well-integrated genotypes. It is this insight on which the Biological Species Concept is based.*" I use this dual requirement, linguistic role and BSC, to establish the list of approved species. This list was set from valid and legitimate names and from the definition of the BSC "*Species are groups of interbreeding natural populations that are reproductively isolated from other such groups. The isolating mechanism by which reproductive isolation is effected are properties of individuals. Geographic isolation therefore does not qualify as an isolating mechanism.*" (Mayr 1996: 264). This isolation may be due to: chromosomal changes (dysploidy, polyploidy, aneuploidy), genetic drift following an old geographical isolation (allopatric speciation), and modifications in flowering periods, pollinators, ecological preferences (parapatric speciation)… Generally, isolation is followed by morphological modifications, especially if it is an old event. These changes are used in diagnosis to differentiate closely related species. One of the major difficulties of BSC is to decide when allopatric populations can be designed as a new species. In absence of any observations or experimental evidences (natural or experimental hybrids, meiotic disruptions, pre- or post-zygotic infertilities, etc.), cytological (e.g. chromosome numbers) or morphological criteria (cf. 1.7.3, type S2) can help to decide.

1.7.3. Categories of species

The literature may not be sufficient to decide on species status. According to scientific knowledge levels, I classify the studied taxa in five categories here exposed:

Non-approved species (S0). These species are included under other specific taxa that were published earlier. They are closely related to others; they differ only by minor characters like hairiness, color and size of flowers or leaves, e.g. *V. sergievskiae* differs from *V. rupestris* by absence of hairiness. Hybrids with related species are unknown. They were often treated in literature as heterotypic synonyms or infraspecific taxa, e.g. *V. epipsiloides* included under *V. epipsila* subsp. *repens*. With knowledge advancement, an infraspecific taxon (S0) may become a proved biological species (S4), e.g. *V. sieheana* included under *V. riviniana* (Becker 1923a) as *V. riviniana* subsp. *neglecta*. The new count of 2n = 60 for *V. sieheana* allowed to rank it as species.

Typological species (S1). These species are very little known. Sometimes they are only known through the protologue and one or few specimens. It is often difficult to find closely related species because the author has not provided a diagnosis or a description fairly detailed, e.g. *V. mariae*.

Putative biological species (S2). This category brings together well-known plants, with significant morphological characters that allow differentiating them from related species. These differences must not be confused with the intraspecific variations which express through flower or leaf

Figure 1 Study area. In medium grey, floristic districts of the RFE according to Kharkevich & Tzvelev (2003). In light gray, adjacent regions according to Brummit's (2001) levels 2, 3 and 4: Siberia [ALT – Altay, BRY – Buryatiya, CTA – Chita, IRK – Irkutsk, KRA – Krasnoyarsk, TVA – Tuva, WSB – West Siberia, YAK – Yakutiya]; China: [CHI – Inner Mongolia, CHM – Manchuria]; JAP – Japan; [JAP-HK – Hokkaido; JAP-HN – Honshu]; KOR – Korea: [KOR-NK – North Korea]; Subartic Amer.: [ALU – Aleutian Islands are not shown on the map]

colors, hairy organs present or no, corolla or leaf sizes that depend on seasons, plant habit linked with ecological factors. However this variability shows qualitative and quantitative limits which, when they are exceeded, contributes to the identification of species, e.g. sizes of spur, stipules or sepal appendages. Some criteria, like styles, nectar appendages, seeds, stems architecture slightly vary within a species; their shapes or sizes have a major taxonomic value. However in this category, no cytological or biological item (total or partial sterile hybrids) could not prove the status of biological species. Two types can be discerned:

- **S2a** = taxa with some closely related species, e.g. the Asian *V. tokubuchiana* (2n = 24) partially sympatric with the circumboreal species *V. selkirkii* (2n = 24);
- **S2b =** taxa with a singular morphology, without closely related species, e.g. *V. kitamiana*.

Cryptic species (S3). If the recognition of a species is based on ambiguous characters or others that could be difficult to check, the risk of identification error increases and the number of observers being able to exchange information decreases: the linguistic function of the name loses efficiency. A species whose identification is based on genetic, chemical or micro-morphological characters (chromosome number, pollen, anatomy) cannot be determined by botanists *in natura*. To avoid these problems and conserve a strong linguistic power to species name, I choose to include the biological species that cannot be differentiated by macro-morphological characters (that can be verified *in natura* with a pocket loupe) in a cryptic species complex. It is designed by the oldest species name, e.g. *V. yazawana* (1902) includes *V. chassanica* (1986).

Recognized biological species (S4). This category includes species with a reproductive isolation established through: (1) a difference of chromosome number between two related taxa, e.g. *V. patrinii* (2n = 24) and *V. mandshurica* (2n = 48); (2) attested natural or experimental hybrids with a total or partial sterility. In both cases, macro-morphological characters allow to distinct two related species. Advances in biological knowledge of species are able to move a taxon in the S4 category.

1.7.4. Key to species categories

The aim of this key is whether one taxon A should be considered as a species or not. If not, A is included under B (B is a closely related species previously described).

1 Documentation (protologue, types, floras, or field observations) allows to compare A with other species **2**
– Documentation too poor to really compare A with other species: protologue with an imprecise description; species little known, few known specimens, e.g. *V. mariae* **S1**

2 A is closely related to another species B **3**
– A is not closely related to other species (singular morphology), e.g. *V. kitamiana* **S2b**

3 A and B differ by low-value taxonomic characters (hairiness, flower color, corolla or leaf sizes, etc.) **4**
– Significant morphological differences between A and B (style, grow type, sepal appendages size, etc.) **10**

4 A published after B; A included under B **S0**
– A validly published before B **5**

5 Chromosome numbers known for A and B **6**
– Chromosome numbers unknown for A and/or B **9**

6 A and B have not a same chromosome number, B included under A **S3**
– A and B share a common chromosome number **7**

7 Attested hybrids between A and B, B included under A .. **S3**
– Non-attested hybrid between A and B **8**

8 Only one chromosome number known for A and B, B included under A **S2**
– Several chromosome numbers known for A and/or B, B included under A **S3**

9 Attested hybrids between A and B; B included under A .. **S3**
– Non-attested hybrid between A and B; B included under A **S2**

10 Chromosome numbers unknown for A and/or B **11**
– Chromosome numbers known for A and B **12**

11 Attested hybrids between A and B; A ≠ B **S4**
– Non-attested hybrid between A and B; A ≠ B **S2a**

12 Several chromosome numbers known for A, A ≠ B **S3**
– Only one chromosome number known for A **13**

13 A and B have different chromosome number; A ≠ B .. **S4**
– A and B share a common chromosome number **14**

14 Attested hybrids between A and B; A ≠ B **S4**
– Non-attested hybrid between A and B; A ≠ B **S2a**

2. SPECIES OF GENUS *VIOLA* IN THE RUSSIAN FAR EAST [RFE]

2.1. Classification of Species

V. subg. *Viola*
V. sect. *Viola*
1. *V. collina* Besser

V. sect. *Trigonocarpae* Godr.
V. subsect. *Rosulantes* (Borbás) Juz.
2. *V. kusanoana* Makino
3. *V. mauritii* Tepl.
4. *V. rupestris* F.W. Schmidt
5. *V. sacchalinensis* H. Boissieu

V. subsect. *Grypocerae* Espeut
6. *V. grypoceras* A. Gray
7. *V. mariae* W. Becker

V. subsect. *Mirabiles* (Nyman ex Borbás) Juz.
8. *V. mirabilis* L.

V. subsect. *Arosulatae* (Borbás) Juz.
9. *V. acuminata* Ledeb.
10. *V. canina* L. emend. Rchb.

V. subg. *Violidium* C. Koch
V. sect. *Violidium* (C. Koch) Juz.
11. *V. multifida* Willd.
12. *V. incisa* Turcz.
13. *V. dactyloides* Schult.
14. *V. albida* Palib.
15. *V. gmeliniana* Schult.
16. *V. hirtipes* S. Moore
17. *V. pacifica* Juz.
18. *V. patrinii* DC. ex Ging.
19. *V. mandshurica* W. Becker
20. *V. phalacrocarpa* Maxim.
21. *V. philippica* Cav.
22. *V. prionantha* Bunge
23. *V. selkirkii* Pursh ex Goldie
24. *V. tokubuchiana* Makino
25. *V. variegata* Fisch. ex Link
26. *V. tenuicornis* W. Becker

V. sect. *Plagiostigma* Godr.
27. *V. epipsila* Ledeb.
28. *V. pallens* (Banks ex Ging.) Brainerd

V. sect. *Brachycerae* Juz. ex Espeut
29. *V. brachyceras* Turcz.

V. sect. *Vaginatae* (W. Becker) Ching J. Wang
30. *V. yazawana* Makino
31. *V. diamantiaca* Nakai

V. sect. *Bilobatae* (W. Becker) Juz.
V. subsect. *Bilobatae* (W. Becker) W. Becker
32. *V. arcuata* Blume

V. subsect. *Amuricae* Juz. ex Espeut
33. *V. amurica* W. Becker

V. subsect. *Raddeanae* (W. Becker) Espeut
34. *V. raddeana* Regel

V. subg. *Nosphinium* (W. Becker) Espeut
V. sect. *Langsdorffianae* (W. Becker) Espeut
35. *V. langsdorffii* Fisch. ex Ging.
36. *V. kamtschadalorum* W. Becker & Hulten

V. subg. *Chamaemelanium* (Ging.) Juz.
V. sect. *Chamaemelanium* Ging.
V. subsect. *Nudicaules* (W. Becker) Espeut
37. *V. uniflora* L.
38. *V. muehldorfii* Kiss
39. *V. orientalis* (Maxim.) W. Becker
40. *V. brevistipulata* (Franch. & Sav.) W. Becker

V. sect. *Dischidium* Ging.
41. *V. biflora* L.
42. *V. crassa* Makino

V. sect. *Kitamianae* Espeut
43. *V. kitamiana* Nakai

V. sect. *Memorabiles* (W. Becker) Juz.
44. *V. kusnezowiana* W. Becker

V. subg. *Melanium* (Ging.) Peterm.
V. sect. *Melanium* Ging.
45. *V. tricolor* L.
46. *V. arvensis* Murray

2.2. Key to the Species of *Viola*

1 Corollas yellow at least on the throat entrance of the spurred petal **2**
– Corollas never yellow **11**

2 Throat of spurred petal pilose; style capitate with large stigma hole (Fig. 2E, F); stipules dentate, lobed or divided (subg. ***Melanium***) **3**

– Throat of spurred petal glabrous or shortly papillose; style with small stigma hole; stipules undivided or at most toothed (subg. ***Chamaemelanium***) **4**

3 Labellum of stigma hole protruded (Fig. 2E, F); spurred petal generally with 7 striae (rarely 5), often branched or forked sometimes right; pollen grains mainly 4-apertured .... **45.** ***V. tricolor***

– Labellum of stigma hole less or not protruded; spurred petal generally with 5 striae, right, very rarely forked; pollen grains mainly 5-apertured .... **46.** ***V. arvensis***

4 Plants without annual erect or decumbent stems; rhizome long creeping, slender, whitish, producing directly flowers and leaves (Fig. 3B, sect. ***Memorabiles***) **44.** ***V. kusnezowiana***

– Plants with annual erect or decumbent stems producing flowers (Fig. 3D) **5**

5 Corollas white with yellow center; style tubular (sect. ***Kitamianae***) .... **43.** ***V. kitamiana***

– Corollas completely yellow **6**

6 Apical part of the style 2-lobed; lateral petals beardless; leaves emarginate, obtuse or subobtuse (sect. ***Dischidium***) **7**

– Apical part of the style capitate; lateral petals bearded; leaves with ± extended acute apex (subsect. ***Nudicaules***) .. **8**

7 Leaves thin, soft, with marginal teeth ended by an inconspicuous gland; capsule up to 6 mm long; lower petal up to 13 mm long; sepals green; seeds up to 2 mm long .... **41.** ***V. biflora***

– Leaves thick, firm, with marginal teeth ended by a conspicuous gland; capsule up to 8 mm long; lower petal up to 15 mm long; sepals often tinged with purple-red; seeds up to 2.5 mm .... **42.** ***V. crassa***

8 Lowest cauline leaf with a flower at its axil **9**

– Lowest cauline leaf without a flower **10**

9 Rhizome short, erect; sepal appendages little but distinct .... **39.** ***V. orientalis***

– Rhizome long, creeping, branched; sepal appendages inconspicuous .... **40.** ***V. brevistipulata***

10 Lowest cauline leaf distinctly petiolate, distant from the upper ones that are grouped in the upper part of the stem; rhizome long, slender, procumbent .... **38.** ***V. muehldorfii***

– Lowest cauline leaf shortly petiolate, close to the upper ones in the upper part of the stem; rhizome vertical or oblique .... **37.** ***V. uniflora***

11 Style flat at top with broader margin on lateral and back sides (like a head of nail, Fig. 2G, H), beaked in front, with stigma hole at tip of the beak **12**

– Style not margined at top, but curved or suberect forming a beak ± long with stigma hole at tip (Fig. 2A–D) (subg. ***Viola***) **37**

12 Plants with annual flowering stems, erect or decumbent that wither after fructification (Fig. 3C, F) **33**

– Plants without annual flowering stems; flowers and leaves at the top of the rhizome (Fig. 3A–B) **13**

13 Stipules ½ or more adnate to petiole (sect. ***Violidium***) **14**

– Stipules free or up to ½ adnate to petiole **29**

14 Leaves divided in ± deep segments **15**

– Leaves entire or crenulate or dentate **18**

15 Leaves pinnately incised, never to midrib; petiole narrowly winged in upper part .... **12.** ***V. incisa***

– Leaves palmately or pinnately divided; petiole no winged **16**

16 Leaves divided into 5 short petioluled, undivided, dentate segments .... **13.** ***V. dactyloides***

– Leaves otherwise segmented **17**

17 Sepal appendages conspicuous, 2.5–4.5 mm long, irregularly 2–3 dentate at apex .... **14.** ***V. albida***

– Sepal appendages inconspicuous, ≤ 2 mm long, truncate, entire or 1–2 denticulate .... **11.** ***V. multifida***

18 Leaves oblong-elliptical or spatulate, gradually narrowed into very short petiole .... **15.** ***V. gmeliniana***

– Leaves cordate, truncate or shortly cuneate in long petiole **19**

19 Spur ≤ 3 mm long; flowers always white; petiole clearly winged in upper part; roots dark brown .... **18.** ***V. patrinii***

– Spur > 3 mm long; flowers white or purplish; petiole winged or not; roots dark or light **20**

20 Roots dark brown; petiole clearly winged in upper part after anthesis; leaf blades truncate or broadly cuneate at base, sometimes slightly hastate after anthesis, with margin shallowly and remotely denticulate or subentire; lateral petals distinctly or sparsely bearded .... **19.** ***V. mandshurica***

– Roots yellowish or light grey; petiole winged or not; leaf blades cordate, hastate or truncate at base, with margin denticulate; lateral petals bearded or not **21**

21 Rhizome slender; after anthesis leaves ± accrescent with wingless petiole **22**

– Rhizome thick; after anthesis leaves prominently larger than those of anthesis, with winged or wingless petiole ... **25**

22 All leaf blades with rounded or obtuse apex even after anthesis **23**

– All leaf blades with subacute, acute or acuminate apex even during anthesis **24**

23 Leaves mainly orbicular with a base distinctly cordate, after anthesis sometimes broadly ovate; sepals glabrous or puberulous .... **25.** ***V. variegata***

– Leaves mainly ovate with a base shallowly cordate or subrounded; sepals clearly ciliate along margin (subsp. *trichosepala*) or glabrous .... **26.** ***V. tenuicornis***

24 Flowers pale rose-purple to whitish; leaves rather thick, broadly ovate to narrowly deltoid-ovate; apex acute to acuminate; beak of style clearly protruding .... **24.** ***V. tokubuchiana***

– Flowers pale violet, bluish or whitish; leaves thin, broadly ovate to ovate, apex (sub) acute; beak of style gradually ended .... **23.** ***V. selkirkii***

25 Petiole wingless covered ± densely with white patent hairs (0.5–1 mm long); flowers white .... **16.** ***V. hirtipes***

– Petiole winged in upper part mainly on accrescent leaves after anthesis; glabrous or shortly villous **26**

26 Sepal appendages 3–4 mm long, dentate, glabrous; flowers white with spur ≤ 6 mm long .... **17.** ***V. pacifica***

– Sepal appendages ≤ 2 mm long, glabrous or pubescent; flowers white or purple, with spur 4–9 mm long **27**

27 Leaf blade generally broadest between the base and the lower third, margin shallowly crenate with flattened teeth .... **21.** ***V. philippica***

– Leaf blade generally broadest between the lower third and the middle, margin clearly crenate with more rounded teeth **28**

28 At anthesis leaf blade orbiculate to ovate, at fruiting

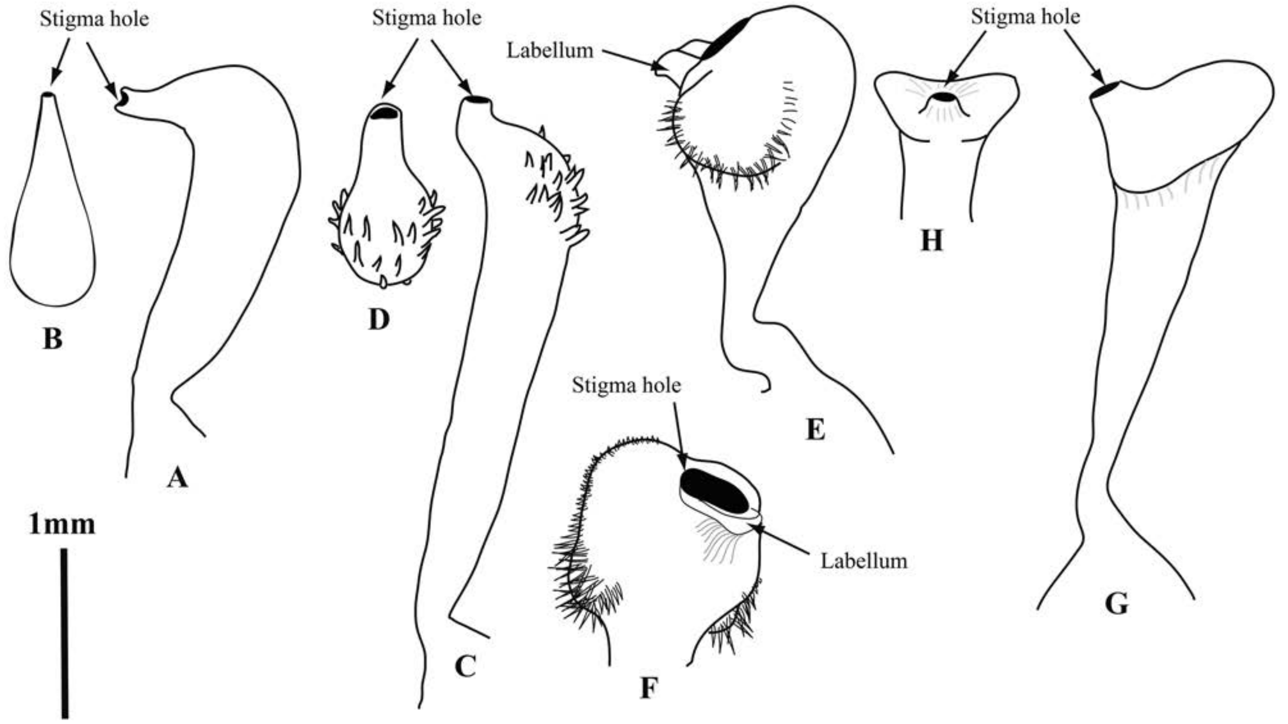

Figure 2 *V. collina* Besser: A – side view of the style, B – upper view of the style. *Viola sacchalinensis* H. Boissieu: C – side view of the style. D – upper view of the style. *Viola tricolor* L.: E – side view of the style, F – front view of the style. *Viola mandshurica* W. Becker: G – side view of the style, H – front view of the style. All the pictures are drawn to the same scale, from author's observations and literature (Hama 1975, Igari 1996)

deeply cordate; lateral petals bearded; ovary villous rarely glabrous .... **20. *V. phalacrocarpa***

– At anthesis leaf blade oblong-ovate to ovate-lanceolate, at fruiting truncate to slightly cordate; lateral petals glabrous or bearded; ovary glabrous .... **22. *V. prionantha***

29 Leaves long acute to acuminate, petiole > 10 cm long at fruiting (sect. ***Vaginatae***) **30**

– Leaves rounded, obtuse or mucronate never long acute, petiole < 10 cm long **31**

30 Plant without stolons; rhizome oblique or vertical; lateral petals glabrous .... **30. *V. yazawana***

– Plant with long, slender stolons; rhizome obliquely ascending or horizontal; lateral petals ± bearded .... **31. *V. diamantiaca***

31 Rhizome horizontal, slender, long-jointed with few leaves at tip; bog plants (sect. ***Plagiostigma***, Fig. 3B) **32**

– Rhizome oblique or vertical, thicker and shorter, with many leaves forming a rosette; forest plants (sect. ***Brachycerae***, Fig. 3A) .... **29. *V. brachyceras***

32 Flowers purplish, 1.5–1.8 cm long with spur; pedicels not or slightly exceeding leaves .... **27. *V. epipsila***

– Flowers white, small: 7–8 mm long with spur; pedicels clearly exceeding leaves .... **28. *V. pallens***

33 Cauline leaves oblong-triangular never cordate; at anthesis, annual erect stems without leaf rosette at the top of the rhizome (subsect. ***Raddeanae***, Fig. 3F) ..... **34. *V. raddeana***

– All leaves cordate; at anthesis, caudex with ± many basal leaves, with or without annual stems **34**

34 Flowers 2–3 cm across, pale to deep purple; spur purple tinged; sepals > 5 mm long, 2 mm wide; leaves orbicular, broad-ovate (sect. ***Langsdorffianae***) **35**

– Flowers smaller less to 1.5 cm across, white rarely pale purple; spur green or white; sepals ≤ 5 mm long, 2 mm wide; leaves triangular-reniform to ovate (sect. ***Bilobatae***) **36**

35 Plant up to 40 cm high, ascending stems with long internodes; upper leaves acute; flowers deep purple .... **36. *V. kamtschadalorum***

– Plant ≤ 25 cm, decumbent stems with short internodes; upper leaves obtuse to acutish; flowers light purple .... **35. *V. langsdorffii***

36 Chasmogamous flowers first in rosette leaf axils, then chasmogamous or cleistogamous flowers in cauline leaf axils of annual stems (subsect. ***Amuricae***, Fig. 3E) .... **33. *V. amurica***

– Flowers only on annual erect or decumbent stems in cauline leaf axils, never in rosette leaf axils (subsect. ***Bilobatae***, Fig. 3C) .... **32. *V. arcuata***

37 Plants with a perennial rhizome ending in a leaf rosette producing flowers, without erect or decumbent elongated stems (Fig. 3A) **38**

– Plants with a perennial rhizome ending in a leaf rosette or without a rosette, producing erect or decumbent elongated stems that wither after fruiting (sect. ***Trigonocarpae***) **40**

38 Margin of stipules fimbriate-dentate **39**

– Margin of stipules entire, ciliate .... **8. *V. mirabilis*** (beginning of flowering, Fig. 3E)

39 Sepals with acute apex; spur 6–8 mm long .... **6. *V. grypoceras*** (beginning of flowering, Fig. 3E)

– Sepals with obtuse apex; spur ≤ 4 mm long ... **1. *V. collina***

40 Plants with a perennial rhizome ending in a leaf rosette (monopodial growth) with annual elongated stems **41**

– Plants with a branched rhizome not ending in a leaf rosette, but with annual erect or decumbent stems that wither after fruiting (sympodial growth, subsect. ***Arosulatae***, Fig. 3F) **47**

41 Plants with a perennial rhizome ending in a leaf rosette producing chasmogamous flowers first, then annual stems with chasmogamous or cleistogamous flowers (Fig. 3E) . **42**
– Plants with a perennial rhizome ending in rosette without flowers, producing annual stems with chasmogamous or cleistogamous flowers (subsect. ***Rosulantes***, Fig. 3C) **44**

42 Margin of stipules fimbriate-dentate (subsect. ***Grypocerae***) **43**
– Margin of stipules entire ciliate (subsect. ***Mirabiles***) .... **8. *V. mirabilis***

43 Style smooth .... **6. *V. grypoceras***
– Style papillose .... **7. *V. mariae***

44 Style with very short suberect beak, generally glabrous . **45**
– Style with distinctly hooked beak turned upwards at tip, generally papillose (Fig. 2C–D) **46**

45 Spur 3–8 mm long; lateral petals glabrous or slightly bearded .... **2. *V. kusanoana***
– Spur 1.5–4 mm long, lateral petals bearded .. **3. *V. mauritii***

46 Sepal appendages 0.5–1.5 mm long .... **4. *V. rupestris***
– Sepal appendages emarginate or dentate 1.5–3 mm long ... . **5. *V. sacchalinensis***

47 Stipules pinnatipartite-incised with many conspicuous teeth or fringes; leaves often with concave margins near the apex .... **9. *V. acuminata***
– Stipules less divided, with few teeth or little fringes; leaves with convex or right margins near the apex ... **10. *V. canina***

2.3. Taxa of Genus *Viola*

For each infrageneric taxa, in presentation order:
Name; **Type**; **Basionym** (each with bibliographic references); **Chromosome Numbers** (with base number, di-, polyploid numbers, dysploid or aneuploid numbers or counting/identification errors); **Hybrids** (intra or inter infrageneric taxa); **Taxonomy**; **Characters**; **Distribution** (Brummitt 2001, levels 1, 2).

For each species, in presentation order:
Specific name and **Basionym** with bibliographic reference (often not cited in references); **Categories of Species**: S0 to S4 (cf.1.7.3); **Infrageneric taxa**; **Species knowledge of the author**: **(1) Type** knowledge, T0 = unread protologue, T1 = studied protologue, T2 = original specimens studied; **(2) Plant** knowledge, P0 = unread description, P1 = descriptions read in botanic literature, P2 = drawings, photos seen in literature, P3 = specimens studied in herbaria, P4 = living plants observed in botanic gardens, P5 = living plants observed in nature, P6 = living plants observed on loc. cl. **GN** = species studied in molecular phylogenetics; **Typification: (1)** The locus classicus as written in protologue and if possible equivalence in the system of geographical units adopted by Brummitt (2001); more precise data (city, mountain, river, etc.) are placed after Brummitt's units e.g. [PRM: Vladivostok]; **(2)** specimens cited in the protologue with type status; **(3)** type (holotype, lectotype or neotype) previously published or here designated with the herbarium code, the catalog number or barcode (in square brackets) with the location on the sheet if necessary; **(4)** label information left by the botanist who has gathered or stored the specimen before the publishing date of protologue (botanical name used, country or location of the gathering, date, gathering number, collector's name, etc.); **(5)** notes left by a specialist (sometimes the protologue author); **(6)** other original specimens studied (isotype, syntype, paratype …); **Chromosome Numbers**: gametic chromosome count (n) and/or somatic count (2n), countries abbreviations of the plants counted e.g. 2n = 24 [China, RFE], the most frequent numbers are underlined: e.g. 2n = <u>34</u>, 36, counts without a bibliographic reference were found in Chromosome counts database (http://ccdb.tau.ac.il/) or Fedorov (1969); **Known hybrids**; **Taxonomy**: **(1)** incl. = list of taxa cited in floras or herbaria and considered as a heterotypic synonym or infraspecific taxa; **(2)** misapplied names = names of other species wrongly assigned, found in literature or herbaria; **Infraspecific taxa** described, noted or that could be found in the [RFE]; **Keys** to closely related species or infraspecific taxa are proposed; **Distribution**: **(1)** floristic districts of the [RFE] (cf. 1.6); **(2)** adjacent regions (Brummitt 2001, levels 3, 4), [YAK, CTA, CHI, CHM, KOR-NK, JAP-HK, ALU, ASK]; **(3)** general range (Brummitt 2001, levels 1, 2); **(4)** Countries where the specific name is erroneously applied for another, e.g. *V. mauritii* auct. [China] non Tepl. = *V. sacchalinensis*.

Viola subg. *Viola*

Type: *V. odorata* L. It was designated as the type of the genus by Britton & Brown, Ill. Fl. N.U.S. ed. 2. 2: 546 (7 June 1913). All infrageneric taxa of genus *Viola* published after 7 june 1913 that include *V. odorata* must be autonyms (Art. 22.2).

Equally Ranked Synonym: *V.* subg. *Nomimium* (Ging.) Peterm., Deutschl. Fl. 64 (1849) p.p. excl. *V. pinnata, V. palustris, V. epipsila*.

Chromosome Numbers. Estimated ploidy level at the beginning of lineage: allotetraploid (Marcussen et al. 2015); secondary base number x' = 10, diploid: 2n = 20; auto- or allopolyploids: 2n = 40, 60, 80; errors or aneuploids: 2n = 12, 16, 18, 24, 34, 35, 36, 37, 42, 48, 58, 72; 0–c.10 B chromosomes.

Hybrids. Some natural hybrids between sect. *Viola* × *Trigonocarpae* were reported (Becker 1910a, Nikitin 2007). Two natural hybrids cited with subg. *Violidium*: *V. rupestris* × *V. selkirkii* (Nikitin 2003), *V. rostrata* × *V. violacea* (Yoshida et al. 2016). Three experimental F1 (completely sterile) hybrids between subg. *Viola* sect. *Trigonocarpae* × *Violidium* sect. *Plagiostigma* were created (Clausen 1951 p. 148).

Taxonomy. According to Becker (1925), sect. *Nomimium* included several infrageneric taxa as *Adnatae*, *Stolonosae*, *Vaginatae*, *Bilobatae*, *Langsdorffianae*, *Memorabiles*. This classification is still used in literature under autonym subg. *Viola* (Bezdeleva 1987, Baikov 2012, Chen et al. 2007, Wang 1991, Zuev 1996). Clausen (1964 as sect. *Rostellatae*) and phylogenetic analyses (Marcussen et al. 2012, 2015) clearly show that subg. *Viola* (sect. *Viola* and *Trigonocarpae*) and subg. *Violidium* constitute two independent lineages. The subg. *Viola* here defined includes sect. *Viola* and *Trigonocarpae*. It is equivalent to sect. *Rostellatae* Boiss. sensu Clausen (1964).

Characters. Flowers frequently blue violet, violet, purple or mauve; sometimes white, magenta, or variegated; never yellow but for some species (*Arosulatae*) pale green-yellow to bright green spur. Stipules free or slightly adnate. Style with hooked beak or with short beak more or less curved upward, never capitate or clavate at top, papillose or not (Fig. 2A–D). Generalized cleistogamy.

Distribution (included *V. pilosa* Blume and related species, Okamoto et al. 1993): [N-Amer.; Afr.: N-Afr., Macaronesia; Eur.; Asia-Temp.; Asia-Trop.: Indi., Indo-China, Malesia].

Viola sect. *Viola*

Type: *V. odorata* L.

Equally Ranked Synonyms: sect. *Nomimium* Ging., Mém. Soc. Phys. Genève 2(1): 23 (1823) p.p. excl. *V. palmata* L., *V. canina* L.; "*Nominium*" orthographical error corrected to "*Nomimium*" Gingins (1824); *nomimus* means: legitimate. *V.* sect. *Hypocarpae*, Godr. *Fl. Lorraine, ed.2.* 1: 86 (1857). *V.* sect. *Uncinatae (*Kupffer) Kuppfer, *Fl. Caucas. crit.* 3(9): 174 (1909).

Chromosome Numbers. Diploid: 2n = 20; polyploid: 2n = 40 (*V. suavis*, *V. ambigua*).

Hybrids. Many hybrids within the sect.; some natural hybrids with sect. *Trigonocarpae* subsect. *Rosulantes* (Becker 1910a, b, Nikitin 2007), with subsect. *Arosulatae* (Nikitin 2007) and with subsect. *Grypocerae* (Hama 1975).

Characters. Perennial rhizome ending in a leaf rosette producing flowers, without annual erect or decumbent stems (Fig. 3A) but only with stolons according to species. Sepals with obtuse apex. Style with hooked beak, never papillose (Fig. 2A–B). Cleistogamous capsules globulose on decumbent peduncles, lying on the ground during dehiscence; never ballistic seed dispersal, only ant dispersal. Seeds with conspicuous elaiosome (myrmecochory exclusively).

Distribution (*V. pilosa* Blume group not included in this sect.):[Afr.: N-Afr., Macaronesia; Eur.; Asia-Temp.].

1 ***Viola collina*** **Besser,** Cat. Hort. Cremeneci 151. 1816

S4 – subgen *Viola* sect. *Viola* – T2 P5 – GN

Typification. Loc. cl.: "*Crescit in apricis elatis*" without any further informations but surely in the vicinity of Kremenetz, [UKR: Kremenets]. Lectotype designated (Nikitin & Silantjeva 2006) LE n.v.; original specimens WU [WU-Keck 0037807]!p; K [K000327649]!p.

Chromosome Numbers. 2n = <u>20</u> [AUT, CZE, GER, KOR, POL, RFE]; 2n = 40 [KOR (Lee 1967 n.v.)].

Hybrids. Within the sect. *Viola* with species having 2n = 20, 40: *V. alba, V. ambigua, V. hirta, V. odorata, V. pyrenaica, V. suavis*; with sect. *Trigonocarpae* species 2n = 40: *V. riviniana* (Nikitin 2001 as *V.* x *yurii* Nikitin), *V. canina* (Nikitin 2007 as *V.* × *karakulensis* Nikitin & O. Baranova).

Taxonomy. Incl.: *V. microdonta* Chang, *V. rudolfii* Vl.V. Nikitin, *V. teshioensis* Miyabe & Tatew., *V. tomentosifolia* Makino ex U. Ohga. Morphological variability: flower and leaf colors, leaf and capsule hairiness (Becker 1918, Chen et al. 2007).

Distribution: [RFE: Lower-Zeya, Bureya, Amgun, Ussuri, S-Sakhalin, S-Kuril]; adjacent regions [CHT, CHM, CHI, KOR-NK, JAP-HK]; general range [Eur.; Asia-Temp.: M- & E-Asia, Sib., China, MON, RFE].

V. teshioensis Miyabe & Tatew., Trans. Sapporo Nat.

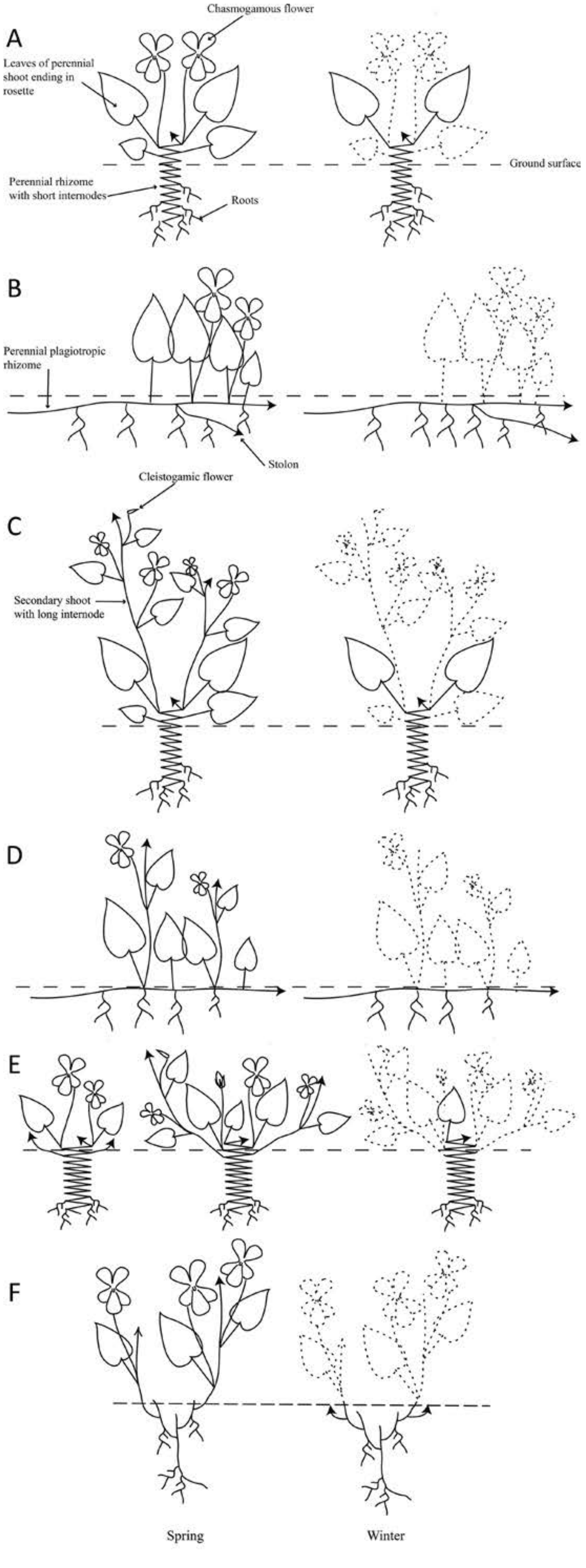

Figure 3 Mode of growth. A – plants with a perennial orthotropic rhizome ending in a flowering leaf rosette, bearing or not creeping stolons, without annual flowering shoot (sect. *Viola*, sect. *Violidium*, sect. *Brachycerae*); B – plants with a perennial plagiotropic rhizome, with leaves and flowers at its end, bearing or not creeping stolons, without annual flowering shoot (sect. *Vaginatae*, sect. *Plagiostigma*, sect. *Memorabiles*); C – plants with a perennial orthotropic rhizome ending in a leaf rosette without flower, producing erect or decumbent flowering shoots that wither in winter (subsect. *Rosulantes*, subsect. *Bilobatae*, sect. *Langsdorffianae*); D – plants with a perennial plagiotropic rhizome, bearing leaves and secondary flowering shoots at its end (subsect. *Nudicaules*, sect. *Dischidium*, sect. *Kitamianae*); E – plants with a perennial rhizome ending in leaf rosette, producing chasmogamous flowers first, then with secondary shoots producing chasmogamous or cleistogamous flowers (subsect. *Mirabiles*, subsect. *Grypocerae*, subsect. *Amuricae*); F – plants with a branched rhizome not ending in a leaf rosette, with annual erect to decumbent flowering shoots that whiter after fruiting period (sympodial growth, subsect. *Arosulatae*, subsect. *Raddeanae*)

Hist. Soc. 14: 187. 1936, nom. nov. for *V. nipponica* Maxim. var. *yezoana* H. Koidz., cited reference: "*Kyoritsu Joshi Yakugaku Semmon gakko Kyoukai-zasshi V. (1936), 16, cum diagn.*". This journal was very locally published in Japan (alumni magazine of the graduates of Kyoristu Women's College of Pharmacy) and not available in any public library; thus according to Ohba & Akiyama (2005 p. 356), new names published by Koidzumi cannot make any effective publication (Art. 29.1). *V. nipponica* var. *yesoana* is so invalid and consequently *V. teshioensis* because Miyabe & Tatewaki (1936) do not describe this plant in the protologue: *V. teshioensis* should be considered as a nom. inval. nud. Distribution: [JAP, SAK, KUR].

***Viola* sect. *Trigonocarpae* Godr.**, Fl. Lorraine, ed.2, 1: 88. 1857.

Type: *V. riviniana* Rchb. (according to Nikitin 1996).

Equally Ranked Synonym. *V.* sect. *Rostratae* (Kupffer) Kupffer, *Fl. Caucas. Crit.* 3(9): 194 (1909).

Chromosome Numbers. 2n = 20; auto- or allopolyploids: 40, 60, 80; errors or aneuploids: 2n = 12, 16, 18, 24, 34, 35, 36, 37, 42, 48, 58, 72; 0– c.10 B chromosomes.

Hybrids. Many hybrids within the sect. Some natural hybrids cited with sect. *Viola* (Becker 1910a, b, Nikitin 2007), with subg. *Violidium* sect. *Violidium* (cf. subg. *Viola*).

Characters. Perennial rhizome ending in a leaf rosette, more or less leafy (Fig. 3C) or without a rosette (Fig. 3F), producing annual erect to decumbent stems that wither after fruiting, without stolons. Sepals with acute apex. Style with short beak more or less curved upward, papillose or not (Fig. 2C–D). All capsules ellipsoid, on erect peduncles; ballistic and ant seed dispersal. Seeds with small elaiosome.

Distribution: [N-Amer.; Afr.: N-Afr., Macaronesia; Eur.; Asia-Temp.: W-Asia, Cauc., M- & E-Asia, Sib., China, RFE; Asia-Trop.: Indi.].

***Viola* subsect. *Rosulantes* (Borbás) Juz.**, in Schischkin & Bobrov (ed.), Fl. URSS 15: 375. 1949.

Basionym: *V.* [unranked] *Rosulantes* Borbás, in Syn. Deut. Schweiz. Fl., ed. 3 [Hallier & Brand] 1: 196. 1890.

Type: *V. riviniana* Rchb. (according to Nikitin 1996).

Chromosome Numbers. 2n = 20; auto- or allopolyploids: 40 (*V. riviniana*), 60 (*V. sieheana*), 80 (*V. howellii*); errors or aneuploids: identical to those of sect. *Trigonocarpae* minus : 2n= 72.

Hybrids. Many hybrids inside subsect. Natural hybrids with subsect. *Mirabiles*, *Arosulatae* (Becker 1910a,b), *Grypocerae* (Hama 1975), *Repentes* (Kupffer 1903). Some natural hybrids with sect. *Viola* (Becker 1910a,b, Nikitin 2007). Two natural hybrids cited with subg. *Violidium* sect. *Violidium* (cf. subg. *Viola*).

Characters. Perennial rhizome ending in a leaf rosette without flowers, producing annual stems with chasmogamous or cleistogamous flowers (Fig. 3C). Spur of lower petal pale greenish yellow, white, whitish tinged purple to violet.

Distribution: [N-Amer.; Afr.: N-Afr., Macaronesia; Eur.; Asia-Temp.: W-Asia, Cauc., M- & E-Asia, Sib., China, RFE; Asia-Trop.: Indi.].

2 *Viola kusanoana* Makino, Bot. Mag. (Tokyo) 26: 173. 1912

S2a – subg. *Viola* sect. *Trigonocarpae* subsect. *Rosulantes* – T2 P3 – GN

Typification. Loc. cl.: "*A common species in the northern Japan*" [JAP]; several syntypes are noted in protologue. Lectotype: Akiyama & Ohba (2001) TI [DB 02257]!p, [JAP-HN: Fukushima Pref.], leg. G. Nakahara, 3 June 1904.

Chromosome Numbers. n = 10; 2n = 20: [JAP].

Hybrids. With subsect. *Grypocerae* (Hama 1975) species 2n = 20: *V. grypoceras*, *V. rostrata*.

Taxonomy. Incl.: *V. dageletiana* Nakai, *V. insularis* Nakai non Gren., *V. miyakei* Nakai, *V. mutsuensis* W. Becker, *V. silvestriformis* W. Becker. *V. kusanoana* is closely related to *V. grypoceras* from which it differs by the absence of basal flowers (cf. *V. grypoceras* no 6). This species was sometimes confused with *V. sacchalinensis*. I gather under *V. kusanoana* plants with glabrous or slightly papillose style, lightly curved at top, forming a very short beak with a large stigma hole; stipules narrowly lanceolate, with long fringes. *V. kusanoana* is morphologically related to southern populations (*V. conspersa*) of American species *V. labradorica* (2n = 20) but the style of the last one is curved, papillose at top, forming a short beak with a large stigma hole directed forward.

Distribution: [RFE: N-Sakhalin, Ussuri, S-Sakhalin, S-Kuril]; adjacent regions [JAP-HK]; general range [E-Asia, RFE].

V. mutsuensis W. Becker, Beih. Bot. Centralbl., Abt. 2, 34(2): 241. 1916. Loc. cl.: "*Japonia borealis*" [JAP]. Seven syntypes leg. Faurie. Lectotype here designated: G [G00418177]!h, leg. Faurie, no 1281, 4 Mai 1898, "*Hirosaki*" [JAP-HN: Aomori Prefecture, Hirosaki: city located in the old Mutsu Province]; designated on sheet by Nakai in 1912 as *V. kusanoana*, *V. mutsuensis* by Becker in 1915 and finaly *V. kusanoana* by Becker in 1928. Syntype: G [without barcode, stored under *Viola kusanoana*]!h, leg. Faurie no 13082. Although Becker (1923a p. 50) includes syntypes of *V. sacchalinensis* under *V. mutsuensis*, the protologue (Becker 1916a p. 241) allows to relate this plant to *V. kusanoana* as proposed by Maekawa (1954), Akiyama et al. (1999): narrower stipules, style glabrous with a short suberect beak (Becker 1923b fig. 42).

V. silvestriformis W. Becker, Beih. Bot. Centralbl., Abt. 2, 34(2): 242. 1916. Loc. cl.: "*Sachalin*" [SAK]. Three syntypes leg. Glehn. Lectotype designated (Byalt 2018): LE [LE01009469]!p, leg. Glehn, 27 May 1861, "*Arkaiwo*" [SAK: Arkovo]; det. Becker in 1916 as "*Viola silvestriformis Bckr*"; lectotype selected by Nikitin on sheet. This taxon is poorly known. The diagnosis of Becker (1923a p. 49) helps to know that it is different from *V. sacchalinensis* (as *V. komarovii*) and more related with *V. kusanoana*: style suberect, narrower stipules; the style is however few papillose and lateral petals shortly bearded (according to Becker 1923a).

V. miyakei Nakai, Bot. Mag. (Tokyo) 42 (504): 563 (1928). Loc. cl.: "*Sachalin*" [SAK]. One type designated and two paratypes. Holotype: SAPS [SAPS 0044]!p, leg. T. Miyake, 1 July 1906, "*Oosaka*" [S-SAK: Pyatirech'ye]; examined and identified by Nakai in 1928. Contrary to Maekawa (1954), I think this plant should not be included under *V. sacchalinensis* but under *V. kusanoana*: in protologue, Nakai describes a plant with lateral petals beardless and narrower, more fimbriate stipules.

3 *Viola mauritii* Tepl., Zap. Ural'sk. Obshch. Lyubit. Estestv. 7(3): 37. 1882

S2a – subg. *Viola* sect. *Trigonocarpae* subsect. *Rosulantes* – T2 P3

Typification. Loc. cl.: "*Iljinskoje im Distrik Perm am Ural*", [East European Russia: Perm] (protologue n.v., according to Becker 1923a). Lectotype designated (Nikitin & Silantjeva 2006) n.v. LE. Original specimen P [P04696607]!h.

Chromosome Numbers. 2n = 12 [Sib.]; 2n = c.16, 18 [Sib.] (Krivenko et al. 2013); 2n = 20 [Sib.] (Krivenko et al. 2012, 2015). It is the only species of the subg. *Viola* with *V. sacchalinensis* to have chromosome counts lower than 2n = 20. The only count 2n = 12 (Rostovtseva et al. 1981 n.v.) seems enigmatic for the sect. *Trigonocarpae*.

Hybrids. Inside subsect. with species 2n = 20: *V. sacchalinensis* (Nikitin 2002)

Taxonomy. Incl.: *V. teplouchovii* Juz. According to Becker (1923a), *V. mauritii* is related to the American species *V. labradorica* and to *V. kusanoana*.

Distribution: [RFE: Kolyma, Okhotsk, Aldan, Dauria, Lower-Zeya]; adjacent regions [YAK]; general range [Eur.: E-Eur.; Asia-Temp.: Sib., MON, RFE]; incorrect usages for *V. mauritii* auct. [China] non Tepl.: Wang (1991) = *V. sacchalinensis*.

V. teplouchovii Juz., Spisok Rast. Gerb. Fl. S.S.S.R Bot. Inst. Vsesoyuzn. Akad. Nauk. 13: 83. 1955. Loc. cl.: "*Prov. Irkutsk, distr. Balagansk*", [IRK: Balagansk]. Only one specimen is cited in the protologue *"in fruticeto ripario vere inundato ad fl. Uda, leg. Maltzev, 27 May 1908";* it must be accepted as the holotype (Art. 9.1 note 1). Four preparations were traced with the same single, original label; two constitute the holotype (Art. 8.3) LE [01009647, 01009648]!p, the other two are isotypes PE [0008501]!p, G [without barcode]!h. Therefore the lectotype designated by Byalt (2018) LE [01009647] must be considered as a preparation of the holotype. This taxon corresponds to *V. mauritii* var. *longicalcarata* W. Becker (1915), that constitutes eastern populations of *V. mauritii*. Becker (1923a) does not quote any more for this var. that differs from type in morphological characteristics of little value.

4 *Viola rupestris* F.W. Schmidt, Neuere Abh. Königl. Böhm. Ges. Wiss. 1: 60. 1791

S4 – subg. *Viola* sect. *Trigonocarpae* subsect. *Rosulantes* – T2 P5 – GN

Typification. Loc. cl.: "*In saxis Moldavae*" [CZE: Vltava valley], "*Pragae ad St. Procopium*" [CZE: Svatý Prokop, now in Prague], "*in circulo Pilsnensi in monte Schwannberg & opposito Schafsberg*" [CZE: two hills near Kraskov in the vicinity of Planá u Mariánských Lázní]. Lectotype designated (Kirschner & Skalicky 1989): BP [herb. Kitaibel, no IX/196]!p, no locality indicated on the lectotype label.

Chromosome Numbers. 2n = 18 [Sib.]; 2n = <u>20</u> [Cauc., CZE, GER, GRB, GRC, NET, NOR, POL, Sib., SPA]; 2n = 20 +4–8B [AUT].

Hybrids. Inside subsect. with species 2n = 20, 40: *V. reichenbachiana, V. sacchalinensis, V. mauritii, V. riviniana*; with subsect. *Mirabiles* species 2n = 20: *V. mirabilis*; with subsect. *Arosulatae* species 2n = 40: V. *canina, V. persicifolia, V. pumila*; with subg. *Violidium*: *V. selkirkii* (Nikitin 2003 as *V.* × *reschetnikovae* Vl.V. Nikitin), single described example of natural hybrid between subg.

Taxonomy. Incl.: *V. arenaria* DC., *V. glaberrima* (Murb.) Ye.V.Serg. non (Ging.)House, *V. glauca* M. Bieb., *V. himalayensis* W. Becker, *V. sergievskiae* Tzvelev. This species is present throughout Eurasia from [W-SPA] to the [RFE], from [N-NOR] to [Cauc.] and [N-PAK]. Its variability covers principally hairiness (glabrous to puberulous), size and color of flowers. Contrary to the protologue, original specimens are not glabrous but subglabrous (Kirschner & Skalicky 1989). Two allopopulations were described: subsp. *licentii* W. Becker [China] and subsp. *relicta* Jalas [NOR]. Harvey (1966) has proved that *V. adunca*, an American closely related species, should not be included under *V. rupestris* (hybrid sterility). Tetraploid populations 2n = 40 were found in Canada and described as *V. aduncoides* by A. Löve & D. Löve (1976).

Distribution: [RFE: Okhotsk, Aldan, Nyukzha, Dauria, N- and S-Sakhalin, Upper- and Lower Zeya, Bureya, Amgun, Ussuri]; adjacent regions [CTA, YAK]; general range [Eur.; Asia-Temp.: W- & M-Asia, China, MON, Sib., RFE; Asia-Trop.: Indi.].

V. arenaria DC., in A.P. de Candolle & Lamarck, Fl. Franc., ed. 3, 4(2): 806. 1805. Loc. cl.: "*Elle croît dans les lieux sablonneux du bas Valais d'où elle m'a été envoyée par M. Scleicher.*" [SWI: canton of Valais]. Original material: De Candolle cites only the gathering of Schleicher "*V. nummularifolia Schl. Cent. exsic. 29*" that must be interpreted as the holotype (Art. 9.1 note 1). This specimen was traced: G-DC [G00209492]!h with the printed label "*29 Viola numularifolia All. Frequens in locis arenosis in Vallesia inferiori*", det. Espeut 2012 as *V. rupestris*.

Approved Infraspecific Taxa:

***V. rupestris* var. *glaberrima* Murb.**, Bot. Not. 1887: 186. 1887. Loc. cl.: [SWE: Öland]. Lectotype undesignated. Homotypic synonyms: *V. glaberrima* (Murb.) Ye.V.Serg. [1961] non (Ging.) House [1906] nom. homon.; *V. sergievskiae* Tzvelev, nom. nov. of *V. glaberrima* (Murb.) Ye.V.Serg. *V. glaberrima* (Ging.) House is an American violet from E-USA that belongs to subg. *Chamaemelanium*. This var. is the only one mentioned in the [RFE] by Becker (1915).

***V. rupestris* var. *arenaria* (DC.) Beck**, *Fl. Nieder-Osterreich* 2(1): 519 (1892).

Key to varieties of *V. rupestris*:

1 Plant glabrous .... **var. *glaberrima***
– Plant ± pubescent **2**

2 Plant covered all over with very short hairs, especially on stems .... **var. *arenaria***
– Plant sparcely pubescent, sometimes almost glabrous .... **var. *rupestris***

5 *Viola sacchalinensis* H. Boissieu, Bull. Soc. Bot. France 57: 188. 1910

S3 – subg. *Viola* sect. *Trigonocarpae* subsect. *Rosulantes* – T1 P3 – GN

Typification. Loc. cl.: "*SACCHALIEN, dans les forêts de Korsakof*" [SAK: Port of Korsakov]. Three syntypes cited "*Faurie, no 543, 544, 545*". Lectotype designated (Nikitin 2008 p. 170) n.v. LE, leg. Faurie no 543, June 1908. Isolectotype: P [P02141154]!p. Isosyntypes: "*Faurie no 544, 545*", P [P02141155, P02141156]!h contain only fruiting plants.

Chromosome Numbers. n = 10 [JAP]; 2n = 16–18 [RFE] (Probatova et al. 2001); 2n = <u>20</u> [RFE, Sib., JAP]; 2n = 24 [JAP] odd count on *V. sacchalinensis* var. *alpina* (Nishikawa 1985 n.v.); 2n= 40 [RFE] (Probatova et al. 2017c).

Hybrids. Inside subsect with species 2n = 20: *V. mauritii* (Nikitin 2002), *V. rupestris* (Becker 1916a p. 242 as *V. komarovii* × *V. rupestris* var. *arenaria* – however the author notes that pollen grains are normal); with subsect. *Mirabiles*: *V. mirabilis* (Nikitin 2007).

Taxonomy. Incl.: *V. harae* Miyabe & Tatew., *V. komarovii* W. Becker, *V. koraiensis* Nakai, *V. miranda* W. Becker, *V. venusta* Nakai, *V. canina* var. *kamtschatica* Ging. Misapplied names: *V. mauritii* auct. [China] non Tepl. This species has a controversial definition. I include under *V. sacchalinensis*, all closely related taxa which have an usually papillose style (Fig. 2C–D, except var. *alpicola*) with conspicuous beak curved upward at tip and upper stipules conspicuous, elliptic lanceolate. Plants which present glabrous styles with a short suberect beak and a broad stigmatic orifice at tip and upper stipules narrowly lanceolate are grouped under *V. kusanoana* (cf. no 2). *V. sacchalinensis* is closely related to *V. rupestris*: Voroschilov (1985) regards this plant as a subsp. of *V. rupestris*. Becker (1916a p. 238) notes it is sometimes difficult to differentiate *V. komarovii* from *V. rupestris*: he indicates that *V. komarovii* has larger corollas, leaves, stipules and sepal appendages; Zuev (1996) reports also that this species has longer sepal appendages: 1.5–3 mm vs. 1 mm for *V. rupestris*.

Distribution: [RFE: all except Chukotka, Anyuy, Anadyr-Penzhina, Commander Is.]; adjacent regions [YAK, CTA, CHI, CHM, JAP-HK, KOR-NK]; general range [Sib., MON, RFE, China, E-Asia].

V. komarovii W. Becker, Beih. Bot. Centralbl., Abt. 2, 34 (2): 237. 1916. Loc. cl.: "*in Wäldern, Sibirien (vom oberen Ob östlich), Amurprovinz, Primorskaja, Sachalin, Kamtschatka, Japan; – auch in der Mongolei (am Sajanischen Gebirge)*" with many localities and regions cited. Only four syntypes clearly identified with gathering number: Karo no 343, Komarov no 1111, Faurie no 9652, no 9672. The protologue contains also many places that do not have priority in the choice of lectotype (Art. 9.12, 40.3 Note 2). Consequently, the specimen LE [01009742] selected by Nikitin on the sheet, and Byalt (2018) cannot be accepted because it is not a syntype but only a specimen studied by the author. Art. 9.19c allows to replace this lectotype by a true syntype. Lectotype of *V. komarovoii* here designated: LE [01009741]!p, leg. V. Komarov no 1111, 3 June 1896, "*Fluvium Sui-Fun Vallis Liuczecheza*" [PRM: Razdolnaya River (= *Suifen*)], as "*Viola sylvestris Kit.*"; det. Becker in 1916. Syntype: P [P04646215]!h, leg. Faurie no 9672; syntypes untraced: Faurie no 9652 and Karo no 343. Becker (1915) has previously included *V. komarovii* under *V. sacchalinensis*.

V. miranda W. Becker, Repert. Spec. Nov. Regni Veg. 14: 322. 1916 and Becker (1923a p. 50). Loc. cl.: "*Sachalin: auf einem Gebirgspass zwischen dem Tym-Tale und dem Ochotskischen Meer; in einer engen Schlucht*" [SAK: mountain range between the Tym valley and the Sea of Okhotsk]. Only one specimen noted "*B. Pilsudski Pl. sachal. (1894) no 16 (Herb. Ac. Sc. Petrop.)*" that must be considered as the holotype: LE [01009712]!p, leg. Pilsudsky no 16, 27 July 1894. This specimen is based on the same gathering as *V. mariae* (cf. subsect. *Grypocerae*). *V. miranda* is very little known: for Becker, its main morphological characteristic is a style with a beak distinctly curved downward (Becker 1923b fig. 43); its foliage is similar to this of *V. sacchalinensis* but this single specimen cannot permit to establish a sure relationship with the latter. Supplementary investigations are needed to precise the taxonomic status of this taxon. In this expectation, like Juzepczuk (1949), I maintain *V. miranda* under *V. sacchalinensis*.

V. koraiensis Nakai, Bot. Mag. (Tokyo) 30: 281. 1916. Loc. cl.: "*Corea sept.*" [KOR-NK] with several sites. Four syntypes. Lectotype (Akiyama & Ohba 2001): TI [DB 02250]!p, leg. T. Mori, 13 August 1913 "*in pumiceis montis Paiktusan 2100–2400 m.*" [KOR-NK: summit of Changbai Mountain]. Syntypes: TI [DB 02251, DB 02252, DB 02253]!p. This taxon was included under *V. sacchalinensis* var. *alpicola*.

V. canina var. *kamtschatica* Ging., Linnaea 1: 407 (1826). Loc. cl.: "*rapportée du Kamtschatka par Mr Adelb. de Chamisso (1816)*" [KAM]. Lectotype undesignated; original material untraced.

Approved Infraspecific Taxa

***V. sacchalinensis* var. *alpicola* P.Y. Fu & Y.C. Teng**, Fl. Pl. Herb. Chin. Bor.-Or. 6: 291. 1977. Type untraced. Heterotypic synonym: *V. koraiensis* Nakai. This var. has not been found in the [RFE]. Its taxonomic status should be revised. It must not be confused with *V. sacchalinensis* var. *alpina*, from JAP-HK. Distribution: mountains of [KOR-NK, CHM: Jilin].

***V. sacchalinensis* var. *alpina* H. Hara**, Bot. Mag. (Tokyo) 50: 303. 1936. Loc. cl.: [JAP-HK: upper part of Mount Apoi]. Holotype: TI [DB 02138]!p, leg. H. Hara no 4666, 25 May 1933. Heterotypic synonym: *V. harae* Miyabe & Tatew. This var. has not yet been found in the [RFE].

Key to varieties of *V. sacchalinensis*:

1 Lateral petals and style glabrous .... **var. *alpicola***
– Lateral petals distinctly bearded, style papillose in the upper part **2**
2 Thick leaves, purplish beneath .... **var. *alpina***
– Thin leaves, green beneath .... **var. *sacchalinensis***

Viola subsect. *Grypocerae* Espeut, subsect. nov.

Type here designated: *V. grypoceras* A. Gray

Included species: *V. faurieana* W. Becker, *V. obtusa* (Makino) Makino, *V. ovato-oblonga* (Miq.) Makino, *V. rostrata* Pursh.

Chromosome Numbers. 2n = 20; 3–6 B chromosomes; errors or aneuploids: 2n = 18.

Hybrids: Natural hybrids with subsect. *Rosulantes* (Hama 1975).

Characters. Perennial rhizome ending in a leaf rosette producing chasmogamous flowers first, then annual stems with chasmogamous or cleistogamous flowers (Fig. 3E). Margin of stipules fimbriate-dentate, never entire ciliate. Spur of lower petal pale greenish yellow, white, whitish tinged with purple.

Distribution: [N-Amer.; Asia-Temp.: China, E-Asia].

6 *Viola grypoceras* A. Gray, Narr. Exped. China Japan [Perry] 2: 308. 1856

S4 – subg. *Viola* sect. *Trigonocarpae* subsect. *Grypocerae* – T2 P3 – GN

Typification. Loc. cl.: "*Yokohama, on wooded hill-sides*" [JAP-HN: Yokohama]. Original specimens collected by Williams & Morrow to Yokohama during an American naval expedition to the China and Japan seas (1852 to 1854) could not be traced. Lectotype undesignated.

Chromosome Numbers. n = 10 [JAP]; 2n = 20 [China, JAP].

Hybrids. Inside subsect. with species 2n = 20: *V. faurieana*, *V. ovato-oblonga*; with subsect. *Rosulantes* species 2n = 20: *V. grayi, V. kusanoana*.

Taxonomy. Incl.: *V. coreana* H. Boissieu, *V. hichitoana* Nakai, *V. hideoi* Nakai, *V. hosoii* Nakai, *V. krugiana* W. Becker, *V. leveillei* H. Boissieu, *V. longipedunculata* Franch. & Sav., *V. lucida* Nakai, *V. lutchuensis* Nakai, *V. pruniflora* Nakai, *V. rhizomata* Nakai, *V. takesimana* Nakai, *V. wichurae* Nakai. This species was recently discovered in the [RFE: S-Kuril (Iturup, Kunashir); S-Sakhalin (Probatova et al. 2001, Barkalov 2009)]. It is a polymorphic species, common in [JAP, KOR-SK, China, TAI]. May be, *V. grypoceras* went unnoticed in the [RFE] because of its resemblance with *V. kusanoana*. However *V. grypoceras* bears flowers on the basal leaf rosette and annual stems while *V. kusanoana* has only flowers on stems like *V. rupestris*.

Distribution: [S-Sakhalin, S-Kuril]; adjacent regions [JAP-HK]; general range [RFE, China, E-Asia].

7 *Viola mariae* W. Becker, Repert. Spec. Nov. Regni Veg. 14: 322. 1916

S1 – subg. *Viola* sect. *Trigonocarpae* subsect. *Grypocerae* – T2 P3

Typification. Loc. cl.: "*Sachalin: auf einem Gebirgspass zwischen dem Tym-Tale und dem Ochotskischen Meer; in einer engen Schlucht*", [SAK: mountain range between the Tym valley and the Sea of Okhotsk]. Only one specimen noted "*leg. Pilsudski 27.VII.1894 (Herb. Ac. Sc. Petrop.)*" that must be considered as the holotype: LE [01009713]!p, leg. Pilsudsky, 27 July 1894; det. W. Becker. in 1916. This taxon is only known by the holotype and Becker's protologue; it was dedicated to his wife.

Chromosome Numbers. Unknown.

Hybrids. Unknown.

Taxonomy. Contrary to what Becker then Juzepczuk have written on the sheet, this taxon is not related to *V. komarovii* (cf. *V. sacchalinensis* no5) but to subsect. *Grypocerae*: basal and cauline flowers vs. only cauline flowers for *V. komarovii*, narrow sepal appendages vs. conspicuous sepal appendages, shallowly cordate or subtruncate leaves as *V. faurieana* or as some var. of *V. grypoceras* (Akiyama et al. 1999) vs. cordate leaves. However, the style of *V. mariae* is papillose (Becker 1916b) vs. smooth for *V. grypoceras*. Further investigations are needed to precise the taxonomic status of this taxon which was gathered at the same place that *V. miranda* (cf. *V. sacchalinensis*). *V. mariae* could be a hybrid *V. grypoceras* × *V. sacchalinensis*.

Distribution: [RFE: N-Sakhalin]; general range [RFE].

Viola **subsect.** ***Mirabiles*** **(Nyman ex Borbás) Juz.**, in Schischkin & Bobrov (ed.), Fl. URSS 15: 375. 1949.

Basionym: *V.* [unranked] *Mirabiles* Nyman ex Borbás in Syn. Deut. Schweiz. Fl., ed. 3 [Hallier & Brand] 1:195 (1890).

Type: *V. mirabilis* (according to Art. 10.8).

Chromosome Numbers. 2n = 20. Species with 2n = 40 such as *V. willkommii* Willk. or *V. pseudomirabilis* Coste are allopolyploids between sect. *Mirabiles* and *Rosulantes*.

Hybrids. Natural hybrids with subsect. *Rosulantes* (Becker 1910a,b).

Characters. Perennial rhizome ending in a leaf rosette producing chasmogamous flowers first, then annual stems with chasmogamous or cleistogamous flowers (Fig. 3E). Margin of stipules entire ciliate, never fimbriate. Spur of lower petal pale greenish yellow, white, whitish tinged purple or violet.

Distribution: [Eur.; Asia-Temp.: Cauc., M- & E-Asia, China, Sib., MON, RFE].

8 ***Viola mirabilis*** **L.,** Sp. Pl. 2: 936. 1753

S4 – subg. *Viola* sect. *Trigonocarpae* subsect. *Mirabiles* – T2 P5 – GN

Typification. Loc. cl.: "*habitat in Germaniae, Sueciae nemoribus*", Eur. Lectotype (Jonsell & Jarvis 2002): LINN [1050-15]!p, no locality indicated on the label.

Chromosome Numbers. n = 10 GER; 2n = 20 [CZE, DEN, GER, JAP, POL, RFE] as *V. brachysepala* [SWE, Sib.].

Hybrids. With subsect. *Rosulantes* species 2n = 20, 40: *V. reichenbachiana, V. rupestris, V. sacchalinensis* (Nikitin 2007), *V. riviniana.*

Taxonomy. Incl.: *V. brachysepala* Maxim. Eastern populations from Asia have glabrous stems and petioles = subsp. *subglabra* (Ledeb.) Zuev. As in Eur. (Becker 1915) or JAP (Igari 1996), chasmogamous flowering starts generally on the leaf rosette but it happens regularly that this flowering can continue on annual stems, or more rarely, only on these stems (Becker 1910b p. 29, Espeut pers. obs.). Cleistogamous flowers appear later.

Distribution: [RFE: Lower-Zeya; Bureya; Ussuri]; adjacent regions [CTA, CHI, CHM, KOR-NK, JAP-HK]; general range [Eur.; Asia-Temp.: Cauc., M- & E-Asia, China, Sib., MON, RFE].

V. brachysepala Maxim., Prim. Fl. Amur. 50. 1859. Loc. cl.: "*Am obern Amur: auf der Mitte Weges zwischen der Seja- und Komar-Mündung*", [AMU]. Only one gathering is mentioned "*7 Sept. 1856*"; it must be accepted as the holotype (Art. 9.1 note 1): LE [LE1015925]!p, leg. Maximowicz 7 September 1856; examined by Regel, and then by W. Becker in 1912; designated as type on sheet by Nikitin. Isotype: LE [LE1015926]!p. Specific status proposed by Juzepczuk (1949) is not retained, because diagnostic characters are included in variations of *V. mirabilis*, in particular flowering characters. Nonetheless if this plant has really lost its ability to produce cleistogamous flowers (Juzepczuk 1949), its taxonomic status could be changed. Further field and culture observations are needed to confirm this loss.

Approved Infraspecific Taxa

V. mirabilis **subsp.** ***subglabra*** **(Ledeb.) Zuev**, in G.A. Peschkova (ed.), Fl. Sibiri 10: 87. 1996.

V. mirabilis **var.** ***subglabra*** **Ledeb.**, Fl. Ross. 1: 251. 1842. Lectotype undesignated. Loc. cl.: "*in Siberia baikalensis [ad Angaram (Turcz.) et circa Irkutzk! (Kruhse pl. exsicc.)] inque Davuria! (Frisch. pl. exsicc.)*" [IRK, CTA]. Incl. *V. mirabilis* fa. *latisepala* W. Becker in B. Fedtschenko, Fl. Aziat. Ross. 8: 29. 1915. Distribution: [Sib., RFE, JAP, KOR, MON].

V. mirabilis **var.** ***strigosa*** **(W. Becker) Espeut, stat. nov.** Basionym: *V. mirabilis* fa. *strigosa* W. Becker in B. Fedtsch., Fl. Aziat. Ross. 8: 29. 1915. Loc. cl.: [WSB: Tomsk]. Syntypes: "*N.J. Kusnezow It. ad gub. Tomsk (1913) nr. 63, 367 et 368*". Lectotype designated (Byalt 2018) LE, leg. Kusnezov & Tripolitova no 368, 29 May 1913, "Томская губ., Барнульский у., колок у пос. Антонинского", Tomsk Oblast. This taxon and *V. brachysepala* have a similar hairiness.

V. mirabilis **var.** ***glaberrima*** **W. Becker**, in B. Fedtschenko, Fl. Aziat. Ross. 8: 29. 1915. Lectotype undesignated. Loc. cl.: "*Sibirien*" [Sib.].

Key to infraspefic taxa of *V. mirabilis*:

1 Stems distinctly hairy on one side .... **subsp.** ***mirabilis***
– Stems (sub)glabrous – **subsp.** ***subglabra*** **2**

2 Leaves glabrous .... **var.** ***glaberrima***
– Leaves ± pubescent **3**

3 Leaves with scattered short hairs on both sides, sometimes subglabrous .... **var.** ***subglabra***
– Leaves hispidulous on veins (beneath) or near margins .... **var.** ***strigosa***

Viola **subsect.** ***Arosulatae*** **(Borbás) Juz.**, in Schischkin & Bobrov (ed.), Fl. URSS 15: 389. 1949.

Basionym: *V.* [unranked] *Arosulate* Borbás in Syn. Deut. Schweiz. Fl., ed. 3 [Hallier & Brand] 1: 204. 1890.

Type: Nikitin (1996) designate *V. jordanii* Hanry as type however this species don't exist in the protologue whereas several specifics names are cited. The choice may be superseded (Art. 10.2). Type here designated: *V. pumila* Vill. This species is chosen because it is the only one of the protologue that is taxonomically undoubted.

Chromosome Numbers. 2n = 20; auto- or allopolyploids: 2n = 40; aneuploids: 2n = 36, 42, 58; possible errors: 2n = 24, 48, 72; 0– c.10 B chromosomes.

Hybrids. Natural hybrids with subsect. *Rosulantes* (Becker 1910a,b), *Repentes* (Kupffer 1903); with sect. *Viola* (Becker 1910a,b, Nikitin 2007); with subg. *Violidium* sect. *Violidium* (Nikitin 2003).

Characters. Branched rhizome not ending in a leaf rosette, with annual erect to decumbent flowering stems that whiter after fruiting (sympodial growth, Fig. 3F). Margin of stipules more or less regularly dentate to fimbriate, sometimes entire. Spur of lower petal pale green-yellow to bright green.

Distribution: [N-Amer.: Subartic Amer.; Eur.; Afr.: N-Afr.; Asia-Temp.: W-Asia, Cauc., M- & E-Asia, Sib., MON, RFE; Asia-Trop.: Indi.].

9 ***Viola acuminata*** **Ledeb.,** Fl. Ross. 1: 252. 1842

S4 – subg. *Viola* sect. *Trigonocarpae* subsect. *Arosulatae* – T1 P3 – GN

Nom. nov. for *V. micrantha* Turcz., Bull. Soc. Imp. Naturalistes Moscou 5: 183. 1832, nom. homon. for *V. micrantha* Presl. (1822).

Typification. Ledebour (1842 p. 252) says clearly that *V. acuminata* is a nom. nov. for *V. micrantha* Turcz.: "*Nomen* *mutandum erat, ne confundatur cum V. micrantha Gusson. Fl. sicul. I, p. 134*". The Gussone's plant is *V. micrantha* J. & C. Presl, Delic. Prag. 1: 27. 1822, that corresponds to *V. parvula* Ten. (very different species belonging to subg. *Melanium*). The type of *V. acuminata* must be that of *V. micrantha* Turcz. (Art. 7.4). Loc. cl.: "*in China boreali prope oppidum Kalgan*", [China: province Hebei, "*Kalgan*" = old European name of the city of Zhangjiakou]. Lectotype of *V. micrantha* Turcz. designated (Grabovskaya-Borodina, 2010 p. 497) LE [01011514]!p.

Chromosome Numbers. n = 10 [JAP]; 2n = 20 [JAP, China] as *V. austro-ussuriensis* [RFE]; odd counts are difficult to explain: 2n = 24 [RFE] as *V. austro-ussuriensis* (Probatova et al. 2017a), possible confusion with *Bilobatae* species; 2n = 40 [RFE] a single count (Probatova et al. 2001) that corresponds perhaps to *V. canina* subsp. *ruppii* (cf. no 10).

Hybrids. Within sect. *Trigonocarpae* with species 2n = 20 (Hama 1975): *V. ovato-oblonga*, *V. obtusa*, *V. thibaudieri*. *V. acuminata* was never crossed with *V. canina* in experimental hybridizations.

Taxonomy. Incl.: *V. austro-ussuriensis* (W. Becker) Kom., *V. micrantha* Turcz. non J. & C. Presl, *V. turczaninowii* Juz., *V. laciniosa* A. Gray. This species is well defined by sympodial growth, leaves cordate with acute apex, conspicuous stipules usually deeply fimbriate. Variations concern hairiness (glabrous form), size and color of flowers, size of stipules that are smaller in southern range [China, KOR, JAP] and larger in the northern [CHM, Sib., RFE, N-JAP (Becker 1917a p. 382)]. This stipule extension occurs also in *V. canina*. Bergdolt (1932) has shown experimentally that this elongation is due to ecological factors (water, nutrients, light …): e.g. dry conditions product smaller stipules (I also noticed that on *V. elatior* Fr.); variability of *V. acuminata* is certainly linked to field conditions.

The American species, *V. striata* Aiton (2n = 20), seems closely related to *V. acuminata* but the first one is classified in subsect. *Rosulantes,* plants with monopodial perennial rhizomes terminated by rosettes of few leaves subtending annual flowering stems (Becker 1925, Gershoy 1934). However Holm (1933 p. 140) states that *V. striata* does not possess terminal rosette (like *V. acuminata*): this can be easily verified on P specimens e.g. P04673791, P04814023. Further studies are needed to include *V. acuminata* in *V. striata*. The western species *V. jordanii* Hanry (2n = 40) is also morphologically very similar (Becker 1917a p. 377); it is certainly a polyploid of *V. acuminata*. Becker thinks that *V. canina* is a closely related species coming from *V. acuminata*; he says *V. canina* subsp. *montana* becomes similar to *V. acuminata* near Irkutsk (Becker 1917a p. 382). *V. acuminata* could be a parent of the polyploid *V. canina* (cf. no 10).

Distribution: [RFE: Upper- and Lower-Zeya, Bureya, Amgun, Ussuri, N- and S-Sakhalin, S-Kuril]; adjacent regions [CTA, CHI, CHM, KOR-NK, JAP-HK]; general range [China, Sib., MON, RFE, E-Asia].

V. turczaninowii Juz., in Shishkin & Bobrov (ed.), Fl. URSS 15: 395. 1949. This taxon is a nom. nov. for *V. micrantha* Turcz., Bull. Soc. Imp. Naturalistes Moscou 5: 183. 1832. Its type is consequently the same as *V. acuminata*; *V. turczaninowii* is then a nom. superfl. (Art. 52.1) of *V. acuminata*.

Approved Infraspecific Taxa

***V. acuminata* Ledeb. subsp. *acuminata*.** Incl. *V. turczaninowii* Juz. Misapplied name *V. acuminata* auct. non Ledeb.: Juzepczuk (1949) = V. *acuminata* subsp. *grandistipulata*. Distribution: [China, Sib., MON, E-Asia, RFE: Ussuri?].

***V. acuminata* Ledeb. subsp. *grandistipulata* (W. Becker) Espeut, comb. & stat. nov.** Basionym: *V. micrantha* Turcz. "*Rasse*" *grandistipulata* W. Becker, Beih. Bot. Centralbl., Abt. 2, 34(2): 383. 1917. Lectotype here designated: G [G00418167]!h, leg. F. Karo no 351, May 1899 as *V. acuminata* Ledeb., "*Zejskaja Pristan am Zeaflusse. In nassem, dichten Gebüsche*", [AMU]. Becker mentions no types for this taxon however he cites this specimen among those of *V. micrantha* s.l. (Becker 1917a p. 381). In 1928, he examines in G this one and names it "*V. micrantha* Turcz. var. *grandistipulata Bckr*". Isolectotype: G [G00418168]!h. Stipules of upper leaves measure 2–3 cm long. Heterotypic synonym: *V. laciniosa* A. Gray. Distribution: [China, Sib., E-Asia] [RFE: Upper- and Lower-Zeya, Bureya, Amgun, Ussuri, S-Sakhalin, S-Kuril]. In the variability of this subsp., two var. can be noted:

***V. acuminata* Ledeb. var. *dentata* W. Becker**, in B. Fedtschenko, Fl. Aziat. Ross. 8: 49. 1915. Loc. cl.: "Приморская обл.: долина р. Тютихе", [PRM: valley of Rudnaya], Rudnaya is the new name for Tyutihe river. Only one collector noted "Н.В. Дюкина". Lectotype designated (Byalt 2018): LE [LE01015921, LE01015922]!p; leg. N.V. Dyukina in valley of Rudnaya (north of the Gulf of St. Vladimir) 26 May 1909; det. Becker 1912. Syntype: LE [LE01015920]!p. Stipules more dentate than fimbriate. Distribution: [RFE: Ussuri].

***V. acuminata* Ledeb. var. *austroussuriensis* (W. Becker) Espeut, stat. nov.** Basionym: *V. acuminata* subsp. *austro-ussuriensis* W. Becker in B. Fedtschenko, Fl. Aziat. Ross. 8: 49. 1915, corrected "*austroussuriensis*" (Art. 60.11). Lectotype designated (Bezdeleva 1987 p. 105): LE [LE01015924]!p, specimen gathered by E.S. Kusnezowa on May 17, 1909, "*Okeanskaja*"; examined by W. Becker in 1912, by Juzepczuk in 1949, and then by Nikitin. Many syntypes are cited in protologue including LE [LE01015923]!p. Loc. cl.: "*Okeanskaja*" [PRM: Okeanskaya is a locality near Vladivostok]. Plants described with large corollas and long spurs, stipules foliaceous and dentate. Then Becker (1917a p. 384) considers this plant as an accidental genetic alteration "*lusus*" of *V. micrantha* Turcz. var. *dentata* W. Becker. Russian authors classify it as a species: *V. austroussuriensis* (W. Becker) Kom. According to Becker (1915, 1916a) and Chen et al. (2007), I include this plant under *V. acuminata*. Distribution: [RFE: Ussuri].

Key to infraspecific taxa of *V. acuminata*:

1 Stipules ≤ 1.5 cm long .... **subsp. *acuminata***
– Upper stipules > 1.5 cm long **2**

2 Fimbriate stipules, with fringes longer than wideness of rachis .... **subsp. *grandistipulata***
– Dentate stipules, with teeth not more longer than wideness of rachis **3**

3 Spur < 2.5 mm long .... **var. *dentata***
– Spur 2.5 – 5 mm long .... **var. *austroussuriensis***

10 *Viola canina* L., Sp. Pl. 2: 935. 1753, emend. Rchb., Iconogr. Bot. Pl. Crit. 1: 60. 1823

S4 – subg. *Viola* sect. *Trigonocarpae* subsect. *Arosulatae* – T2 P5 – GN

Typification. Lectotype designated (Nikitin 1995): LAPP [Herb. Linn. no 277] n.v. Isolectotype: G [collection Burman "*Herb. Linn. 277*"]!h. These specimens as well as the three plants from the upper part of the sheet LINN [Herb. Linn. 1052.12]!p belong to the erect form of *V. canina* (Jonsell & Jarvis 2002) that is very common in N-Scand. mountains (Becker 1917a, Marcussen & Karlsson 2010); it is named *V. canina* subsp. *montana* by Scand. botanists [= *V. canina* γ *montana* (L.) Fr., *Novit. fl. suec.* ed. II., 273 (1828)]. Nikitin's lectotypification is in conflict with the protologue description "*caule demum ascendente*" (= stems only ascending) and does not follow Rec. 9A.4 that requires to preserve current usage applied, since Reichenbach (1823) who was the first botanist to characterize *V. canina* s.s. (Espeut 2013). The character "*caule ascendente*" is the only one used by Linnaeus to differentiate *V. canina* from *V. montana* that has "*caulibus erectis*" (= erect stems). Art. 9.19c allows superseding the lectotype when it is in conflict with the protologue. New lectotype here designated: BM [BM000647307]!p Herb. Clifford: 427, *Viola* 5. Loc. cl.: "*in Europae apricis"*, Eur. Jonsell & Jarvis (2002) have also made this choice without knowing the previous Nikitin's lectotypification. This specimen agrees with the character "*caule ascendente*" and the current usage of Reichenbach.

Chromosome Numbers. 2n = 20 [SPA, GER, Sib. as *V. nemoralis* (Krivenko et al. 2012, 2013)]; 2n = 40 [AUT, CZE, DEN, E-Eur., FRA, GER, GRB, ICE, NET, NOR, POL, SPA, SWE, Sib. (as *V. nemoralis*)]; 2n = 40+0–10B [DEN, GER as *V. montana*, SWE]. Contrary to 2n = 40 widely spread, counts 2n = 20 (Krivenko et al. 2012, 2013 as V. nemoralis) from [BRY] may be due to a confusion with *V. acuminata* (cf. no 9) or *V. stagnina*, both species with 2n = 20 and present in the Lake Baikal region. It is also possible that another unknown taxon exists. The count n = 36, 2n = 72 (Clausen 1927) is an error recognized by the author (Clausen 1931a). Finally, odd counts 2n = 24, 48 from [IRK] (Probatova et al. 2016b) are hard to explain because never found in the subg. *Viola*; they correspond perhaps to a confusion with species of sect. *Bilobatae* like *V. amurica*.

Hybrids. Inside subsect. *Arosulatae* rarely with species 2n = 20: *V. persicifolia*; 2n = 40: rarely with *V. pumila* Chaix, unusually with *V. elatior*; 2n = 58: unusually with *V. lactea* Sm. With subsect. *Rosulantes* species 2n = 40: very often with *V. riviniana*; 2n = 20: less frequently with *V. reichenbachiana, V. rupestris*; 2n = 60 rarely with *V. sieheana* (Becker 1910a,b, 1917a p. 376). With subsect. Repentes: *V. uliginosa* (Kupffer 1903). With sect. *Viola*: *V. collina* (Nikitin 2007 as *V.* × *karakulensis* Vl.V. Nikitin & O.Baranova). With subg. *Violidium*: *V. selkirkii* (Nikitin 2001 as *V.* × *viatkensis* Vl.V. Nikitin). None hybrid seems to be noted with *V. acuminata,* however their presence is possible in [Sib.]: *V. canina* is an allopolyploid which one parent is *V. persicifolia* (2n = 20, Moore & Harvey 1961); the other parent could be *V. acuminata* (this species was never crossed with *V. canina* in experimental hybridizations).

Taxonomy. Incl.: *V. montana* L. p.p., *V. nemoralis* Kütz., *V. pobedimovae* Ye.V.Serg., *V. ruppii* All. Unlike V. *acuminata*, *V. canina* has less divided stipules with more or less long teeth mostly in lower half. Type populations from S- and W-Eur. have always stipules smaller than petioles, usually less than half their length; stems are generally ascending, sometimes erect when specimens grow in high herbaceous strata (wetlands, underbrush). In Alps (*V. ruppii*), M-Eur. (*V. nemoralis*) and N-Eur. (*V. montana* auct. Scand. non L.) as well as in [E-Eur., Sib.] there are populations with more developed stipules (up to 3 cm long), longer than half or full length of petiole (upper leaves). These populations are generally erect; they correspond to *V. canina* subsp. *ruppii.* Only this subsp. was noted in the [RFE: AMU, KAM] by Becker (1915, 1917a). Plants from [KAM] are surely *V. sacchalinensis* and correspond to *V. canina* var. *kamtschatica* Ging. (Becker 1916a, Becker & Hulten 1928 as *V. komarovii*). Plants from [AMU] were described by Maximowicz (1859) under *V. montana* L. sensu Fries that represents erect form of *V. canina* (Fries 1828 p. 273). In Russian literature, *V. canina* is mentioned in the [RFE] by Juzepczuk (1949) under *V. montana*, Bezdeleva (1987) as *V. canina* s.l., and Czerepanov (1995) as *V. ruppii.* Since, no study notes it in the [RFE]. *V. canina* is present with certainty in KRAS (Becker 1917a, Zuev 1996); its presence in the [RFE] is probable. The count 2n = 40 (Probatova et al. 2001) in [PRM] may belong to *V. canina.*

Distribution: [RFE: Lower-Zeya? Amgun?]; adjacent regions [YAK, CTA]; general range [N-Amer.: Subarctic Amer.; Eur.; Afr.: N-Afr.; Asia-Temp.: W- & M-Asia, Cauc., Sib., RFE].

V. montana L., Sp. Pl. 2: 935. 1753, nom. ut. rej. Lectotype designated (Nikitin 1988): LINN [1052.13]!p. This specimen corresponds with certainty to *V. elatior* Fr. I do not agree with Danihelka et al. (2010) who consider that the lectotypification is in accordance with the protologue. Indeed the Nikitin's lectotypification is in conflict with the protologue on description and distribution. Leaves of *V. montana* are said "*oblongo-cordatis*", those of Nikitin's lectotype are cuneate or truncate as usual for *V. elatior* (Eckstein et al. 2006). The distribution cited by Linnaeus is "*in Alpibus Lapponiae, Austriae, Baldo*", however *V. elatior* does not grow in mountains but in river plains and valleys (Eckstein et al. 2006) and it does not exist in Lapland (Marcussen & Karlsson 2010), nor in Austrian Alps (Gams 1925, Eckstein et al. 2006) nor on Monte Balbo (Prosser et al. 2009). Becker (1917a p. 392) stated already that this taxon combined both *V. elatior* and erect forms of *V. canina.* Kirschner & Skalicky (1989), then Danielka et al. (2010) propose the rejection of this specific name.

V. nemoralis Kütz., Linnaea 7: 46. 832. Lectotype designated (Nikitin 1995): illustration Kützing (1832). Loc. cl.: [GER: Saxony-Anhalt, Magdeburg]. It is an erect form of *V. canina* with conspicuous stipules.

V. ruppii All., Mélanges Philos. Math. Soc. Roy. Turin 5: 84, no 109. 1774. The first valid mention of this taxon was published in a list of plants cultivated in the botanical garden of Turin (ITA): *Auctuarium ad synopsim methodicam stirpium horti reg. taurinensis*. Allioni cites as description the phrase name of Haller (1768 p. 241 no 562 [misprint *569*]): "*Viola caule erecto, multifloro, foliis ovato-lanceolatis, serratis".* It is the valid description of *V. ruppii.* Haller cites some localities in wet meadows and swamps: "*in Jenae* [GER: Iena] *legi in pratis udis, tum in similibus pratis Sueviae* [GER: Swabia]*; haud longe Scaphusia* [SWI: Schaffhausen]. *Cl. CHALELAIN in paludosis circa Anet* [SWI: Ins]*".* He gives also as synonym a plant described by Ruppius (1745 p. 289), growing in marshy meadows near Leipzig (GER). Allioni has chosen the epithet "*ruppii*" in memory of H.B. Rupp (Latin name *Ruppius*). The plant of Rupp is also cited as synonym of *V. persicifolia* Schreb. In Ruppius (1745), the description "*angustis Persicae foliis"*, the ecology and the early flowering period (April) correspond surely to *V. pumila* ; on the other hand, the Haller's description (1768) "*folia* […] *subcordata ex ovatis lanceolata*, *flos* […] *pallidus, petala pallidissima pene decolora, pulchre lineata*" agrees with *V. stagnina* Kit. ex Schult. or some forms of *V. canina.* In conclusion, plants described or cited by Haller (1768) might correspond to *V. stagnina, V. pumila* Chaix or *V. canina.*

Allioni (1785 p. 99, no 1646) gives a more detailed description with a picture (tab. 26, fig. 6) that can be equated without ambiguity to *V. canina.* He cites new localities in Piedmont (ITA). In Allioni's herbarium TO !p, there are three sheets of *V. ruppii* without numbers, dates, geographical locations nor gathering informations, so it is impossible to choose a lectotype because original material prior to or together with the protologue (1774) cannot be traced. When in doubt, I choose in Allioni's herbarium a neotype that preserves the current usage for this taxon (Art. 9.8). Neotype here designated for *V. ruppii*: TO [herbarium Allioni, sheet with three flowering plants, first plant on right side]!p (Fig. 4).

Approved Infraspecific Taxa

***V. canina* subsp. *ruppii* (All.) Schübl. & G. Martens**, Fl. Wurtemberg 159. 1834. Heterotypic synonym: *V. schultzii* Billot ex F.W.Schultz, *V. nemoralis* Kütz., *V. pobedimovae* Ye.V. Serg., *V. montana* L. p.p. Bergdolt (1932) showed that the stipules elongation of *V. canina* is related to ecological factors (water, nutrients, light). Populations with large upper stipules and more elongated leaves occur from French Alps to [Sib.], not more to W. In Scand., the distinction between the two subsp. is very difficult (Marcussen & Karlsson 2010).

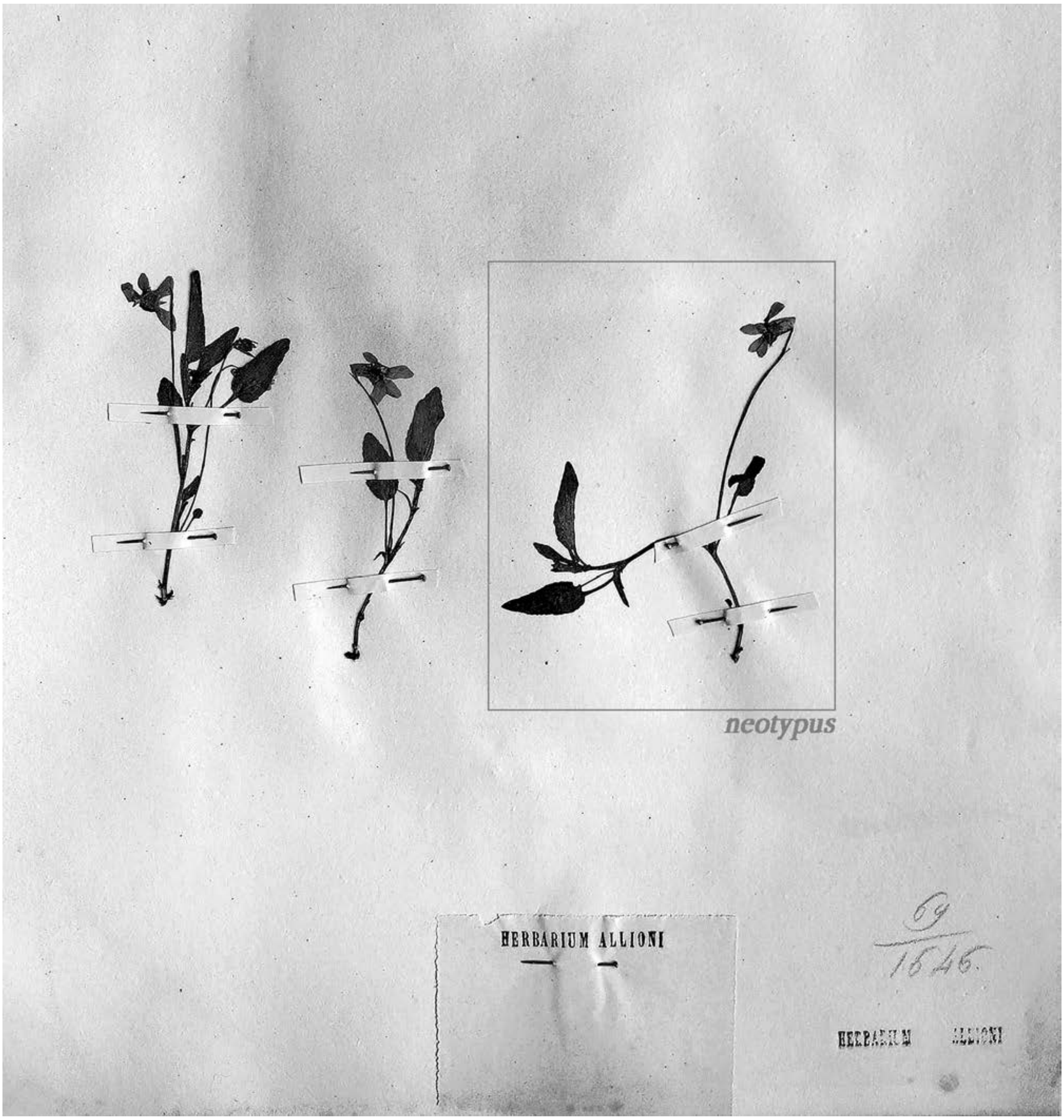

Figure 4 Neotype selected for *Viola ruppii* All. [TO][Herbarium Allioni]. Locations of the neotype here designated on herbarium sheet

Key to closely related taxa (often confused) of *V. canina* from [Sib.] and [RFE]:

1 Blade of middle and upper leaves often with concave margin near the top forming a markedly acute apex; middle and upper stipules incised with many conspicuous teeth or fringes .... ***V. acuminata***

– Blades of middle and upper leaves with convex or straight margin (rarely slightly concave) near the top forming a progressively obtuse or acute apex; middle and upper stipules less divided or subentire with few teeth or little fringes **2**

2 Leaf blade cuneate (rarely truncate), often markedly decurrent onto the petiole .... ***V. pumila*** (incl. *V. accrescens*)

– Leaf blade truncate to cordate, slightly or not decurrent onto the petiole **3**

3 Spur distinctly green, saccate, nearly as long as wide, ± equal to the sepal appendages; corolla white (rarely slightly purple); leaf blade generally 2–4 times as long as wide, rarely less .... ***V. stagnina***

– Spur light greenish yellow, cylindrical, longer than wide, generally exceeding the sepal appendages; corolla purple to slightly lilac (rarely whitish); leaf blade 1–2.5 times as long as wide .... **4 *V. canina* s.l.**

4 Stipules of middle and upper leaves longer than half of the petiole; upper leaves subcordate to subtruncate, generally 2–2.5 times as long as wide; stems erect .... ***V. canina* subsp. *ruppii***

– Stipules of middle and upper leaves shorter than half of the petiole; upper leaves subcordate, generally less 2 times as long as wide; stems ascending or erect .... ***V. canina* subsp. *canina***

Viola **subg.** ***Violidium*** **C. Koch**, Linnaea 15: 251. 1841

Type: *V. somchetica* C. Koch. The author simultaneously published the subg. *Violidium* and *V. somchetica* which is the only species cited inside.

Chromosome Numbers: estimated ploidy level at the beginning of lineage: allotetraploid (Marcussen et al. 2015); secondary base number x' = n = 12, "diploid": 2n = 24; auto- or allopolyploids: 2n = 48, 72; errors or aneuploids: 2n = 12, 20, 22, 26, 40, 44; 0–3 B chromosomes.

Hybrids. Some natural hybrids between sect. of subg. *Violidium*. Two natural hybrids cited with subg. *Viola*: *V. rupestris* x *V. selkirkii* (Nikitin 2003), *V. rostrata* × *V. violacea* (Yoshida et al. 2016). Three experimental F1 hybrids with subg. *Viola* were created (Clausen 1951 p. 148) but they were completely sterile.

Taxonomy. Phylogenetic studies, Yoo et al. (2005, 2007, 2010), Liang & Xing (2010), Marcussen et al. (2012, 2015) confirm the classification of Clausen (1964) that regroups Eurasian and American plants having the secondary base number x' = n = 12 in sect. *Plagiostigma*. Marcussen et al. (2012) propose to separate from sect. *Plagiostigma* five high-polyploids infrageneric taxa: *Boreali-Americanae* (2n = 48, 52, 54, 56), *Langsdorffianae* (2n = 60, 64, 72, 96, 120), *Mexicanae* (2n = 80), *Nosphinium* (2n = 80) and *Pedatae* (2n = 54, 56). I regroup them in subg. *Nosphinium* (cf. no 35, 36). Subg. *Violidium* here defined is equivalent with sect. *Plagiostigma* s.l. Clausen (1964) except *Boreali-Americanae* and *Langsdorffianae*; it includes sect. *Violidium, Plagiostigma, Brachycerae, Vaginatae, Bilobatae, Australasiaticae,* and *Diffusae*. The name *Violidium* is the oldest and the only one to have been used at rank of subg.

Characters. Flowers frequently blue violet, violet, purple, mauve, magenta or white, never yellow but for some species pale green-yellow at the base of lateral petals or on the throat and spur of the lower petal; stipules free or clearly adnate; style patellately flattened or clavate at top, mostly marginate laterally or behind, with short beak in front, never papillose (Fig. 2G–H).

Distribution: [N-Amer.; S-Amer.: Caribbean; Afr.: N-Afr., Macaronesia; Eur.; Asia-Temp.: W-, M- & E-Asia, Cauc., Sib., China, RFE; Asia-Trop.; Australasia].

Viola **sect.** ***Violidium*** **(C. Koch) Juz.**, in Schischkin & Bobrov (ed.), Fl. URSS 15: 408. 1949

Type: *V. somchetica* C. Koch.

Equally Ranked Synonym. *V.* sect. *Adnatae* (W. Becker) Ching J. Wang, Fl. Reipubl. Popularis Sin. 51: 41. 1991.

Chromosome Numbers: 2n = 24; auto- or allopolyploids: 48, 72; errors or aneuploids: 2n = 12, 20, 26, 40; 0–3 B chromosomes.

Hybrids. Many hybrids within the sect. A single natural hybrid with sect. *Plagiostigma* (cf. *V. selkirkii*, *V. epipsila*). Two natural hybrids cited with subg. *Viola* sect. *Trigonocarpae* (cf. subg. *Violidium*).

Taxonomy. In cytogenetic studies (Gong et al. 2010, Liang & Xing 2010, Yoo & Jang 2010), *V. dissecta* is isolated and not related with *V. albida* s.l. Thus, the infrageneric taxon, *V. Pinnatae* Kitt., is certainly a paraphyletic group and dissected leaves a homoplasy.

Characters. Perennial rhizome ending in a leaf rosette producing flowers, without annual stems (Fig. 3A); stipules adnate to petiole half or more.

Distribution: [N-Amer.; Eur.; Asia-Temp.: W-, M- & E-Asia, Cauc., Sib., China, RFE; Asia-Trop.; Australasia].

11 ***Viola multifida*** **Willd. ex Schult.,** Syst. Veg., ed. 15 bis [Roemer & Schultes] 5: 352. 1819

S3 – subg. *Violidium* sect. *Violidium* – T2 P3 – GN

Typification. Loc. cl.: "*In Siberia a Jenisea ad Lenam",* [Sib.]. Lectotype here designated: HAL [HAL0117784 ex herb. Willdenow]!p, leg. Pallas, "*Sibiria*", det. Willdenow. This specimen was collected by Pallas who explored [Sib.] from 1771 to 1773 far as [CTA]. B. Heuchert has typified on the sheet this specimen in 2013; I agree with his choice. Other Pallas's material: LINN [1052.4]!p as *V. pinnata*.

Chromosome Numbers. All for *V. dissecta,* 2n = 24 [China, Sib., RFE]; 2n = 40 [KRA]; 2n = 48 [KRA, PRM].

Hybrids. Within the sect. with species 2n = 24, 48: *V. incisa* and *V. mandshurica* (Nikitin 2007).

Taxonomy. Incl.: *V. dissecta* Ledeb., *V. pinnata* var. *angustisecta* W. Becker. Homotypic synonym: *V. pinnata* subsp. *multifida* (Willd.) W. Becker. *V. pinnata* and *V. milanae* are closely related species of *V. multifida*. As in the case of *V. albida* (Jang et al. 2006), I think that the notch of the blade is not sufficient to justify the creation of new species. However, assuming that *V. pinnata* is an allotetraploid (2n = 48) arised from the crossing between *V. milanae* (2n = 24, Krivenko et al. 2012, 2015) and *V. multifida* (2n = 24), I keep these plants to the specific rank. This hypothesis is supported by the intermediate morphology of *V. pinnata*, and its potential presence in [Sib.]: (1) *V. milanae* has palmatipartite to palmatisect leaf blades with entire to slightly lobed oblong segments; (2) *V. multifida* has 2–3 pinnatisect leaf blades with narrowly oblong to linear segments; (3) leaf blades of *V. pinnata* are intermediate, palmatisect leaf blades with central segment pinnatifid to pinnatisect and lateral segments entire or irregularly lobed. In [Sib.], the three species seem to be present: Regel (1862) noted *V. pinnata* present in [ALT, IRK, BRY] with *V. dissecta*. The specimen P [P04646144 Bunge no 294]!p from [ALT] shows a typical morphology of *V. dissecta* while Turczaninow's specimen P [P04646146]!p from [IRK] and Bunge's one P [P04675579]!p from [ALT] have leaves similar to *V. pinnata*. The populations from the [RFE] and [Sib.] with 2n = 48 might correspond to *V. pinnata*. Deeper analysis of these plants is required, also in Eur. where chromosome counts were made only on botanical garden plants. Gingins (1824) notes that Eur., seeds are bigger than Siberian; thus seed sizes can help to differentiate between two related taxa (Espeut 2004): *V. pinnata* (Espeut pers. obs. [FRA]): 2.3–2.4 mm, 1.4–1.6 mm in diameter, v.s. *V. milanae*: 1 mm in diameter (Nikitin & Silantjeva 2006). I have not been able to get the seed size of *V. multifida* (2n = 24).

Distribution: [RFE: Dauria, Lower-Zeya, Ussuri]; adjacent regions [CTA, CHI, CHM]; general range [M-Asia, MON, China, Sib., RFE].

V. pinnata L., Sp. Pl. 2: 934. 1753. Loc. cl.: "*Sibiria & Alpibus Europae*"; Linnaeus does not distinguish between Eur. and [Sib.] populations. Gingins (1824) is the first to differentiate between var. *europaea* et var. *sibirica*. Becker (1922, 1923c) groups oriental populations with more dissected leaf blades in the subsp. *multifida* (he cites as synonym *V. multifida*, *V. dissecta*). Like Regel (1862), he assigns the type of species to European populations. Consequently, an European lectotype had to be searched in type material. Linnaean collections possess only one specimen, LINN 1052.3 (Jarvis 2007). The plant of the upper part of this sheet belongs to *V. multifida*, the bottom one to *V. dactyloides* Schult. No gathering indication is noted. The protologue cites J. Bauhin's illustration, therefore it could be chosen as lectotype (Art. 9.12). Lectotype here designated: illustration J. Bauhin, *Historia Plantarum universalis* 3: 544 (1651) !p, as "*Viola montana folio multifido*".; the plant described by Bauhin comes from "*Wůrms*" [ITA: Bormio]. Distribution: [Eur.: AUT, FRA, ITA, SWI, YUG: Slovenia; Asia-Temp.: ALT, IRK].

V. dissecta Ledeb., Fl. Altaic. 1: 255. 1829. Loc. cl.: "*in sabulosis ad trajectum fl. Katunja supra ostium fl. bolschoi Ulegumen,* *nec non rarius prope Barnaul in montosis*" [ALT: Katun River, Barnaul]. Lectotype designated (Nikitin & Silantjeva 2006): LE [LE01024095]!p, leg. Bunge 466, 1826, "*in sabulosis ad fluvium Katunja nec non prope Barnaul"*. Isolectotype: LE [LE01024096]!p. Distribution: [M-Asia, China, Sib., MON, RFE].

V. milanae Vl.V. Nikitin, Novosti Sist. Vyssh. Rast. 38: 191. 2006. Loc. cl.: "*Respublica Tuva, Todzhinski districtus, "Azas" resevatum, lacum Kadysh ripa septentrionalis, 52°37' lt. bor., 97°07' lg. or., alt. ca. 1200m supra mare, silva umbrosa in declivis montium, 28 VII 2004*" [TVA: Todzhinsky District]. Holotype and isotypes n.v. LE . This plant was dedicated to Nikitin's wife. Heterotypic synonym: V. *pinnata* var. *latisecta* W. Becker p.p. Distribution: [Sib.: ALT, TVA, IRK].

Key to closely related species of *V. pinnata*:

1 Leaf blade completely or partially pinnatisect **2**
– Leaf blade only palmatipartite or palmatisect . ***V. milanae***

2 Main rachis of the leaf blade broader than rachis of divisions at their insertion point .... ***V. pinnata***
– Main rachis of the leaf blade nearly as broad than rachis of divisions at their insertion point .... ***V. multifida***

12 *Viola incisa* Turcz., Bull. Soc. Imp. Naturalistes Moscou 15: 302. 1842

S3 – subg. *Violidium* sect. *Violidium* – T2 P3 – GN

Typification. Loc. cl.: "*In glareosis ad Baicalem paulo ultra vicum Goloustnaja, ad ostium rivuli Krestôwkâ*", [IRK: Lake Baikal]. Lectotype designated (Nikitin & Silantjeva 2006) n.v. LE, leg. Turczaninow, May 1832, "*Sibiria. In glareosis ad Baicalem*" [IRK]. Original specimens: K [K000651376, K000651379, K000651377]!p; P [P02141098]!p; G [G00189211]!p.

Chromosome Numbers. 2n = 24 [Sib.] (Krivenko et al. 2012, 2015); 2n = 48 [RFE] (Probatova et al. 2004).

Hybrids. Within the sect. with *V. multifida* (Nikitin 2007 as *V. dissecta*).

Taxonomy. Incl.: *V. fissifolia* Kitag. This species is closely related to *V. multifida*. It was recently ranked as var. of *V. dissecta* (Chen et al. 2007). I keep this taxon with a specific rank because spur flower is short, 3–4 mm long, and petioles distinctly winged in upper part, vs. spur 4–8 mm long and unwinged petioles for *V. multifida*. The presence of hybrids with *V. multifida* (= *V.* × *incissecta* Vl. Nikitin) also justifies a specific rank.

Distribution: [RFE: Lower-Zeya, Ussuri]; adjacent regions [CHI, CHM]; general range [Sib., China, MON, RFE].

V. fissifolia Kitag., Bot. Mag. (Tokyo) 49: 226. 1935. Holotype (Akiyama & Ohba 2001): TI [02205]!p. Loc. cl.: "*Manshuria*" [CHM: Liaoning].

13 *Viola dactyloides* Schult., Syst. Veg.**,** ed. 15 bis [Roemer & Schultes] 5: 351. 1819

S2 – subg. *Violidium* sect. *Violidium* – T2 P3

Typification. Loc. cl.: "*in Sibiria: Pallas; olim Ircutiae Gmelin*" [Sib.]. Pallas explored the Baikal region in 1772. Lectotype here designated: HAL [HAL0117797]!p as "*Viola digitata"*, leg. Pallas [Sib.], Willdenow's herbarium. Typified on sheet by B. Heuchert 2013.

Chromosome Numbers. 2n = 24 [Sib., RFE].

Hybrids. Within the sect. with *V. variegata* (Nikitin 2007).

Taxonomy. This species is morphologically well-characterized; it is related to *V. multifida.*

Distribution: [RFE: Aldan, Dauria, Upper- and Lower-Zeya, Bureya, Ussuri]; adjacent regions [CTA, CHI, CHM]; general range [China, MON, Sib., RFE].

Approved Infraspecific Taxa

***V. dactyloides* var. *multipartita* W. Becker**, Beih. Bot. Centralbl., Abt. 2, 34(2): 245. 1916. Loc. cl.: "*Primorsk, Tütische (44° / 136°)* [...] *Chabarowsk und im Ussuri Gebiet, fluv. Jodsiche* ", [PRM: *Tütische* = Dalnegorsk ?, KHA]. Three syntypes. Lectotype (Byalt 2018) n.v. LE, leg. Desoulavy no 23, Khabarovsk [KHA], 14 May 1902, det. Becker 1914. This taxon has more dissected leaves.

14 *Viola albida* Palib., Trudy Imp. S.-Peterburgsk. Bot. Sada 17(1): 30. 1899

S2 – subg. *Violidium* sect. *Violidium* – T2 P3 – GN

Typification. Loc. cl.: three syntypes gathered by Sontag "*Kyong-kwi: Seoul, Schin-Ku-Kaï 18 Maji '94 fl.; Thee Mun-An-Tai-Kul 29 April. '94 fl.; Hut-Tschai_Meo 1 Maji '94 fl.",* [KOR-SK: Gyeonggi-do, Seoul]. Lectotype designated (Nikitin 2004 p. 176) n.v. LE, leg. Sontag, 29 April 1894, Seoul "*Thee Mun-An-Tai-Kul"*. Syntypes n.v. LE; isosyntype "*Schin-Ku-Kaï*" K [K000254246]!p.

Chromosome Numbers. n =12 [JAP] as *V. chaerophylloides*, *V. eizanensis* var. *simplicifolia*; 2n = 24 [China] as *V. chaerophylloides,* [JAP] as *V. chaerophylloides* and *V. eizanensis,* [KOR] as *V. chaerophylloides*, *V. albida*, *V. takahashii*; 2n = 26+2B [KOR] as *V. takahashii*, *V. chaerophylloides.*

Hybrids. Within the sect. with species 2n = 24, 48 (Hama 1975, Akiyama et al. 1999): *V. keiskei, V. phalacrocarpa, V. philippica, V. sieboldii, V. tokubuchiana, V. violacea, V. yezoensis, V. mandshurica.*

Taxonomy. Incl.: *V. chaerophylloides* (Regel) W. Becker, *V. eizanensis* (Makino) Makino, *V. sieboldiana* (Maxim.) Makino, *V. takahashii* (Nakai) Taken. Jang et al. (2006) have proved that *V. chaerophylloides* can be considered as an infraspecific taxon of *V. albida* because there are important morphological and genetic similarities between these two taxa. Molecular phylogenetic analyses show that *V. eizanensis* and *V. chaerophylloides* var. *sieboldiana* belong to *V. albida* s.l. and not to *V. pinnata* or *V. dissecta* (Jang et al. 2006, Toyama & Yahara 2009). Neither sterile hybrid nor plants with reduced fertility were reported among this group to demonstrate the existence of genetic barriers; the only one supposed hybrid, *V. chaerophylloides* var. *sieboldiana* x *V. eizanensis,* produces fertile seeds (Hama 1975 pl. 120). Pending further research on cross-fertilization between these taxa, I include *V. eizanensis* in *V. albida* s.l. Distinctive characters: spur long, 5–7 mm, stout, thickened and sepals with conspicuous basal auricles 4–6 mm long. Morphological variability of leaves: leaf blades always entire, with conspicuous teeth (*V. albida* s.s.); irregularly lobed ou 3–5-fid, sometimes entire after anthesis (var. *takahashii*); irregularly 3-sected (var. *eizanensis*); regularly 3–5-palmatisect (var. *chaerophylloides*, var. *sieboldiana*). Leaf indentations vary in time, important during anthesis, reduced in fruiting (Becker 1923c p.122, Hama 1975, Akiyama & Ohba 2001). Only var. *chaerophylloides* (Regel) F. Maek. was noted in [RFE]. *V. extremiorientalis* should not be equated with *V. albida* s.s. (Czerepanov 1995) but with *V. selkirkii* (cf. no 23).

Distribution: [RFE: Lower-Zeya, Ussuri]; adjacent regions [CHM, KOR-NK; general range [China, RFE, E-Asia].

Approved Infraspecific Taxa

***V. albida* var. *albida*.** Distribution: [KOR, CHM: Liaoning].

***V. albida* var. *takahashii* (Nakai) Nakai**, Bot. Mag. (Tokyo) 36: 84. 1922. Basionym: *V. dissecta* Ledeb. var. *takahashii* Nakai in J. Matsumura (ed.), Icon. Pl. Koisikav. 1(4): 94. 1912. The epithet "*takahashii*" used by Nakai is indirectly related to the plant that Takahashi discovered on Mount Nanzan [KOR-SK] and that Makino (1912) named *V. dissecta* var. *chaerophylloides* subvar. *takahashii.* This name is invalid because published as synonym of *V. dissecta* var. *chaerophylloides* subvar. *multifida* Makino (Art. 36.1b). The lectotype designated by Akiyama & Ohba (2001) corresponds to a 1913 Nakai's gathering TI [DB no 02134]!p; it is admissible because later than the basionym (1912). Homotypic synonym: *V. takahashii* (Nakai) Taken. Heterotypic synonym: *V. chaerophylloides* fa. *simplicifolia* Makino. Distribution: [China, JAP, KOR].

V. albida **var.** ***chaerophylloides*** **(Regel) F. Maek.**, in H. Hara, Enum. Spermatophytarum Japon 3: 195. 1954. Basionym: *V. pinnata* var. *chaerophylloides* Regel in Bull. Soc. Imp. Naturalistes Moscou 34(4): 467. 1862. Type material "*V. dissecta Wilf. pl. exsicc. Corea (Wilford)*". This plant was described by Regel from specimens collected by Wilford (assistant in the herbarium at the Royal Botanic Gardens of Kew), certainly on S-Korean Islands formerly called Port Hamilton [KOR-SK: Geomun-do = Komundo] in 1859 (Jackson 1901 p. 69). Wilford's specimens could not be traced in K and LE. The specimen LE [LE01024097]!p, leg. Jankowski, May 1882, "*ad fl. Sedemi*" [PRM: Sedimi river] was designated by Bezdeleva as type (1987: 120). It cannot be considered as the lectotype because this specimen is later than the protologue (Art. 9.19c); however it can be accepted as a neotype (Art. 7.11 Ex. 14) as proposed Nikitin on the sheet. Isoneotypes: LE [LE01024098, LE01024099]!p. Homotypic synonym: *V. chaerophylloides* (Regel) W. Becker, *V. pinnata* subsp. *chaerophylloides* (Regel) W. Becker. Distribution: [China, JAP, KOR, RFE: Ussuri].

V. albida **var.** ***eizanensis*** **(Makino) Espeut comb. nov**. Basionym: *V. dissecta* Ledeb. var. *eizanensis* Makino, Bot. Mag. (Tokyo) 26: 155. 1922. Loc. cl.: "*Japan, mountains*", [JAP]. Lectotype undesignated; original material untraced. Homotypic synonym: *V. eizanensis* (Makino) Makino. Distribution: [JAP].

V. albida **var.** ***sieboldiana*** **(Maxim.) Espeut, stat. nov.** Basionym: *V. pinnata* L. var. *sieboldiana* Maxim. in Bull. Acad. Imp. Sci. Saint-Pétersbourg 23: 313. 1877. Loc. cl.: "*Vidi cultam ex horto Sieboldiano Nagasaki Japoniae*", [JAP]. Lectotype undesignated; original material untraced. Homotypic synonym: *V. sieboldiana* (Maxim.) Makino, *V. chaerophylloides* var. *sieboldiana* (Maxim.) Makino, *V. dissecta* var. *sieboldiana* (Maxim.) Nakai, *V. albida* fa. *sieboldiana* (Maxim.) F. Maek. Distribution: [China, JAP].

V. albida **subsp.** ***marginata*** **W. Becker**, Beih. Bot. Centralbl., Abt. 2, 40 (2): 141. 1923. Loc. cl.: "*Amur-Provinz, Zeja und Bureja-Bezirk, Gebiet von Ozerkov, unweit Tolstovka*", [AMU]. Holotype: LE [LE01009659]!p, "*leg. M. Korotkij nr. 1084, 30. 8. 1910*", det. W. Becker 1917a. Juzepczuk (1949) included this taxon under *V. mandshurica*; I don't agree with this specific rank and maintain this plant as subsp. of *V. albida*. This taxon is known only through holotype and protologue. It differs from *V. pacifica* and *V. mandshurica* by its leaves more distinctly dentate and more narrowly acute, and from *V. mandshurica* by its conspicuous sepal appendages, and cordate leaves. Further observations are needed to clarify its taxonomic position. Distribution: [RFE: Lower-Zeya].

Key to infraspecific taxa of ***V. albida*** (taxa disposed by increasing indentation):

1 Leaf blade at anthesis simple, margin crenate or serrate 2
– Leaf blade at anthesis divided, or ± irregularly lobed 3

2 Leaf blade glabrous, petiole very narrowly winged in upper part .... **var. *albida***
– Leaf blade pubescent, petiole distinctly winged in upper part .... **subsp. *marginata***

3 Leaf blade usually irregularly few lobed sometimes subsimple .... **var. *takahashii***
– Leaf blade more regularly deeply divided 4

4 Leaf blade 3-sected; flowers generally pale red-purple .... **var. *eizanensis***
– Leaf blade 5-sected; flowers generally white 5

5 Terminal lobe of leaves irregularly dentate or shallowly divided .... **var. *chaerophylloides***
– Terminal lobe of leaves tripartite to pinnatipartite or 3-lobed .... **var. *sieboldiana***

15 ***Viola gmeliniana*** **Schult.**, Syst. Veg., ed. 15 bis [Roemer & Schultes] 5: 354. 1819

S2b – subg. *Violidium* sect. *Violidium* – T2 P3

Typification. Loc. cl.: "*In Ircutia ad lacum Baical et in Kamtschatka*". In the protologue, the reference "*Reliqu. Willd. MS*" relates to Willdenow's collections. Lectotype here designated: HAL [0117793 ex herb. Willdenow]!p as "*Viola Gmelini*", leg. Pallas in [Sib.]. Pallas explored the Baikal region in 1772. Typified on sheet by B. Heuchert 2013.

Chromosome Numbers. 2n = 24 [MON, Sib. (Krivenko et al. 2012, 2015)].

Hybrids. Unknow.

Taxonomy. Incl.: *V. fischeri* Sweet non W. Becker, *V. fusiformis* Sm. Misapplied names: *V. lanceolata* auct. ant. Sib non L. Other species, related to *V. gmeliniana*, are present more to the west in M-Asia.

Distribution: [RFE: Okhotsk, Aldan, Nyukzha, Dauria, Upper- and Lower-Zeya, Bureya, Amgun, Ussuri]; adjacent regions [YAK, CTA, CHI, CHM]; general range [China, Sib., MON, RFE].

16 ***Viola hirtipes*** **S. Moore**, J. Linn. Soc., Bot. 17: 379. 1879

S4 – subg. *Violidium* sect. *Violidium* – T2 P3 – GN

Typification. Loc. cl.: "*Hab. in montibus prope Kwandien*", [CHM: Liaoning, Kuandian County]. Lectotype here designated: K [K000254234]!p, "*Kwandien mts*", 29 April 1876; examined and considered as the holotype by Y.S. Chen June 2006. This specimen cannot constitute a holotype because the protologue does not indicate any specimen but a mere locality (Art. 40.3 note 2).

Chromosome Numbers. n = 12 [JAP]; 2n = 24 [China, KOR, RFE]; 2n = 24+3B [KOR].

Hybrids. Within the sect. with species 2n = 24, 48: *V. mandshurica*, *V. patrinii*, *V. sieboldii* (Hama 1975, Igari 1996, http://www.io-net.com).

Taxonomy. Incl.: *V. hirtipedoides* W. Becker, *V. miyabei* Makino. It is a relatively isolated species; *V. hancockii* W. Becker seems to be the more related species (Gong et al. 2010). Morphological variability: hairiness of petioles and blades, petioles with patent curled hairs (type), pubescent (var. *grisea* Nakai) or subglabrous (fa. *nudipes* Hiyama, var. *pubescens* Bezd.); flowers sometimes white (fa. *lactiflora* Hashim.); leaves with purple veins (fa. *rhodovenia* (Nakai) Hiyama.

Distribution: [RFE: Ussuri]; adjacent regions [CHM, KOR-NK, JAP-HK]; general range [RFE, E-Asia].

Approved Infraspecific Taxa

V. hirtipes **var.** ***pubescens*** **Bezd.**, in S.S. Kharkevich (ed.), Sosud. Rast. Sovet. Dal'nego Vostoka 2: 113. 1987. Loc. cl.: "*Oriens Extremus, reservatum Kedrovaja Padj*" [PRM: Ussuri, Kedrovaya Pad Nature Reserve]. Only one specimen noted; holotype: VLA n.v., leg. K.D. Stepanova. 1 June 1964. Petioles subglabrous and leaf blades densely pubescent. Distribution: [RFE: Ussuri].

17 ***Viola pacifica*** **Juz. ex Bezd.**, S.S. Kharkevich (ed.), Sosud. Rast. Sovet. Dal'nego Vostoka, 2: 111. 1987

S2a – subg. *Violidium* sect. *Violidium* – T2 P3

Nom. nov. for *V. phalacrocarpa* subsp. *brevicalcarata* W. Becker, in B.A. Fedtschenko, Fl. Aziat. Ross. 8: 72 (1915).

V. pacifica Juz., Schischkin & Bobrov Fl. URSS 15: 411 (1949) is a nom. inv. because this replacement name is not followed by only one replaced synonym but by two synonyms, *V. phalacrocarpa* var. *brevicalcarata* W. Becker (1915) and *V. keiskei* subsp. *transmaritima* W. Becker (1916a), without any indication of the type. This nom. nov. is therefore invalid (Art. 41.1). Bezdeleva (1987) make this nom. nov. valid by choosing *V. phalacrocarpa* subsp. *brevicalcarata* as replaced synonym.

Typification. Replaced synonym: *V. phalacrocarpa* subsp. *brevicalcarata*. Loc. cl.: "оз. Ханка, окр. Камень-Рыболовъ" [PRM: Lake Khanka, vicinity of Kamen-Rybolov]. Only one specimen cited in the protologue "оз. Ханка, окр. Камень-Рыболовъ (Дюкина и А.И. Черскій)" [= Lake Khanka, vicinity of Kamen-Rybolov (Dyukina and A.I. Cherski)]; it must be accepted as the holotype (Art. 9.1 note 1). Holotype: LE [LE01009653]!p, leg. Cherski and Dyukina, 2 May 1908 as "*Viola phalacrocarpa Maxim.*"; det. Becker 1912 as "*Viola phalacrocarpa Maxim. f. brevicalcarata W. Bckr.*"; det. Juzepczuk 1949 as "*Viola pacifica Juz.*"; selected as type on sheet by Nikitin. Homotypic synonym: *V. phalacrocarpa* subsp. *brevicalcarata* W. Becker. The specimen LE [LE01009655]!p designated by Bezdeleva (1987) as lectotype cannot be accepted (Art. 9.19a).

Chromosome Numbers. 2n = 24 [RFE].

Hybrids. Unknown

Taxonomy. Heterotypic synonym: *V. keiskei* subsp. *transmaritima* W. Becker. *V. pacifica* is intermediate between *V. prionantha* s.l. (cf. no 22) and *V. macroceras* Bunge; distinctive characters: cordate leaves with winged petioles, in upper part. *V. pacifica* is also close to *V. albida* s.s. and *V. keiskei* s.l. that have no winged petiole, and for the second taxon long spur more than 6 mm.

Distribution: [RFE: Lower-Zeya, Ussuri]; general range [RFE].

V. keiskei Miq. subsp. *transmaritima* W. Becker, Beih. Bot. Centralbl., Abt. 2, 34 (2): 251. 1916. Loc. cl.: "*Mandschurei, Primorsk*" [PRM]. One only specimen noted in the protologue "*N.A. Palczewsky Pl. extremi Orient. (1906) nr. 24a; Primorskaja (Herb. Ac. Imp. Sc. Petersb.)*" that must be seen as the holotype (Art. 9.1 Note 1): LE [01009684]!p, leg. N.A. Palczewsky no 24a, "Приморская областъ, Владивосток, г. Орлиное гнездо" [PRM: Vladivostok]; det. Becker 1915 "*Viola Keiskei Miq. sbsp. transmaritima W. Bckr.*"; det. Juzepczuk 1949 "*Viola pacifica Juz.*"; erroneously selected as lectotype by Nikitin on sheet and Byalt (2018). Distribution: [RFE: PRM].

V. alexandrowiana (W. Becker) Juz., in Schischkin & Bobrov (ed.), Fl. URSS 15: 412. 1949. Basionym: *V. phalacrocarpa* subsp. *alexandrowiana* W. Becker, in B. Fedtschenko, Fl. Aziat. Ross. 8: 72. 1915. Loc. cl.: "Верхоленскій у., с. Тутура", [IRK: Verholensk, Tutura]. Only one specimen is noted in the protologue "(Александровъ) *13. V. – 1911. № 20*"; it must be accepted as the holotype (Art. 9.1 note 1): LE [01009683]!p, leg. Alexandrow no 20, 13 May 1911, Tutura, as "*Viola Patrini DC.*"; det. Becker 1915 as "*Viola Keiskei Miq. sbsp. transmaritima W. Bckr. var. leptophylla W. Bckr.*"; det. Juzepczuk 1949 as "*Viola Alexandrowiana (W. Bckr.) Juz.*". The specimen LE [01009668]!p, leg. Alexandrow no 246, 31 August 1910, Tutura, cannot be the type (Art. 9.19a), as proposed Nikitin on sheet and Byalt (2018). *V. alexandrowiana* is closely related to *V. pacifica*. Differences between the two taxa are minor: lateral petals bearded and leaves less developed after anthesis for *V. alexandrowiana*; vs. lateral petals beardless and leaves more developed after anthesis for *V. pacifica*. 2n = 24 [BRY, IRK (Krivenko et al. 2012)]; only one count 2n = 48 (Krasnoborov et al. 1980, botanical garden of Novosibirsk). Further cytological and morphological studies are needed to compare *V. alexandrowiana* and *V. pacifica*. Distribution: [Sib.: BRY, KRA, IRK]

V. keiskei var. *leptophylla* W. Becker, Beih. Bot. Centralbl., Abt. 2, 34 (2): 251. 1916. Two syntypes, Alexandrow no 20 and no 246. Lectotype designated (Byalt 2018): LE [01009683]!p, leg. Alexandrow no 20, 13 May 1911, Tutura; homotypic synonym of *V. alexandrowiana*.

18 ***Viola patrinii*** DC. ex Ging., in A.P. de Candolle, Prodr. 1: 293. 1824

S4 – subg. *Violidium* sect. *Violidium* – T2 P3 – GN

Typification. Loc. cl.: "*Sibiria*". No type cited in protologue. Nikitin (2008) cites as lectotype "*Viola primulifolia circa Irkutia julio (Patrini) M. D. Delessert. 1816 (P-DC – photo!)*". He makes a mistake: this specimen is not in P, but in G-DC. Therefore this lectotypification is non-validated (Art. 9.22). The correct specification of the lectotype here designated: G-DC [G00208984]!h. This specimen was collected by Patrin in [IRK]; Ginging used the epithet "*Patrinii*" to differentiate Siberian plants from the American *V. primulifolia* L. emend. Ging.

Chromosome Numbers. n = 12 [JAP]; 2n = 12 [KRA] (Stepanov 1994b n.v. cited by Probatova et al. 2001); 2n = 20 [RFE]; 2n = 24 [KRA, JAP, RFE]; 2n = c. 48 [RFE]. "*2n = 36 Miyaji (1927)*" is an error of citation (Probatova et al. 2001): Miyaji indicated "*x = 36?*" as a haploid count. This author confounds also *V. patrinii* with *V. mandshurica* var. *albescens* Nakai (Miyaji 1929) that is now considered as *V. betonicifolia* var. *albescens* (Nakai) F. Maek. & Hashim. The count 2n = c. 48 (Sokolovskaya & Probatova 1986) is perhaps due to a confusion with *V. mandshurica* that sometimes has white flowers (cf. no 13, Hama 1975, Chen et al. 2007). Stepanov (1994b) is the only author to cite 2n = 12; but in subg. *Violidium*, any taxon has a so low chromosome number and all the species are considered as tetraploids with a haploid number: n = 12 (Clausen 1929, Marcussen et al. 2015).

Hybrids. Within the sect. with species 2n = 24, 48: *V. hirtipes, V. mandshurica*.

Taxonomy. Incl. *V. prunellifolia* Fisch. ex Ging., *V. patrinii* var. *subsagittata* Maxim., *V. patrinii* var. *macrantha* Maxim., *V. patrinii* fa. *hispida* W. Becker. Misapplied name: *V. primulifolia* auct. ant. non L. The complex taxonomy of *V. patrinii* is debated. Plants grouped here under this name have white flowers with short spurs (less than 4 mm), distinctly winged petioles and dark roots, 2n = 24. Before Becker (1917b), the name *V. patrinii* has often be misapplied in herbaria and floras for species now identified as *V. betonicifolia, V. inconspicua, V. mandshurica, V. philippica, V. prionantha*. Taxonomy of *V. patrinii* contains also plenty of infraspecific taxa, most of them are included in this species. This taxonomic complexity added to overlapped geographic areas of related species have produced many misidentifications in collections and literature.

Distribution: [RFE: Dauria, Upper- and Lower-Zeya, Bureya, Amgun, Ussuri, S-Sakhalin, S-Kuril]; adjacent regions [CTA, CHI, CHM, KOR-NK, JAP-HK]; general range [China, Sib., MON, RFE, E-Asia].

V. patrinii fa. *hispida* W. Becker, in B. Fedtschenko, Fl. Aziat. Ross. 8: 69. 1915. Loc. cl.: "Приморская обл.: Уссури, Сунгари, Амуръ (Максимовичъ)" = Ussuri, Sungari, Amur (Maximowicz) [PRM, CHM, AMU]. Original material: according to Becker (1916a p. 245) specimens collected by Maximowicz from "*Ussuri, fluv. Wai-fu-din (44° lat. bor., 135° long. or.); Amur (52°, 128°; 53,5°, 124°); Sungari (43°/127°)*". Lectotype undesignated. The form with pilose leaves corresponds partly with *V. mandshurica*. Indeed, Becker gave the name of this form to the Maximowicz's plant *V. patrinii* var. *macrantha*.

V. patrinii var. *subsagittata* Maxim., Prim. Fl. Amur. 49. 1859. Loc. cl.: "*In der Nähe der Ussuri-Mündung am linken Amurufer; zwischen Dawunda und Mare, auf Wiesen selten* […] *am Ussuri, der Por-Mündung gegenüber und sonst, auf Wiesen häufig*" [AMU, PRM]. Lectotype designated (Byalt 2018): LE

[LE01026035]!p, leg. Maximowicz, 22 August 1855, as "*Viola Patrinii DC. var. subsagittata Maxim.*", "*zwischen Dawunda und Marè*" [= between Davunda and Marè]. Leaves (fruiting plant) with conspicuous basal lobes. Becker (1917b p. 159) included this plant under typical *V. patrinii* whereas Juzepczuk (1949 p. 422) saw it as an oriental form. This plant cannot be equated with *V. lactiflora* Nakai (= *V. limprichtiana* W. Becker) that has wingless petiole.

V. patrinii var. *macrantha* Maxim., Prim. Fl. Amur. 49. 1859. Loc. cl.: "*Am obern Amur: auf Inseln bei Albasin* […] *auf lehmigen Wiesen der Inseln, etwa 90 W.* [approximately 96 km] *unterhalb Aicho, am südl. Amur*" [AMU: Albazino, Heihe]. Lectotype designated (Byalt 2018): LE [LE01026034]!p, leg. Maximowicz, 29 August 1856, "*unterhalb Aicho*" [= below Ajgun = Heihe], det. Becker 1912 as "*Viola Patrinii DC. f. hispida W. Bckr*". Becker (1917a p. 159) included this Maximowicz's taxon under *V. mandshurica,* except plants from Albazino (May 1855) that are *V. patrinii.*

19 *Viola mandshurica* W. Becker, Bot. Jahrb. Syst. 54: 179. 1917

S4 – subg. *Violidium* sect. *Violidium* – T2 P3 – GN

Typification. Loc. cl.: "*Mandchurei, Korea, Nordostchina, Japan*" [CHM, AMU, KHA, PRM, KOR, JAP]. Several syntypes are cited in the protologue. Lectotype designated (Byalt 2018): L E [LE01026031]!p, leg. N. Palczewsky no 1908, end of May 1902 fl., 22 June 1902 fr., "*Mandshuria rossica (prov. Primorskaja). In montosis, locis herbosis, pr. urb. Wladiwostok*" [PRM: Vladivostok], as "*Viola Chinensis G. Don*". This sheet contains plants gathered at two dates that forms two specimens (Art. 8.2 ex.3 and definition of "*gathering*" in the footnote). Because this material was collected at more than one time, it belongs to more than one gathering and cannot be accepted as a type (infraction to Art. 8.2). Lectotype here designated: LE [LE01026031 flowering plants only]!p, end of May 1902. Isolectotype: LE [LE01026032 flowering plants only]!p. Syntypes: Palczewsky no 1908 LE [LE01026031 fruiting plants only, LE01026032 fruiting plants only]!p; Faurie, no 473 P [P04672354]!h and G [G00343773]!h; Faurie no 4016 P [P04672366]!h and G [G00343772]!h; Karo no 136, P [P04731670]!h.

Hybrids. Several hybrids cited by Hama (1975), Akiyama et al. (1999) within the sect. with species 2n = 24, 48, 72: *V. albida* (as *V. eizanensis*), *V. betonicifolia, V. hirtipes, V. inconspicua, V. minor, V. patrinii, V. phalacrocarpa, V. philippica* (as *V. yedoensis*), *V. multifida* (Nikitin 2007 as *V. dissecta*), *V. sieboldii, V. tokubuchiana, V. variegata* ?, *V. violacea*.

Chromosome Numbers. n = 24, 2n = 48: [China, JAP, RFE]. Two counts 2n = 24 from [KOR] (Lee 1967 n.v.) and [PRM] (Krivenko et al. 2015) perhaps result to a confusion with *V. philippica* (=*V. yedoensis*) morphologically fairly similar (cf. no 21). Counts 2n = 72 [JAP] as *V. mandschurica* var. *albescens* Nakai (Miyaji 1929) correspond to *V. betonicifolia* var. *albescens* (Nakai) F. Maek. & Hashim.

Taxonomy. Incl. *V. hsinganensis* Taken., *V. ikedaeana* W. Becker ex Taken., *V. niijimensis* Nakai, *V. oldhamiana* Nakai, *V. rhodosepala* Kitag., *V. patrinii* var. *macrantha* Maxim., *V. patrinii* fa. *hispida* W. Becker p.p. Misapplied name: *V. chinensis* auct. [RFE] non G. Don. The taxonomy of *V. patrinii* and related species as *V. mandshurica* is complex and much debated. Taxa grouped here under this name have spurs more than 3 mm long, clearly winged petioles after anthesis, sepal appendages shorter than 2 mm long, dark roots and 2n = 48. This species is very similar to *V. philippica*: it differs by its dark roots vs. whitish, most often bearded lateral petals vs. often glabrous. Its variability covers principally hairiness, flower color, and shape of leaf blade.

Distribution: [RFE: Dauria, Upper- and Lower-Zeya, Bureya, Ussuri, S-Kuril]; adjacent regions [CHI, CHM, JAP-HK, KOR-NK]; general range [China, RFE, E-Asia].

20 *Viola phalacrocarpa* Maxim., Bull. Acad. Imp. Sci. Saint-Pétersbourg 23: 318. 1877

S4 – subg. *Violidium* sect. *Violidium* – T2 P3 – GN

Typification. Loc. cl.: "*In Mandshuria: ad Amur australem, Usuri, Suifun fl., circa sinum Possjet ad limites Koreae* […] *In Japonia boreali: Hakodate* […] *Yokohama* […]" [CHM, AMU, KHA, PRM, KOR, JAP]. The protologue don't give any reference of gatherings but only geographical places where this taxon was found. The specimen chosen by Nikitin (2004 p. 176) as lectotype belongs to Maximowicz's material collected during his second botanical expedition (1859–1864): LE [LE01017336]!p, leg. Maximowicz, no 131, "*Japonia. Hakodate. 10/22 V 1861*" [JAP-HK: Hakodate]. Other original specimens gathered by Maximowicz (*Iter secundum*) were traced in LE [LE01015966, LE01015967, LE01015968, LE01015969, LE01015970, LE01015971, LE01017334, LE01017335, LE01017339, LE01017340]!p; in P [P02141063]!h; in K [K000651382, K000651383, K000651386, K000651387]!p; in BR [BR0000005628896, BR0000005628209]!p. The location "*Amur australem – Oettu*" or "*Aetu*" of some specimens from LE and BR corresponds to an old Russian settlement, between Amgun river and Dzhevdukha Lake [KHA: Imeni Poliny Osipenko District, 52.87°N, 139.46°E] (LE, M. Legchenko, pers. com.). The epithet "*phalacrocarpa*" refers to its glabrous capsules.

Chromosome Numbers. n = 12 [JAP]; 2n = 24 [JAP as *V. phalacrocarpoides*, KOR].

Hybrids. Within the sect. with species 2n = 24, 48: *V. albida*, *V. philippica*, *V. variegata*, *V. violacea*, *V. japonica*, *V. mandshurica.*

Taxonomy. Incl.: *V. conilii* Franch. & Sav., *V. ishidoyana* Nakai, *V. nipponica* Makino, *V. phalacrocarpoides* Makino, *V. pseudoprionantha* W. Becker, V. *reinii* W. Becker. This taxon differs from *V. prionantha* by its leaves more cordate and more ovate-orbicular. Variability: leaf, ovary and capsule villous to glabrous; leaf apex obtuse to acute; flower purple-red, pink or white. These variations are more present in [China, JAP].

Distribution: [RFE: Amgun, Lower-Zeya (Starchenko et al. 2015), Ussuri, S-Kuril (identified from photos taken by Yu. Sundukov on Kunashir Island)]; adjacent regions [CHM, KOR-NK, JAP-HK]; general range [China, RFE, E-Asia].

21 *Viola philippica* Cav., Icon. [Cavanilles] 6: 19. 1800

S3 – subg. *Violidium* sect. *Violidium* – T2 P3 – GN

Typification. Loc. cl.: "*Habitat in Luzon tertio a Manila lapide*" [Philippines: Luzon, City of Manila]. Lectotype here designated: MA [MA82815]!p, "*ex insulis philippicis. Née iter*". Isolectotype: MA [MA82816]!p. Luis Née (1734–1807) and Tadeo Haenke (1761–1816) were the two botanists who followed the Malaspina Expedition (1789–1794) around the world. Becker (1917b pp. 188–189, 1921b pp. 720–722) doubted that loc. cl. of *V. philippica* was Luzon (Philippines) because only subsp. *malesica* exists in this country. He thought the original material correspond to Chinese or Japanese plants. Indeed, the type material (2 plants) does not have the characteristic leaves of subsp. *malesica.*

Chromosome Numbers. 2n = 24 [China] as *V. yedoensis* and *V. philippica,* [JAP] as *V. pseudojaponica* and *V. yedoensis,*[RFE: PRM, Partizansky District] as *V. alisoviana* (Probatova et al. 2001); 2n = c.40 [RFE: PRM] as *V. alisoviana* (Probatova et al. 2001); 2n = 48 [China] as *V. yedoensis* (Huang et al. 1996), as *V. philippica* (Probatova et al. 2016a), [RFE: PRM] as *V. alisoviana* (Probatova et al. 2001, 2004, 2011). Counts 2n = c.40, 48 may correspond to confusions with closely related species *V. prionantha, V. minor, V. mandshurica* or to genuine tetraploid populations of *V. philippica.*

Further studies on *V. alisoviana* are needed to enable the morphological differences between the two ploidy levels and to precise their taxonomic status.

Hybrids. Within the sect. with species 2n = 24, 48: *V. phalacrocarpa*, *V. variegata*, *V. mandshurica*, *V. prionantha* (Becker 1917b p. 188).

Taxonomy. Incl.: *V. alisoviana* Kiss, *V. chinensis* G. Don?, *V. confusa* Champ. ex Benth., *V. longistipulata* Hayata, *V. nantouensis* S.S.Ying, *V. pseudojaponica* Nakai, *V. stenocentra* Hayata ex Nakai, *V. tosaensis* Nakai, *V. yedoensis* Makino. The taxonomy of *V. patrinii* and related species as *V. philippica* is complex and debated. Plants grouped here under this name have: spurs longer than 4 mm, sepal appendages up to 2 mm long, petioles winged in upper part, whitish roots. Unlike Chen et al. (2007), I maintain under *V. philippica* the southern populations (subsp. *malesica* W. Becker) which have broader and distinctly cordate leaves. *V. confusa* and *V. stenocentra* can be assimilated to this subsp. (Becker 1917b, Wang & Huang 1990) and not to *V. inconspicua* (Chen et al. 2007) because this one has smaller spurs 1.8–2,6 mm (Becker 1921b, Jacobs & Moore 1971) and more conspicuous sepal appendages 1,5–4,9 mm. *V. philippica* is similar to *V. prionantha* (cf. no 22) but its leaves are more triangular (broadest between the base and lower third of blade) and less denticulate.

Distribution: [RFE: Lower-Zeya, Ussuri]; adjacent regions [CHI, CHM, KOR-NK]; general range [Asia-Temp.: China, RFE; Asia-Trop.: Indi., Indo-China, Malesia].

V. alisoviana Kiss, Bot. Közlem. 9: 93. 1921. Loc. cl.: "*prope oppid. Nikolsk-Ussurisk in Siberia orientali*" [PRM: Ussuri]. Lectotype here designated: BU [254998]!p, leg. Kiss, 10/05/1918, as "*Viola Alissoviana*", "*Sibiria orientalis. distr. Primorskaj Oblast. ad opp. Nikolsk-Ussurisk. In arena siccis fluvii*". Isolectopype: BU [45127]!p. Type material contains only flowering plants. This taxon is often confused with *V. prionantha* s.l. The description of leaves in protologue and the study of type material enable to relate *V. alisoviana* to *V. philippica*. Field studies in loc. cl. [Ussuri] would allow to better know this taxon and to determine its chromosome number.

V. confusa Champ. ex Benth., Hooker's J. Bot. Kew Gard. Misc. 3: 260. 1851. Loc. cl.: "*Gathered probably on Mount Parker* [...] *also on the opposite hill of the china coast*", [China: Hong Kong Island, Mount Parker]. The type specimen of Bentham cannot constitute a holotype because it belongs to more than one taxon (Art. 9.3, 9.14). Lectotype designed (Becker 1928): K [K000254176 only the two flowering plants]!p, leg. Champion no 352, as *"Viola inconspicua (Bl.)?",* examined by Becker in 1928. Like Becker (1928) and his handwriting on specimen sheet, I think the type of Bentham is heterogeneous: flowering plants = *V. confusa* (flowers with long spur and leaves with winged petioles); fruiting plants = *V. inconspicua* (conspicuous sepal appendages and unwinged petioles). Becker (1917b) equated *V. stenocentra* Nakai with *V. confusa* that he included under *V. philippica* subsp. *malesica* W. Becker. *V. confusa* subsp. *nagasakiensis* (W. Becker) F. Maek. & Hashim. with 2n = 48 belongs to another species, *V. minor* (Makino) Makino.

V. pseudojaponica Nakai, Bot. Mag. (Tokyo) 42: 560. 1928. Loc. cl.: "*Liukiu: Insl. Okinawa* […] *insl. Amami-Oshima*" [NNS: Okinawa island, Amami Ōshima]. Holotype: TI [DB 02307]!p, leg. Miyagi, Okinawa. Several paratypes TI. Taxon with broader and distinctly cordate leaves but with floral characters similar to *V. yedoensis* (Igari 1996).

V. yedoensis Makino, Bot. Mag. (Tokyo) 26: 148. 1912. Loc. cl.: "*Prov. Musashi: Tokyo and its vicinities*" [JAP-HN: Tokyo]. Lectotype undesignated; original material untraced in TI. Czerepanov (1995) included *V. alisoviana* under *V. yedoensis* as synonym; W. Becker equates *V. yedoensis* with *V. philippica* subsp. *munda* on sheet P [P04730567]. Unlike Jacobs & Moore (1971) and Chen et al. (2007), I maintain the subsp. rank adopted by Becker (1917b) to reflect the latitudinal gradient of forms: subsp. *philippica* (N- and central forms) and subsp. *malesica* (S-forms). Becker (1917b) and Steward (1958) indicate intermediate forms between subsp. *philippica* and subsp. *malesica* in [China].

Approved Infraspecific Taxa

***V. philippica* subsp. *philippica*.** Heterotypic synonym: *V. yedoensis* Makino, *V. tosaensis* Nakai, *V. alisoviana* Kiss, *V. philippica* subsp. *munda* W. Becker. Distribution: [Asia-Temp.: PRM, AMU, KOR, JAP, China; Asia-Trop.: Indi., Indo-China].

V. philippica subsp. *munda* W. Becker, Bot. Jahrb. Syst. 54 (5): 175. 1917. Loc. cl.: "*Mandschurei, Korea, Mongolei, nörliches, zentrales und südwestliches China, Burma, Japan*". Many syntypes from [AMU, PRM, KOR, China, Indi.]. Lectotype designated (Byalt 2018): LE n.v., leg. Karo no 42, [AMU: Blagoveshchensk].

***V. philippica* subsp. *malesica* W. Becker**, Bot. Jahrb. Syst. 54 (5): 178. 1917. Many syntypes from [China, Vietnam, JAP, TAI, Philippines, Jawa]. Lectotype here designated: BR [BR0000005509607]!p, leg. Hance, no 947, as "*Viola Patrinii*", Hong Kong, det. Becker in 1916 as *V. philippica* subsp. *malesica*. Heterotypic synonym: *V. confusa* Benth. p.p., *V. stenocentra* Nakai, *V. longistipulata* Hayata, *V. nantouensis* S.S.Ying, *V. pseudojaponica* Nakai. Distribution: [Asia-Temp.: China, JAP, NNS, TAI; Asia-Trop.: Indo-China, Malesia].

Key to infraspecific taxa of *V. philippica*:

1 Leaf blades oval-lanceolate to oblong, truncate to subcordate at base, sometimes shortly cuneate at anthesis, withered in winter, petioles slightly winged .... **subsp. *philippica***

– Leaf blades ovate to triangular-ovate, ± deeply cordate at base, sometimes reniform-cordate, leaves present in winter, and petioles more distinctly winged .... **subsp. *malesica***

22 ***Viola prionantha*** **Bunge,** Enum. Pl. Chin. Bor. 8. 1833

S3 – subg. *Violidium* sect. *Violidium* – T2 P3 – GN

Typification. Loc. cl.: "*China boreal*" [N-China]. Lectotype designated (Nikitin & Silantjeva 2006): LE [LE01017995]!p, leg. Bunge, "*Chin. bor*". It contains parts belonging to more than one taxon: *V. philippica*, *V. prionantha* and hybrids, as W. Becker noted on sheets of LE isolectotypes. The Art. 9.17 allows to narrow the lectotype through a subsequent lectotypification: [second-step] lectotype here designated: LE [LE01017995]!p the first flowering plant starting at top right edge (Fig. 5). Isolectotypes: LE [LE1017996, LE1017997]!p, only plants designated on sheet by W. Becker as *V. prionantha. Original specimens:* P [P02141148]!h.; K [000327780]!p; G [without a barcode, stored under *Viola prionantha*]!h, examined by Becker in 1915, 1928.

Chromosome Numbers. 2n = 24 [ALT] as *V. irinae* (Krivenko et al. 2015), [PRM] as *V. woroschilovii* (Probatova et al. 2016a)]; 2n = 48 [China], [ALT] as *V. irinae* (Krivenko et al. 2012), [KOR] as *V. seoulensis*, [RFE] (Probatova et al. 2012b).

Hybrids. Within the sect. with *V. philippica* (Becker 1917b). Further studies are needed to enable morphological differences between the two ploidy levels 2n =24/48 and to precise the taxonomic status of *V. irinae* (2n = 24) and *V. woroschilovii*. Confusions may have occurred with sympatric related species 2n = 24: *V. irinae* / *V. macroceras* in ALT, *V. woroschilovii* / *V. philippica* in [PRM].

Taxonomy. Incl.: *V. irinae* Zolot., *V. jeniseensis* Zuev, *V. seoulensis* Nakai, *V. taischanensis* Ching J. Wang, *V. woroschilovii* Bezd. Misapplied name: *V. chinensis* auct [KOR] non G. Don. The taxonomy of *V. patrinii* and related species as *V. prionantha* is complex and debated. Plants grouped here under this name have spurs longer than 4 mm, sepal appendages up

Figure 5 Lectotype selected for *V. prionantha* Bunge [LE][LE01017995]. Locations of the neotype here designated on herbarium sheet

to 2 mm long, petioles winged in upper part, whitish roots. Siberian plants, *V. jeniseensis* [KRA] and *V. irinae* [ALT] correspond to disjointed populations located in NW of the main area [China]. *V. prionantha* is morphologically similar to *V. macroceras* (2n = 24) but this last one has more distinctly cordate leaves and unwinged petioles, and also to *V. philippica* that has leaves more triangular (broadest between the base and lower third of blade) and less denticulate. However, genetic studies don't regroup *V. prionantha* and *V. philippica*: the first one seems closer to *V. variegata*, the second to *V. mandshurica* (Yoo et al. 2004, Liang & Xing 2010).

Distribution: [RFE: Ussuri]; adjacent regions [CHI, CHM, KOR-NK]; general range [Sib., China, RFE, E-Asia].

V. seoulensis Nakai, Bot. Mag. (Tokyo) 32: 218. 1918. Loc. cl.: "*Corea: in herbis Seoul*" [KOR-SK: Seoul]. Four syntypes are cited. Lectotype designated (Akiyama & Ohba 2001): TI [02331]!p, leg. Ishidoya no 2446, 05/04/1917; syntypes in TI. Like *V. prionantha*, *V. seoulensis* has whitish roots, oblong to oblong-ovate leaves with slightly winged petioles, purple flowers with long spurs, subglabrous lateral petals, and 2n = 48.

V. woroschilovii Bezd., in Kozhevnikov & Probatova (ed.), Fl. Ross. Dal'nego Vostoka 451. 2006. Loc. cl.: "*Regio Maritima (Primorskij kraj), Chorol distr., in aggere ad viam ferream prope pag. Chorol*", [PRM: Khorolsky District]. Holotype: VLA [10858]!p, leg. T.A. Bezdeleva, 21 August 1986. As *V. prionantha*, its leaves are distinctly crenate and broadest between the lower third and the middle of blades. This taxon is similar to *V. seoulensis* but with 2n = 24. *V. woroschilovii* represents perhaps diploid populations of *V. prionantha*; further studies are needed to confirm this hypothesis and reconsider its status.

23 ***Viola selkirkii* Pursh ex Goldie,** Edinburgh Philos. J. 6(12): 324. 1822

S4 – subg. *Violidium* sect. *Violidium* – T2 P3 – GN

Typification. Loc. cl.: "*Mountains about Montreal, nowhere else*" [E-Canada: Montreal]. Lectotype here designated: K [K000370205]!p, leg. Goldie, "*Montreal*". During his journey in Quebec from 1817 to 1819, the Scottish botanist, J. Goldie (1793–1886), met the author of the *Flora americae septentrionalis,* F.T. Pursh in Montreal (1817). Goldie showed to him this *Viola* that he knew and called "*V. Selkirkii*". Goldie did not say if it was in memory to the famous Scottish privateer, Alexander Selkirk.

Chromosome Numbers. 2n = 12 [KRA] (Stepanov 1994a); 2n = <u>24</u> [Canada, JAP, Sib.], [RFE] as *V. extremiorientalis.* In subg. *Violidium*, all species are considered tetraploid with a haploid number n = 12 (Clausen 1929, Marcussen et al. 2015); the count 2n = 12 is surprising and must be verified.

Hybrids. Within the sect. with *V. tokubuchiana* (Becker & Hulten 1928 as *V. crassicornis*). With sect. *Plagiostigma*: *V. epipsila* (Becker 1915 as *V.* × *klopotovi* Becker). With subg. *Viola*: *V. canina* (Nikitin 2001 as *V.* × *viatkensis* Vl.V. Nikitin), *V. rupestris* (Nikitin 2003 as *V.* × *reschetnikovae* Vl.V. Nikitin); in genus *Viola*, these plants are the only one known natural hybrid between subg. in genus *Viola*.

Taxonomy. Incl.: *V. borealis* Weinm., *V. carnosula* W. Becker, *V. imberbis* Ledeb., *V. kamtschatika* Ging., *V. kapsanensis* Nakai, *V. umbrosa* (Wahlb.) Fries, *V. selkirkii* var. *brevicalcarata* (W. Becker) W. Becker, *V. selkirkii* var. *glabrescens* W. Becker & Hulten. *V. selkirkii* is a circumboreal species with little morphological variability from [N-Amer.] to [Sib]. Variations increase in [RFE, China, JAP-KOR]: white flowers in var. *albiflora* Nakai [JAP, KOR]; subglabrous leaves in var. *glabrescens* W. Becker & Hulten = *V. carnosula* [RFE]; variegated leaves in var. *variegata* Nakai [JAP]; shorter spur in var. *brevicalcarata* [RFE]; bearded lateral petals in var. *subbarbata* W. Becker [China]. Some closely related species appear also: *V. tokubuchiana*, *V. violacea*, *V. sieboldii*.

Distribution: [RFE: Okhotsk, Aldan, Kamchatka, Lower-Zeya, Bureya, Amgun, Ussuri, N- and S-Sakhalin, S-Kuril]; adjacent regions [CTA, CHI, CHM, JAP-HK, KOR-NK, ASK]; general range [N-Amer.: Subarctic Amer., W- & E-Canada, NE-, NC- & NW-USA; Eur.: N- & E-Eur.; Asia-Temp.: Cauc., Sib., MON, China, RFE, E-Asia].

V. carnosula W. Becker, Beih. Bot. Centralbl., Abt. 2, 36 (2): 57. 1918. Loc. cl.: "*Kamtschatka. Umgebung von Malki (oder Malka)*" [S-KAM: Malki]. Only one specimen cited in protologue that must be considered as holotype (Art. 9.1 note 1): LE [LE01026033]!p, leg. Promopopov, 2 June 1908, det. Becker 1917 as "*Viola carnosula W. Bckr. spec. nov.*". Becker & Hulten (1928) placed this taxon as synonym of *V. selkirkii* var. *glabrescens.*

V. kamtschatika Ging., Linnaea 1: 406. 1826. Loc. cl.: "*recueillie au Kamtschatka en 1816 par Mr. Adelbert de Chamisso*" [KAM]. Lectotype undesignated; original material untraced. A. de Chamisso was a French-German botanist who made a scientific voyage round the world (1815–1818) on the Russian ship *Rurik.*

V. selkirkii var. *angustistipulata* W. Becker, Beih. Bot. Centralbl., Abt. 2, 34(2): 245. 1916. Loc. cl.: "*Altai, lacus Telezkoe* [...] *Manshuria* [...] *fluv. Jalu superior circa Schis-si-da-gou* [...] *fluv. Sungari* [...] *Ussuri, Checheir*" [ALT, CHM, KHA]. Lectotype designated (Byalt 2018): LE [LE01017941]!p, leg. Desoulavy no 1486, 20 August 1908, "*Хехцир*" (= Hehcir), det. Becker in 1916 as "*Viola selkirkii Pursh* var. *angustistipulata Bckr*". The location cited into Russian on the lectotype original label corresponds to a mountain ridge in [S-KHA: 48º10'N, 135º03'E] (LE, M. Legchenko, pers. com.). The original material conserved in LE is heterogeneous: specimen LE01017942 comparable with the lectotype while LE01017940 and LE0101739 from Altai look like W-populations of *V. selkirkii* (leaf blades more rounded with apex less pointed). Specimens from the [RFE] are regarded as *V. extremiorientalis* (cf. no 24).

V. selkirkii var. *brevicalcarata* (W. Becker) W. Becker, Beih. Bot. Centralbl., Abt. 2, 34 (2): 414. 1917. Basyonym: *V. selkirkii* fa. *brevicalcarata* W. Becker, in B. Fedtschenko, Fl. Aziat. Ross. 8: 73. 1915. Loc. cl. (Becker 1917a): "*Mandschurei, Wladiwostok*" [PRM: Vladivostok]. No gathering is noted in the protologue. Original material studied by Becker in 1914 was traced in LE. Lectotype here designated: LE [LE01017938]!p, leg. N.A. Palczewski, no precise location or date, only "*Plantae Extremi Orientis 1885–1909*". Plants with short spur 4–5 mm (measurements on sheet).

V. selkirkii var. *glabrescens* W. Becker & Hulten, Ark. Bot. 22A (3): 8. 1928. Many syntypes from [KAM]. Lectotype here designated: S [S-G-6378]!p, leg. Hulten no 346, 8 July 1920, "*Syd-Kamtchatka Savoiko, Mt. Palovinaja 700 m".* Heterotypic synonym: *V. carnosula* W. Becker. Plants with large subglabrous leaves seem to be a form of *V. selkirkii* found at high altitudes (Becker & Hulten 1928).

24 ***Viola tokubuchiana* Makino,** Bot. Mag. (Tokyo) 16: 129. 1902, emend. Nakai (1922)

S2a – subg. *Violidium* sect. *Violidium* – T2 P3 – GN

Typification. Loc. cl.: "*Prov. Musashi […] Prov. Shimotsuke […] Prov. Ishikari in Hokkaido*" JP-HN, JP-HK. Several syntypes in protologue. Lectotype designated (Akiyama & Ohba 2001): TI [02350]!p, leg. S. Okubo, 17 May 1887, [JAP-HN: Tochigi Prefecture, Nikkō]. According to Nakai (1922 p. 36), the type material is composed of three taxa with variegated leaves: *V. tokubuchiana* s.s., *V. selkirkii* and *V. takedana.* Nakai gives to type specimen the nom. superfl. *V. nikkoensis.*

Chromosome Numbers. n = 12 [JAP] as *V. takedana*; 2n = 24 [JAP].

Hybrids. Within the sect. with species 2n = 24 (Hama 1975): *V. albida* (as *V. eizanensis*, *V. chaerophylloides*), *V. yezo-*

ensis. Any hybrid with *V. selkirkii* was noted in [JAP]. Becker & Hulten (1928) described *V. crassicornis* × *V. selkirkii;* considering that *V. crassicornis* can be included under *V. tokubuchiana*, hybrids *V. selkirkii* × *V. tokubuchiana* could exist.

Taxonomy. Incl.: *V. crassicornis* W. Becker & Hulten, *V. extremiorientalis* Voroschilov. & N.S. Pavlova, *V. funghuangensis* P.Y. Fu & Y.C. Teng, *V. nikkoensis* Nakai, *V. scabrida* Nakai, *V. takedana* Makino, *V. selkirkii* var. *angustistipulata* W. Becker p.p. plants from the [RFE]. *V. tokubuchiana* differs in leaves with more acute apex (particularly var. *takedana*) and a more protruding beak on the style (Igari 1996 p. 166–168). Descriptions are often in contradiction, e.g. *glabrous lateral petals* for Nakai (1922) or *bearded* for Akiyama & Ohba (1999). *V. tokubuchiana* is closely related to *V. selkirkii*; further studies are needed to confirm its specific status. It should be sought in Kurils islands and [KAM].

Distribution: [RFE: Kamchatka, Ussuri]; adjacent regions [CHI, CHM, JAP-HK, KOR-NK]; general range [China, RFE, E-Asia].

V. takedana Makino, Bot. Mag. (Tokyo) 21: 57. 1907. Loc. cl.: "*Japan; middle and northern*" [JAP]. Several collectors are cited in protologue without anymore information. Lectotype undesignated. Original material untraced in TI and MAK.

V. crassicornis W. Becker & Hulten, Ark. Bot. 22A(3): 3. 1928. Loc. cl.: "*South Kamtchatka: Between Bolsheredsk and Apatcha* […] *East Kamtchatka: Petropavlosk* […] *Central Kamtchatka: Klutchi*". Holotype: S [S-G-6370]!p, leg. and det. Hulten no 1649, 8 June 1921, "*Kamtchatka australis: Petropavlovsk*", det. Becker 1926. Isotypes: S [S11-32073, S11-32076]!p. In the protologue, *V. crassicornis* is considered as a closely related species of *V. selkirkii* that is present also on the spot. Becker knew *V. tokubuchiana* through Makino's description but he never cites Nakai (1922); he says that he didn't see any specimen (Becker 1923c p. 130). The authors think *V. crassicornis* is closely related to *V. tokubuchiana.* Morphological characteristics, flower color and leaf shape, allow including *V. crassicornis* under *V. tokubuchiana* s.l. After anthesis, it is difficult to differentiate *V. crassicornis* from *V. selkirkii* (Becker & Hulten 1928).

V. extremiorientalis Vorosch. & N.S. Pavlova, Byull. Glavn. Bot. Sada 69: 79. 1968. Loc. cl.: "*in rupibus calcareis partis australis regionis Primorskensis necnon in Korea boreali et China Borealiorientali*" [PRM, KOR-NK, CHM]. Holotype n.v. [MHA], leg. N.S. Pavlova, 23 May 1966, "*in cacumine lapidoso montis Chalban*" [PRM: Khasansky District]. Synonym cited in the protologue: *V. selkirkii* var. *angustistipulata* W. Becker p.p. (only plants from Ussuri). Diagnosis of protologue, description and pictures in Bezdeleva (1987), specimens from VLA allow to suppose that this taxon is closely related to *V. selkirkii*; however it is different by its more ovate and acute leaves, bearded lateral petals. It cannot be integrated to *V. albida* as proposed by Czerepanov (1995) because its sepal appendages are too small and its spurs too big; moreover, this taxon is closely related to *V. tokubuchiana* which has similar leaves.

Approved Infraspecific Taxa:

***V. tokubuchiana* var. *takedana* (Makino) F. Maek.**, in H. Hara, Enum. Spermatophytarum Japon 3: 28. 1954. Distribution: [KOR, JAP-HK, CHM: Jilin].

***V. tokubuchiana* var. *extremiorientalis* (Vorosch. & N.S. Pavlova) Espeut, comb. & stat. nov**. Basionym: *V. extremiorientalis* Vorosch. & N.S. Pavlova, Byull. Glavn. Bot. Sada 69: 79. 1968. Distribution: [KOR-NK, CHM, RFE: Ussuri].

***V. tokubuchiana* var. *crassicornis* (W. Becker & Hulten) Espeut, comb. & stat. nov.** Basionym: *V. crassicornis* W. Becker & Hulten, Ark. Bot. 22A(3): 3. 1928. Distribution: [RFE: Kamchatka].

Key to varieties from [China, RFE]:

1 Ratio length/width of narrowest leaf blades > 1.7; flowers rose-purple or white .... **var. *takedana***
– Ratio length/width of narrowest leaf blades ≤ 1.7; flowers nearly white **2**

2 Spur stout, ≤ 6 mm long; upper leaf blade subvariegated .. .. **var. *crassicornis***
– Spur slender, 6–8 mm long; upper leaf blade concolor .... **var. *extremiorientalis***

25 *Viola variegata* Fisch. ex Link, Enum. Hort. Berol. Alt. 1: 240. 1821

S4 – subg. *Violidium* sect. *Violidium* – T2 P3 – GN

Typification. When he described this species in 1821, Link was curator of the herbarium of the botanic garden "*Hortus regius berolinensis"* (Berlin). In the protologue, he attributes the name *V. variegata* to Fischer, without a mention of the type, gathering or geographic location. Link has certainly studied specimens sent by Fischer who was director of the botanic garden "*Hortus Gorenkensis"* (Moscou). Link's original material could not be traced. A neotype can be selected in Fischer's material. Specimens named by Fischer are labeled "*Viola variegata m.*" (*m.* means *mihi* = myself = Fischer). Such specimens were traced in G-DC and LE. I choose a specimen with a date prior to the protologue (1821). Neotype here designated: G-DC [G00208825]!h, leg. Vlassov, 1819, "*pr. Nertsch. Savod. & Doroninsk*" [CTA: near Nerchinsky Zavod and Doroninskoye], as "*Viola variegata m.*".

Chromosome Numbers. n = 12 [JAP]; 2n = 24 [China, JAP], [Sib.] as *V. variegata* and *V. ircutiana*, [RFE] as *V. variegata, V. primorskajensis.*

Hybrids. Within the sect. with species 2n = 24, 48: *V. dactyloides* (Nikitin 2007), *V. japonica*, *V. mandshurica*? (Maekawa 1954 as *V. kisoana* Nakai), *V. phalacrocarpa*, *V. philippica* (as *V. yedoensis*).

Taxonomy. Incl.: *V. baicalensis* W. Becker, *V. primorskajensis* (W. Becker) Vorosch., *V. umemurae* Makino. The closely related taxa of *V. variegata* differ in leaf color and leaf hairiness, vein color, (white variegated or not). Japanese populations (var. *nipponica* Makino) and those from the [RFE] (*V. primorskajensis*) have dark green leaves, not or indistinctly white variegated along veins, puberulous on both faces when young.

Distribution: [RFE: Dauria, Lower-Zeya, Bureya, Ussuri, S-Sakhalin]; adjacent regions [CTA, CHI, CHM, KOR-NK]; general range [China, MON, Sib., RFE, E-Asia].

V. baicalensis W. Becker, Beih. Bot. Centralbl., Abt. 2, 34(2): 250. 1916. Loc. cl.: "*Siberien, Prov. Irkutzk, Distr. Balagansk, in pascuis pr. Bashejewsky*" [IRK]. Only one specimen cited in protologue that must be considered as holotype (Art. 9.1 note 1): according to Juzepczuk (1949) in LE n.v. Isotype: G [G00366105]!p, leg. M. Malzew no 1210a., 10 June 1903, as "*Viola variegata Fisch.*", "*prov. Irkutzk (Siberia) distr. Balagansk. In pascuis pr. Bashejewsky*" [IRK: Balagansky District], det. Becker 1928 as "*Viola baicalensis W. Bckr. fol. prof. et anguste cordata !!*". Juzepczuk (1949 pp. 415–416) thinks there was a label inversion between this specimen and that which labeled 1210b n.v. gathered by Pal'chevskii near Vladivostok. Indeed, *V. baicalensis* has leaf blades puberulous, not variegated, deeply cordate, similar to [RFE] populations and different from those of Baikal region that correspond to *V. tenuicornis* (cf. no 26).

V. primorskajensis (W. Becker) Vorosch., in A.K. Skvortsov (ed.), Florist. issl. v razn. raĭonakh SSSR 182. 1985. Basionym: *V. tenuicornis* subsp. *primorskajensis* W. Becker in Beih. Bot. Centralbl., Abt. 2, 34 (2): 250. 1916. Loc. cl.: "*Mandschurei, Primorskaja: in der Gegend des Chanka-Sees; Wladiwostok*"

[PRM: Lake Khanka]. Lectotype designated (Byalt 2018): LE [LE01015927]!p, leg. N.A. Palczewsky, 14 May 1885, as "*Viola sylvestris Lam.?*", "*Ussurijskij kraj, Pesčanye rëlki po beregu oz. Hanka meždu der. Abrihanskoj i r. Erik*" [PRM: sandy sloping ridge on the shore of Khanka Lake between Astrakhanka village and channel Erik], det. Becker in 1916 as "*Viola tenuicornis Bckr. subsp. primorskajensis Bckr.*". Isolectotypes: LE [LE01015928, LE01015929]!p. Regel (1862 p. 471) describes *V. variegata* var. *chinensis* Bunge ex Regel for separate [China] and [PRM] populations from [CTA] type. This var. has not variegated, more pubescent leaf blades. Regel has examined Maack's gatherings from Ussuri. In 1915, Becker published *V. variegata* subsp. *chinensis* (Bunge) W. Becker, then in 1916, named *V. tenuicornis* s.s. (= *V. variegata* subsp. *chinensis*) Chinese populations and *V. tenuicornis* subsp. *primorskajensis,* the Russian ones, with more rounded and clearly cordate leaves. Becker didn't cite any specimen. Then this taxon was included under *V. variegata* s.s. (Juzepczuk 1949, Chen et al. 2007) or considered as a species (Bezdeleva 1987). According to my approach, the leaf color (variegated or not), the hairiness of lateral petals (bearded or not), don't justify a new species, but I consider that the leaf blade shape (distinctly orbiculate) allows to include it under *V. variegata* s.l. *V. primorskajensis* is closely related with var. *nipponica* Makino that has leaf blades hairy, concolor or subvariegated above, purple beneath; ovary and sepals puberulous.

Approved Infraspecific Taxa:

V. variegata **subsp.** ***variegata.*** Distribution: [China; MON; CTA; RFE: Dauria, Lower-Zeya, Bureya, Ussuri, S-Sakhalin (Berkutenko & Polezhaev 2005)].

V. variegata **subsp.** ***primorskajensis*** **(W. Becker) Espeut, comb. nov.** Basionym: *V. tenuicornis* subsp. *primorskajensis* W. Becker, Beih. Bot. Centralbl., Abt. 2, 34(2): 250. 1916. Homotypic synonym: *V. tenuicornis* subsp. *primorskajensis* W. Becker, *V. primorskajensis* (W. Becker) Vorosch. Heterotypic synonym: *V. baicalensis* W. Becker, *V. umemurae* Makino, *V. variegata* var. *nipponica* Makino. Distribution: [China?, JAP, RFE: Ussuri].

Key to subsp. of *V. variegata* from the [RFE]:

1 Leaves frequently white variegated, (sub)glabrous; ovary glabrous .... **subsp.** ***variegata***

– Leaves concolor or somewhat variegated, hairy; ovary puberulous .... **subsp.** ***primorskajensis***

26 *Viola tenuicornis* W. Becker, Beih. Bot. Centralbl., Abt. 2, 34 (2): 248. 1916

S2 – subg. *Violidium* sect. *Violidium* – T2 P3 – GN

Typification. Loc. cl.: "*Nordost-China*". Several syntypes from [China]. Lectotype here designated: G [G00418176]!p, unnamed collector, received from "*acad. Imp. Petropol. 1835*", as "*Viola variegata Fisch. China*", det. Becker in 1916 as "*Viola tenuicornis Bckr*" then reviewed in 1928. Isolectotype: K [K000327764]!p. Syntypes: Bunge no 43, Schindler no 32 and Giraldi no 5962 could not be found.

Chromosome Numbers. 2n = 24 [China] as *V. tenuicornis,* [BRY] as *V. ircutiana* (Krivenko et al. 2012), as *V. trichosepala* (Krivenko et al. 2013), [RFE] as *V. trichosepala.*

Hybrids. Unknown.

Taxonomy. Incl.: *V. ircutiana* Turcz., *V. trichosepala* (W. Becker) Juz., *V. variegata* subsp. *chinensis* (Bunge ex Regel) W. Becker. This species is closely related to *V. variegata,* however *V. tenuicornis* has leaf blades less cordate, more ovate at fruiting. Further studies are needed to confirm the specific status of *V. tenuicornis* that has the same chromosome number as *V. variegata* (2n = 24). Leaf blades of *V. tenuicornis* are no or somewhat white variegated, lateral petals are no or scarcely bearded.

Distribution: [RFE: Dauria, Lower-Zeya, Ussuri]; adjacent regions [CHI, CHM, KOR-NK]; general range [China, Sib., RFE, E-Asia].

V. ircutiana Turcz., Bull. Soc. Imp. Naturalistes Moscou 15: 298. 1842. Loc. cl.: "*In colle sicco ad rivulum Kaja prope Ircutiam copiose. Pauca specimina praeterea legi ad Angaram prope ostium fluvii Kuda. Majo.*" [IRK]. Lectotype designated (Byalt 2018): LE [LE01024030]!p, leg. Turczaninow, "*Ircutia 1828*", selected as lectotype on sheet by Nikitin. Isolectotypes: LE [LE01024031, LE01024032, LE01024033]!p, P [P02141088, P05480015]!h, G [without barcode, stored under *Viola variegata*]!h. I include this taxon under *V. tenuicornis* because its leaf blades are few cordate and ovate after flowering.

Approved Infraspecific Taxa:

V. tenuicornis **subsp.** ***tenuicornis***. Distribution: [China]

V. tenuicornis **subsp.** ***trichosepala*** **W. Becker**, Beih. Bot. Centralbl., Abt. 2, 34(2): 249. 1916. Loc. cl.: "*Mandschurei, Blagowestschensk, in Gebüschen*", [AMU: Blagoveshchensk]. Three syntypes from [AMU]. Lectotype designated (Byalt 2018): LE [LE01024034]!p, leg. Karo no 320 (misprint in protologue "*nr. 230*"), Blagoveshchensk, 1913; selected as lectotype on sheet by Nikitin and Byalt. Syntypes: *Karo no 134,* G [without a barcode, stored under *Viola tenuicornis*]!p, P [P04730710]!p; *Komarov no 1105* untraced. Homotypic synonym: *V. trichosepala* (W. Becker) Juz. It is hairier than the type: leaves, sepals, ovary are pubescent. Distribution: [China; Sib.: BRY; KOR-NK; RFE: Lower-Zeya, Ussuri].

V. tenuicornis **subsp.** ***ircutiana*** **(Turcz.) Espeut, comb. & stat. nov.** Basionym: *V. ircutiana* Turcz., Bull. Soc. Imp. Naturalistes Moscou 15: 298. 1842. Homotypic synonym: *V. variegata* var. *ircutiana* (Turcz.) Regel. Distribution: [Sib.: BRY, IRK; RFE: AMU (Dauria, Skovorodinsky District, Bezdeleva et al. 2006)].

Key to subspecies of *V. tenuicornis*:

1 Sepals ciliate and ovary puberulous ... **subsp.** ***trichosepala***

– Sepals and ovary glabrous **2**

2 Spur slender, often curved upward, long 5–9 mm .... **subsp.** ***tenuicornis***

– Spur thick, straight, short 3–6 mm .... **subsp.** ***ircutiana***

Viola sect. *Plagiostigma* Godr., Fl. Lorraine, ed.2, 1: 90. 1857.

Type: *V. palustris* L. It is the only one cited in the protologue of sect. *Plagiostigma.*

Synonym: *V.* [*Sippe*] *Stolonosae* Kupffer, in Oesterr. Bot. Z. 53(8): 329. 1903.

Chromosome Numbers: 2n = 24; auto- or allopolyploids: 2n = 48; errors or aneuploids: 2n = 44.

Hybrids. Some hybrids within the sect. A single natural hybrid with sect. *Violidium*: *V. epipsila* × *V. selkirkii* (Becker 1915). With sect. *Vaginatae*: *V. shikokiana* × *V. vaginata* (*V. shikokiana* is sometimes included under sect. *Vaginatae*: Hama 1975).

Characters. Plants without annual stems; rhizome horizontal, slender, long-jointed, branched, producing flowers and few leaves at tip (Fig. 3B). Leaves rounded, obtuse or mucronate never long acute; stipules free or weakly adnate near the base. Top of style truncate, margined on lateral sides and abaxially, shortly but distinctly beaked in front. Habitat: bogs, moist forests, river banks.

Distribution: [N-Amer.; S-Amer.: Caribbean, W-South Amer.; Afr.: N-Afr., Macaronesia; Eur.; Asia-Temp.: W-Asia., Sib., China, RFE, E-Asia].

27 *Viola epipsila* Ledeb., Index Seminum [Tartu] 5. 1820

S4 – subg. *Violidium* sect. *Plagiostigma* – T2 P3 – GN

Typification. Loc. cl.: "*Legi frequentem circa Dorpatum locis* *humidis*" [Estonia: Dorpat = Tartu]. Lectotype here designated: M [M0165333]!p, leg. Ledebour, "*prope Dorpat*".

Chromosome Numbers. Subsp. *epipsila* n = 12 [DEN]; 2n = 24: [E-Eur., FIN, ICE, NOR, POL]. Subsp. *repens* n = 12 [JAP]; 2n = 24 as *V. repens* or *V. epipsiloides* [JAP, Sib., RFE, ASK]. Subsp. *palustroides* n = 12 [ASK] as *V. achyrophora* (Sorsa 1968).

Hybrids. Within the sect. with species 2n = 48: *V. palustris* (frequent). With sect. *Violidium* species 2n = 24: *V. selkirkii* (as *V.* × *klopotovi*: Becker 1915).

Taxonomy. Incl.: *V. achyrophora* Greene, *V. epipsiloides* A. Löve & D. Löve, *V. palustroides* (W.Becker) Tzvelev, *V. repens* Turcz. non Schwein. Asian and N-American populations constitute *V. epipsila* subsp. *repens* (Turcz.) W. Becker that differs from type in smaller size, blades with a more acute apex and subglabrous beneath. *V. epipsila* subsp. *palustroides* W. Becker has blades more rounded at apex, pale purple conspicuous flowers 15 mm long (with spur), with lateral petals beardless, and distinct spur 3 mm long. Becker & Hulten (1928) regarded this plant as a mountain form of *V. epipsila* subsp. *repens*. *V. achyrophora* Greene, from Bering Sea (Pribilof Islands), has leaves and flowers very similar to those of *V. epipsila* subsp. *palustroides*. I think these taxa can be grouped together. Marcussen et al. (2012) argues that *V. palustris* (2n = 48) is an allopolyploid formed from *V. epipsila* s.l. and *V. pallens* (cf. no 28).

Distribution: [RFE: all districts, S-Kuril (Akiyama et al. 1999)]; adjacent regions [YAK, CTA, CHI, CHM, KOR-NK, JAP-HK, ALU, ASK]; general range [N-Amer.: Subarctic-Amer., E- & W-Canada, NE-USA; Eur.: M-, N- & E-Eur.; Asia-Temp.: Sib., China, RFE, E-Asia].

V. achyrophora Greene, Pittonia 5: 33. 1902. Loc. cl.: "*St. Paul Island, Bering Sea*" [ASK: Saint Paul Island]. Only one specimen cited in protologue that must be considered as holotype (Art. 9.1 note 1): NDG [NDG32053]!p, leg. J. M. Macoun, July 1897, as "*Viola palustris L.*", det. *as "Viola achyrophora Greene, type!"*.

V. repens Turcz. ex Trautv. & C.A. Mey. non Schwein. [1822], Fl. Ochot. Phaenog. in A.T. Middendorff, Reise Sibir. 1, 2(2): 18. 1856, nom. homon. Loc. cl.: "*In regione Bosuda-Alamyta 30 Maji (florens), prope Udskoi 3 jun. (florens) nec non 9 jun. (florens) collecta est.*" [KHA: Udskoe]. Lectotype designated (Nikitin 2008 p. 180) n.v. LE, leg. Middendorff no 819, 30 May, Bosuda-Alamyta. *V. repens* Schwein. in Amer. J. Sci. Arts 5: 70. 1822, is an American taxon related to *V. striata* Ait. that belongs to sect. *Trigonocarpae*.

V. epipsiloides A. Löve & D. Löve, Bot. Not. 128: 516. 1976, nom. nov. based on *V. repens* Turcz. ex Trautv. & C.A. Mey. [1856] non Schwein [1822].

Approved Infraspecific Taxa:

V. epipsila **subsp.** ***epipsila***. Distribution: [Eur., Asia-Temp.: Sib.].

V. epipsila **subsp.** ***repens*** **(Turcz. ex Traut. & C.A. Mey.) W. Becker**, Beih. Bot. Centralbl., Abt. 2, 34: 406. 1917. Homotypic synonym: *V. repens* Turcz. ex Trautv. & C.A. Mey. non Schwein., *V. epipsiloides* A. Löve & D. Löve. Distribution: [N-Amer.; Asia-Temp.: China, Sib., RFE, E-Asia,].

V. epipsila **subsp.** ***palustroides*** **W. Becker**, Repert. Spec. Nov. Regni Veg. 17: 72. 1921. Loc. cl.: "*Kamtchatka*". No specimen cited in protologue. Lectotype undesignated. Homotypic synonym: *V. palustroides* (W. Becker) Tzvelev; *V. epipsila* var. *palustroides* (W. Becker) W. Becker & Hulten. Heterotypic synonym: *V. achyrophora* Greene. Becker & Hulten (1928) cite several specimens and believe that this taxon is a mountain form of *V. epipsila* subsp. *repens*. Distribution: [RFE: Chukotka (Bezdeleva et al. 2006), Kamchatka, Ussuri (Kozhevnikov & Kozhevnikova 2014)]; [Subarctic Amer.: ASK as *V. achyrophora* (Sorsa 1968), ALU (Tatewaki & Kobayashi 1934)].

Key to related taxa of *V. epipsila*:

1 Spurred petal (with spur) 9–13 mm long, spur 1–2 mm long .... ***V. palustris***
– Spurred petal (with spur) 13–20 mm long, spur 1.5–3 mm long .... **2** ***V. epipsila***

2 Leaf blades with apex rounded or obtuse, rarely slightly acute; pale colored flowers . ***V. epipsila*** **subsp.** ***palustroides***
– Leaf blades with apex acute or obtuse, rarely rounded; purple flowers **3**

3 Leaf blades up to 5 cm wide during anthesis, up to 10 cm after, ± pubescent beneath .... ***V. epipsila*** **subsp.** ***epipsila***
– Leaf blades up to 3 cm wide during anthesis, up to 6 cm after, glabrous rarely somewhat pubescent beneath .... ***V. epipsila*** **subsp.** ***repens***

28 ***Viola pallens*** **(Banks ex Ging.) Brainerd,** *Rhodora* 7(84): 247. 1905

S4 – subg. *Violidium* sect. *Plagiostigma* – T2 P3 – GN

Basionym: *V. rotundifolia* var. *pallens* Banks ex Ging., in A.P. de Candolle, Prodr. 1: 295. 1824.

Typification. Loc. cl.: "*in Labrador et Kamtschatka*" [E-Canada: Labrador]. Plants from [KAM] belong to *V. hultenii*. Lectotype designated (Ballard et al. 2001): BM [BM000617600]!p, leg. J. Williams, "*Labrador*", det. Becker 1928 *as "V. epipsila sbsp. repens (Turcz.) W. Becker"*, det. H.E. Ballard 1995 as lectotype of *V. rotundifolia* var. *pallens* Banks ex Ging. Homotypic synonym: *V. macloskeyi* subsp. *pallens* (Banks ex Ging.) M.S. Baker.

Chromosome Numbers. 2n = 24 [Canada] as *V. pallens* or *V. macloskeyi,* [JAP] as *V. hultenii.*

Hybrids. Within the sect. with species 2n = 24 *V. lanceolata* (Russel 1965 p. 91).

Taxonomy. Incl.: *V. hultenii* W. Becker. Misapplied name: *V. blanda* auct. ant. [RFE] non Willd. Asian populations were first named *V. rotundifolia* var. *pallens* Banks ex Ging. Gingins (1824) regrouped under this name plants of Kamtchatka and Labrador. Later, they were identified as *V. blanda* Willd. (Regel 1862, Becker 1917a) until Becker & Hulten (1928) create a new species: *V. hultenii*. American plants were named *V. pallens* (Banks ex Ging.) Brainerd, then ranked as a subsp. of *V. macloskeyi* (Ballard et al. 2001). Marcussen et al. (2012) show that *V. macloskeyi* and *V. pallens* are genetically distant. *V. pallens* is more northern than *V. macloskeyi* [SW-USA] and possesses leaves with flat crenate margins as *V. hultenii*. *V. blanda* is an American related species with 2n = 48; its leaves are biggest, with a deeper sinus and more hairy; its capsules are purple-red punctate, while those of *V. hultenii* and *V. pallens* have no dots. Marcussen et al. (2012) argue that *V. palustris* (2n = 48) is an allopolyploid resulting from *V. epipsila* s.l. and *V. pallens*, such as Eurasian populations.

Distribution: [RFE: Kamchatka, N- and S-Kuril]; adjacent regions [JAP-HK]; general range [N-Amer.: W- & E-Canada, NW-, NC- & SE-USA; S-Amer.: Caribbean; Asia-Temp.: RFE, E-Asia,]. For America, I follow Ballard et al. (2001): *V. pallens* is an Amphi-Pacific species.

V. hultenii W. Becker, in W. Becker & Hulten, Ark. Bot. 22A (3): 4. 1928. Loc. cl.: "*Kamtchatka, Kurile Islands, Yezo and Nippon*" [KAM, KUR, JAP]. In the protologue, Becker cites several syntypes. Lectotype here designated: S [S-G-6373]!p, leg. Hulten no 1815, 24 June 1920, as "*Viola Hultenii Bckr.*", "*Kamtchatka australis: Between Petropavlovsk and Avatcha*" [S-KAM: Yelizovsky District].

Approved Infraspecific Taxa:

V. pallens **subsp.** ***pallens***. Distribution: [N-Amer.]

V. pallens **subsp.** ***hultenii*** **(W.Becker & Hulten) Espeut, comb. & stat. nov.** Basionym: *V. hultenii* W. Becker, W. Becker & Hulten, Ark. Bot. 22A (3): 4. 1928. This taxon differs from subsp. *pallens* by its leaves with scattered whitish hairs above (especially near margin) and below sometimes near the base. Distribution: [RFE, JAP].

Key to *V. pallens* s.l. and its closely related species:

1 Capsules reddish (purple-red punctate); lateral petals glabrous; leaf blades pubescent .... ***V. blanda***

– Capsules green; lateral petals bearded or glabrous; leaf blades glabrous or slightly pubescent 2

2 Leaf blades slightly pubescent on margins and near the base; lateral petals glabrous .... ***V. pallens* subsp. *hultenii***

– Leaf blades glabrous; lateral petals slightly bearded 3

3 Leaf blades shallowly cordate to truncate, subentire .... ***V. macloskeyi***

– Leaf blades more deeply cordate, distinctly crenate .... ***V. pallens* subsp. *pallens***

Viola sect. *Brachycerae* Espeut, sect. nov.

Type here designated: *V. brachyceras* Turcz.

Nom. inval.: *V.* ser. *Brachycerae* Juz., in Schischkin & Bobrov (ed.), Fl. URSS 15: 405.1949, no Latin description (Art. 39.1).

Chromosome Numbers. 2n = 24; aneuploids: 2n = 20.

Taxonomy. American species included in the sect.: *V. renifolia* A. Gray, *V. brainerdii* Greene. Marcussen et al. (2012) show that *V. renifolia* is in a clade separate from sect. *Plagiostigma* (*V. palustris, V. epipsila*).

Characters. Perennial rhizome ending in a leaf rosette producing flowers, without annual stems (Fig. 3A); rhizome oblique or vertical, short-jointed, never creeping. Leaves rounded, apex obtuse or slightly acute; stipules ½ adnate to petiole (Becker 1917a p. 409). Habitat: mountain forests, river banks or artic-alpine rocky slopes, never in bogs.

Distribution: [N-Amer.; Asia-Temp.: Sib., MON, China, E-Asia].

29 *V. brachyceras* Turcz., Bull. Soc. Imp. Naturalistes Moscou 15: 301. 1842

S4 – subg. *Violidium* sect. *Brachycerae* – T2 P3

Typification. Loc. cl.: "*in rupe, paulo ultra stationem Kruglaja*" [IRK]. Lectotype designated (Byalt 2018): LE [LE01017971]!p, leg. Turczaninov, "*Kruglaja*" 1834, selected on sheet by Nikitin. Isolectotypes: LE [LE01017974, LE01017973]!p; P [P02141136]!p.

Chromosome Numbers. 2n = 20 [IRK, CTA: Krivenko et al. 2013], [ASK] as *V. renifolia* var. *brainerdii* (Dawe & Murray 1981).

Hybrids. Unknown.

Taxonomy. Incl.: *V. blandiformis* Nakai, *V. brainerdii* Greene.

Unlike *Stolonosae* and particularly *V. pallens* s.l., this species does not live in bogs but in wet coniferous woods (*Larix*) and on river banks. Its rhizome is oblique or vertical, thicker and shorter, never creeping and slender. *V. blandiformis* [JAP, KOR] is morphologically similar (short rhizome, glabrous leaves) with a same ecology; it differs only in beardless lateral petals. It is the same for *V. brainerdii*: glabrous leaves except some scattered hairs along veins beneath, lateral petals somewhat bearded; habitat: moist coniferous forests in mountains or on dry crests with alpine-arctic vegetation (Fernald 1912). This taxon is also closely related to *V. renifolia* A. Gray (Fernald 1912) which differs by markedly pubescent leaves, beardless petals and 2n = 24.

Distribution: [RFE: Kolyma, Okhotsk, Aldan, Dauria, Upper- and Lower-Zeya, Bureya, Ussuri]; adjacent regions [YAK, CTA, CHI, CHM, KOR-NK?, JAP-HK, ASK]; general range [N-Amer.: Subarctic-Amer., W- & E-Canada, NE-, NC- & NW-USA; Asia-Temp.: Sib., MON, China, RFE, E-Asia].

V. blandiformis Nakai in Bull. Soc. Bot. France 72: 192. 1925, as '*blandaeformis*'. Loc. cl.: "*Hondo*", JAP-HN. Several syntypes in protologue. Lectotype designated (Akiyama & Ohba 2001): TI [DB 02160]!p, leg. Mochidzuki, July 1910, [JAP (Tochigi pref., Mount Nyoho)]. Syntypes: P [P04697057]!h, leg. Faurie no 2959; TI [DB 02161]!p, leg. Toba. Distribution: [JAP, KOR].

V. brainerdii Greene, Pittonia 5: 89. 1902. Syntypes n.v. from E-Canada. Lectotype undesignated. Homotypic synonym: *V. renifolia* var. *brainerdii* (Greene) Fernald. Distribution: [N-Amer.].

Approved Infraspecific Taxa:

***V. brachyceras* Turcz. var. *brachyceras*.** Heterotypic synonym: *V. brainerdii* Greene. Distribution: [N-Amer.: ASK; Asia-Temp.: China, Sib., MON, RFE]

***V. brachyceras* Turcz. var. *blandiformis* (Nakai) Espeut, comb. & stat. nov.** Basionyme: *V. blandiformis* Nakai, Bull. Soc. Bot. France 72: 192. 1925. Distribution: [JAP, KOR].

Key to sect. *Brachycerae*:

1 Leaf blades pubescent on both faces .... ***V. renifolia***

– Leaf blades glabrous on both faces or only along veins beneath 2

2 Corolla with lateral petals bearded .... ***V. brachyceras* var. *brachyceras***

– Corolla with lateral petals glabrous .... ***V. brachyceras* var. *blandiformis***

Viola sect. *Vaginatae* (W. Becker) Ching J. Wang, Fl. Reipubl. Popularis Sin. 51: 85. 1991

Basionym: *V.* [*Gruppe*] *Vaginatae* W. Becker, Beih. Bot. Centralbl., Abt. 2, 36 (2): 29. 1918.

Type: *V. vaginata* Maxim. (Art. 10.8).

Chromosome Numbers. 2n = 24; aneuploids: 2n = 20, 22; polyploids: 2n = 40

Hybrids. Some hybrids within the sect. (Hama 1975). One hybrid with sect. *Plagiostigma*: *V. shikokiana* × *V. vaginata* (as Becker 1925, I consider that *V. shikokiana* belongs to sect. *Plagiostima*). The count 2n = 24 as *V. papilionacea* Pursh (Probatova et al. 2009) cannot correspond to this American species that belongs to the high-polyploid sect. *Boreali-Americanae* (cf. subg. *Violidium*); counts for this species are 2n = 52, 54. *V. papilionacea* auct. [RFE] is a weed growing near Vladivostok, and seen for the first time in 1998 in the botanical garden of Vladivostok (Probatova, pers. com.). Other unpublished counts, 2n = 26, 32, 34 (Probatova, unpublished data) suggest that this taxon is probably of hybrid origin. It is morphologically related to *V. rossii* Forbes & Hemsl. More studies are needed to clarify its status.

Taxonomy. Sect. *Vaginatae* is morphologically and genetically closely related to sect. *Plagiostigma* (Marcussen et al. 2012, 2015).

Characters. Plants without annual flowering stems (except *V. moupinensis*); rhizome thick, short-jointed, producing flowers and few leaves at tip (Fig. 3B). Leaves long acute to acuminate; stipules free or weakly adnate near the base. Top of style truncate, margined on lateral sides and abaxially, shortly but distinctly beaked in front.

Distribution: [Asia-Temp.: China, MON, RFE, E-Asia; Asia-Trop.: Indi., Indo-China].

30 *Viola yazawana* Makino, Bot. Mag. (Tokyo) 16: 158. 1902

S3 – subg. *Violidium* sect. *Vaginatae* – T1 P3 – GN

Typification. Loc. cl.: "*Prov. Shinano: Mt Togakushi*" [JAP

(Mount Togakushi in Nagano prefecture)]. Two syntypes cited in the protologue: "*K. Matsuoka ! July 1901; K. Tanaka ! May 1902*". Lectotype undesignated; syntypes untraced in TI and MAK.

Chromosome Numbers. 2n = 20 [JAP], [RFE] as *V. chassanica*; 2n = 40 [RFE] as *V. chassanica* or *V. yazawana* (Probatova et al. 2012a).

Hybrids. Unknown.

Taxonomy. Incl.: *V. chassanica* Kork.

Distribution: [RFE: Ussuri]; adjacent regions [KOR-NK]; general range [RFE, E-Asia: JAP, KOR].

V. chassanica Kork., Bot. Zhurn. (Moscow & Leningrad) 71: 87. 1986. Loc. cl.: "*Chassan (prov. Primorskensis); Respublica Democratica Popularis Corea*" [KOR-NK, PRM: Khasan]. Holotype VLA !p, leg. Korkischko, 20 June 1984, "*Chassan, in fluxu sup. fl. Baraschevka, 10 km boreali-occidentem a pago Ovczinnikovo*". This taxon is closely related to *V. yazawana*; the main differences concern more acute sepals for *V. yazawana* and bigger capsules for *V. chassanica*: 9–11 mm de long vs. 7–8 mm. The protologue indicates that this taxon grows in [KOR-NK], however Korean authors make only reference to *V. yazawana* (Lee 1996, Lee 2006). Some Russian botanists (Probatova et al. 2012a) think that *V. chassanica* may be included under *V. yazawana*. Further studies are needed to enable morphologic differences between the two ploidy levels (2n =20, 40), and perhaps to consider *V. chassanica* as a biological species with 2n = 40.

31 ***Viola diamantiaca* Nakai,** Bot. Mag. (Tokyo) 33:205. 1919

S2a – subg. *Violidium* sect. *Vaginatae* – T2 P3 – GN

Typification. Loc. cl.: "*Corea media: in montibus Kongosan*" [KOR-NK: Mount Kumgang]. Several syntypes cited in protologue. Lectotype designated (Akiyama & Ohba 2001): TI [DB 02195]!p, leg. Nakai no 5661, 5 August 1916, Mount Kumgang. Syntypes: TI.

Chromosome Numbers. 2n = 24 [RFE] as *V. rossii* (Probatova & Sokolovskaya 1988).

Hybrids. Unknown.

Taxonomy. Misapplied names: *V. rossii* auct. [RFE] non Forbes & Hemsl., *V. serpens* auct. ant. [KOR] non Ging.

Kozhevnikova et al. (2007) showed that *V. rossii* auct. [RFE] corresponds to Korean species *V. diamantiaca*. This taxon differs from *V. rossii* by its long underground stolons and cleistogamous flowers. It is related to *V. rossii* (2n = 24) which is adapted to colder environments. The relationship between these two species is proved by phylogenetic studies of Liang & Xing (2010) and Gong et al. (2010).

Distribution: [RFE: Ussuri]; adjacent regions [CHM, KOR-NK]; general range [China, RFE, E-Asia: KOR].

***Viola* sect. *Bilobatae* (W. Becker) Juz.**, in Schischkin & Bobrov (ed.), Fl. URSS 15: 439. 1949

Basionym: *V.* "*Gruppe*" *Bilobatae* W. Becker in Beih. Bot. Centralbl., Abt. 2, 34(2): 226. 1916.

Type: *V. arcuata* Blume. It is the first to be described. Type here designated.

Chromosome Numbers. 2n = 24; aneuploids: 2n = 20; polyploids: 2n = 44.

Hybrids. Natural hybrids with sect. *Diffusae* (Hama 1975) and sect. *Australasiaticae* (Wang & Huang 1992).

Characters. Perennial rhizome ending in a leaf rosette more or less leafy or without a rosette, producing stolons or stems, erect or decumbent that wither after fruiting. Stipules foliaceous, lanceolate or ovate, entire or remotely toothed, free or little adnate. Top of style clavate, lobate-marginate on both sides.

Distribution: [Asia-Temp.: China, Sib., RFE, E-Asia; Asia-Trop.; Australasia].

***Viola* subsect. *Bilobatae* (W. Becker) W. Becker**, Acta Horti Gothob. 2: 288. 1926

Basionym: *V.* [*Gruppe*] *Bilobatae* W. Becker in Beih. Bot. Centralbl., Abt. 2, 34 (2): 226. 1916.

Type: *V. arcuata* Blume.

Synonym: *V.* ser. *Alatae* Juz. in Schischkin & Bobrov, Fl. URSS 15: 439. 1949, nom. inval. (no Latin description Art. 39.1).

Chromosome Numbers: 2n = 24; aneuploids: 2n = 20; polyploids 2n = 44.

Hybrids. Natural hybrid with sect. *Diffusae* (Hama 1975 cf. *V. arcuata*); with sect. *Australasiaticae* (Wang & Huang 1992 cf. *V. arcuata*).

Characters. Perennial rhizome ending in a leaf rosette more or less leafy, producing annual erect to creeping stems; flowers only on annual stems in cauline leaf axils (Fig. 3C).

Distribution: [Asia-Temp.: China, RFE, E-Asia; Asia-Trop.; Australasia].

32 ***Viola arcuata* Blume,** Bijdr. Fl. Ned. Ind. 2: 58. 1825

S3 – subg. *Violidium* sect. *Bilobatae* subsect. *Bilobatae* – T1 P3 – GN

Typification. Loc. cl.: "*in montibus altissimis Javae*" Jawa. Lectotype here designated: L [L.2443480]!p, leg. Reinwardt, as "*Viola palustris*", "*Java, Rantja Gedé*", det. Blume, Koorders, Becker, D.M. Moore, C.J. Chang. When he was director at the botanic garden of Bogor (= Buitenzorg) in Jawa, Blume has used specimens gathered by Reinhardt to describe *V. arcuata.*

Chromosome Numbers. n = 10 [JAP] as *V. verecunda*; n = 12 [China] as *V. verecunda*, [JAP] as *V. fibrillosa*, *V. verecunda*; n = 22 [EHM] as *V. distans*; 2n = 20 [JAP] as *V. yakusimana,* [RFE] as *V. vorobievii*; 2n = 24 [China] as *V. verecunda,* [JAP] as *V. verecunda* and *V. semilunaris,* [KOR] as *V. verecunda*, [New Guinea] as *V. arcuata*, [RFE] as *V. verecunda* and *V. vorobievii*; 2n = 44 [EHM] as *V. distans*. A higher ploidy level was found in [Sikkim]: 2n = 44 (Chatterjee & Sharma 1972), as well as two aneuploid counts 2n = 20 [RFE, JAP].

Hybrids. In [JAP] with sect. *Diffusae*: *V. diffusa* (Hama 1975); in [TAI] with sect. *Australasiaticae*: *V. adenothrix* (Wang & Huang 1992). Becker (1916a) cited in China *V. alata* × *V. arcuata* and in [JAP] *V. verecunda* × *V. semilunaris*; these hybrids were never seen again.

Taxonomy. Incl. *V. alata* Burgersd., *V. barkalovii* Bezd., *V. carlesii* Nakai, *V. distans* Wall., *V. excisa* Hance, *V. fibrillosa* W. Becker, *V. hupeiana* W. Becker, *V. semilunaris* (Maxim.) W. Becker, *V. subaequiloba* (Franch. & Sav.) Nakai, *V. verecunda* A. Gray*, V. vorobievii* Bezd., *V. yakusimana* Nakai. Taxa grouped under *V. arcuata* differ from one another with characters of low taxonomic value in this group: ascending (*V. verecunda*, *V. vorobievii*) or decumbent stems (*V. alata, V. barkalovii*), leaf blade with open sinus (*V. semilunaris, V. barkalovii*) or deeply cordate (*V. vorobievii*), with more or less crenate margin, glabrous or pubescent, stipules more or less developed, flower color. The shape and size of leaves of *V. arcuata* are linked with ecological conditions (Wang & Huang 1990 p. 24). Jacobs & Moore (1971) were the first to include *V. alata* under *V. arcuata* although Becker (1916a p. 235–236) reported hybrids between *V. arcuata* and *V. alata* [China] and between *V. verecunda* and *V. semilunaris* [JAP] (not confirmed since).

Distribution: [RFE: Lower-Zeya, Bureya, Ussuri, S-Sakhalin, S-Kuril]; adjacent regions [CHM, KOR-NK, JAP-HK]; general range [Asia-Temp.: China, RFE, E-Asia; Asia-Trop.].

V. alata Burgersd., in F.A.W. Miquel, Pl. Jungh. 2: 121. 1852. Loc. cl.: "*Java in sylvis intactis montis Di-eng, alt. 6000' – 8000'. Incolis Gagang-Gunung (Jungh.)*" [Jawa: Dieng Plateau]. Lectotype here designated: L [L.0011489]!p, leg. Junghuhn, [Jawa: Dieng], examined by Koorders 1909 (revised for Handb. Fl. Java) as "*Viola alata Burgersg. (specimen authenticum)*", det. Becker in 1915 as "*Viola alata Burgersd. subsp. alata W. Bckr.*" and Moore in 1965 as *V. arcuata* (revised for Flora Malesiana).

V. verecunda A. Gray, Mem. Amer. Acad. Arts 6(2): 382. 1858. Loc. cl.: "*Hakodadi*" [JAP-HK: Hakodate]; *Hakodadi* is the American name for Hakodate used during the 19th century. Gray studied specimens collected by Wright during his Japanese exploration. Lectotype here designated: K [K000254191]!p, leg. C. Wright during the US North Pacific Exploring Expedition (1853–56), "*Hakodadi*", det. Y. S. Chen June 2006 as *V. arcuata* (isotype of *V. verecunda*). This specimen was chosen as lectotype because it possesses flowering plants in good state of conservation; isolectotypes: NY [00039642, 00039457]!p.

V. vorobievii Bezd., Komarovskie Chteniya (Vladivostok) 48: 105. 2001. Loc. cl.: "*Insulae Kurilenses; insula Kunashir, vulcanus Mendeljevi, silva conifero-frondosa, in loco paludoso*" [KUR: Kunashir Island, Mendeleyeva]. Holotype n.v. VLA. Paratype: VLA [212579]!p. This taxon is closely related to *V. verecunda*. Only the hairiness of some organs (e.g. peduncules) differentiates these plants from *V. arcuata*. Further cyto-morphological investigations are needed to determinate its taxonomic status. Distribution: [RFE: S-Sakhalin, S-Kuril].

V. barkalovii Bezd., Komarovskie Chteniya (Vladivostok) 48: 102. 2001. Loc. cl.: "*Prov. Chabarovsk, district Lazo, in vicinis pag. Srednechorskij, in prato humido*" [KHA: Imeni Lazo District]. Holotype: VLA [10531]!p. It is a highly branched plant with creeping or decumbent stems, with cordate to subtruncate leaf blades. Specimen P [PL04770806] near Vladivostok is very comparable to the type. *V. barkalovii* seems to be a wetlands ecotype of *V. arcuata*. Further studies are needed for this taxon, only known from fructified specimens from the loc. cl. Distribution: [RFE: Ussuri].

Viola subsect. *Amuricae* Espeut, subsect. nov.

Type: *V. amurica* W. Becker (according to Art. 10.8).

Nom. inval.: *V.* ser. *Amuricae* Juz. in Schischkin & Bobrov (ed.), Fl. URSS 15: 440. 1949, no Latin description (Art. 39.1).

Chromosome Numbers. 2n = 24.

Taxonomy. The type of growth of this subsect. is similar to that of subsect. *Grypocerae* and *Mirabiles* (subg. *Viola*).

Characters. Chasmogamous flowers first in leaf axils of the rosette, then cleistogamous flowers in cauline leaf axils of annual elongated stems (Fig. 3E).

Distribution: [Asia-Temp.: China, Sib., RFE].

33 *Viola amurica* W. Becker, in B. Fedtschenko, Fl. Aziat. Ross. 8: 62. 1915

S2a – subg. *Violidium* sect. *Bilobatae* subsect. *Amuricae* – T2 P3

Typification: Loc. cl.: "*Regio amurensis ad fl. Amur, montes Burejae*" [AMU]. Only one specimen cited in protologue that must be considered as holotype (Art. 9.1 note 1): "*leg. G. Radde 29. V. 1858, det. Regel sub nom. V. biflorae*", LE [LE 01009602]!p, det. on sheet Becker 1912 as *V. amurica*.

Chromosome Numbers. 2n = 24 [RFE] as *V. verecunda*, *V. amurica*.

Hybrids. Unknown. The status of this taxon will be definitively established when hybrids with *V. arcuata* were found; both species are sympatric [RFE: Vladivostok] (Bezdeleva 1987).

Taxonomy. On several specimens from LE, Becker (1916a p. 217) notes that they bear chasmogamous flowers on leaf axils of the rosette before they produce annual stems. He also says that this species is closely related to *V. arcuata* which doesn't bear flower on the leaf rosette but only on annual stems. Juzepczuk (1949), Bezdeleva (1987) and Zuev (1996) also cite this difference. Chen et al. (2007) have not considered this character and included *V. amurica* under *V. arcuata*. Subentire, ovate-orbicular stipules are also a good morphological characteristic.

Distribution: [RFE: Nyukzha, Upper- and Lower-Zeya, Ussuri, S-Sakhalin]; adjacent regions [YAK, CHM, KOR-NK?]; general range [China, Sib., RFE].

Viola subsect. *Raddeanae* (W. Becker) Espeut, stat. nov.

Basionym: *V.* "*Колено*" *Raddeanae* W. Becker in B. Fedtschenko, Fl. Aziat. Ross. 8: 85. 1915.

Type: *V. raddeana* Regel (Art. 10.8).

Synonym: *V.* ser. *Raddeanae* Juz. in Schischkin & Bobrov (ed.), *Fl. URSS* 15: 441.1949, nom. inval. (no Latin description, Art. 39.1).

Chromosome Numbers. 2n = 24; probable aneuploids: 2n = 20.

Taxonomy. The type of growth of this subsect. is analogous to that of subsect. *Arosulatae* (subg. *Viola*).

Characters. At anthesis, rhizome without leaf rosette producing annual erect stems; flowers only in cauline leaf axils (Fig. 3F).

Distribution: [China, RFE, E-Asia].

34 *Viola raddeana* Regel, Bull. Soc. Imp. Naturalistes Moscou 34(2): 463, 501, tab.7. 1861

S3 – subg. *Violidium* sect. *Bilobatae* subsect. *Raddeanae* – T2 P3 – GN

Typification. Loc. cl.: "*im Bureja-Gebirge am Amour von Radde gesammelt*"[AMU]. Lectotype designated (Byalt 2018): LE [LE 01015916]!p, leg. G. Radde 1858. This sheet contains the plants drawn by Regel in the protologue, tab. 7, fig. 1–5. Syntypes: LE [LE01015917, LE01015918]!p, P [P00432524]!p.

Chromosome Numbers. 2n = 24 [KOR, RFE]; in [JAP], probable aneuploid populations with 2n = 20 (Miyaji 1929).

Hybrids. Unknown.

Taxonomy. Incl.: *V. deltoidea* Yatabe. Liang & Xing (2010) and Gong et al. (2010) confirm the relationship of this species with *V. arcuata* and *V. triangulifolia*. The absence of perennial main stem ending in a leaf rosette (sympodial growth) such as *V. canina* or *V. acuminata*, is an example of convergent evolution: this species is not related to *Trigonocarpae* despite the Japanese cytotype 2n = 20 (Miyaji 1929).

Distribution: [RFE: Lower-Zeya, Bureya, Ussuri]; adjacent region [CHM, CHI, KOR-NK]; general range [China, JAP-HK, RFE, E-Asia: JAP, KOR].

Viola subg. *Nosphinium* (W. Becker) Espeut, stat. nov.

Basionym: *Viola* sect. *Nosphinium* W. Becker, in Engler & Prantl, Nat. Pflanzenfam., ed.2, 21(2): 374. 1925. In ancient Greek, this name means: *apart Viola*.

Type: *V. chamissoniana* Ging., Linnaea 1: 408. 1826. First species from Hawaiian Islands (Oahu) discovered by Chamisso in 1817 and well described by Gingins, the first botanist who made a study on the genus *Viola*. Type here designated.

Chromosome Numbers. Estimated ploidy level at the beginning of lineage: allodecaploid derived by amphipolyploidy from subg. *Chamaemelanium* 2n = 12, *Viola* 2n = 20 and *Plagiostigma* 2n = 24, with a theoretical secondary base number n = 28, 2n = 56 (Marcussen et al. 2012); *V. pedata* is the only one species counted with 2n = 56 (Gershoy 1934);

neo-, auto- or allopolyploids: 2n = 72, 80, 96, 120; errors or aneuploids: 2n = 52, 54, c.60–64.

Hybrids. Many hybrids in sect. *Boreali-Americanae* (Gil-Ad 1997), in sect. *Mexicanae* (Ballard 1994).

Taxonomy. In agreement with the results of Marcussen et al. (2015), this subg. is monophyletic and perhaps decaploid; five sect. are included in this subg.:

- sect. *Nosphinium* W. Becker. Distribution: [Pacific: Hawaii].

- sect. *Mexicanae* (W. Becker) Espeut, stat. nov. Basionym: *V.* [unranked] *Mexicanae* W. Becker in Engler & Prantl, Nat. Pflanzenfam., ed.2, 21(2): 369. 1925. Distribution: [N-Amer.: Mexico; S-Amer.: C-Amer., W-South Amer.].

- sect. *Pedatae* (Pollard) Espeut, stat. nov. Basionym: *V.* [unranked] *Pedatae* Pollard in Bot. Gaz. 36: 327. 1898. Distribution: [N-Amer.]

- sect. *Boreali-Americanae* (W. Becker) Espeut, stat. nov. Basionym: *V.* [unranked] *Boreali-Americanae* W. Becker in Engler & Prantl, Nat. Pflanzenfam., ed.2, 21(2): 369. 1925. **Type**: *V. cuculata* Aiton (Gil-Ad 1997). Distribution: [N-Amer.].

- sect. *Langsdorffianae* (W. Becker) Espeut, stat. nov. Distribution: [N-Amer.; Asia-Temp.: JAP, RFE].

Characters. Flowers blue-violet, violet, purple, mauve, magenta or white, never yellow but for some taxa pale green-yellow spur. Spur short, often saccate. Style clavate or enlarged at top, mostly marginate laterally or behind, with short beak in front, never papillose.

Distribution: [Pacific: Hawaii; N-Amer.; S-Amer.: C-Amer., W-South Amer.; Asia-Temp.: RFE, E-Asia].

Viola sect. *Langsdorffianae* (W. Becker) Espeut, stat. nov.

Basionym: *V.* [unranked] *Langsdorffianae* W. Becker, in Engler & Prantl, Nat. Pflanzenfam. ed.2, 21(2): 368. 1925.

Type: *V. langsdorffii* Fisch. ex Ging. (Art. 10.8).

Nom. inval.: *V.* sect. *Arction* Juz., in Schischkin & Bobrov (ed.), Fl. URSS 15: 437.1949, no Latin description (Art. 39.1).

Chromosome Numbers. Many counts were published: for *V. ursina* 2n = c.60, c.64; for *V. langsdorffii* 2n = c.72, up to 90, c.96, c.120; for *V. kamtschadalorum* 2n = 72, c.96. Given the number frequency, this sect. seems simply characterized by a high polyploids series created from the primary base number x = 6, and sometimes aneuploid events. At the opposite, Marcussen et al. (2012) suggest the secondary base number n = 51 (2n = 102), and justify differences with other results by great difficulties in counting many small chromosomes. Yet, for *V. langsdorffii* their plant material comes from Moscow Botanical Garden (with no other indication) and from Alaska (Juneau Co.). However, in [RFE], two species exist: a robust form of *V. langsdorffii* 2n = 60-64 (cf. *V. ursina*) and *V. kamtschadalorum* 2n = c.96; in [SAK] both are present (Barkalov & Taran 2004) and perhaps a third with 2n = c.72. Marcussen et al. (2012) explain their numbers by a set of hypotheses, involving several really complex steps (too long to be exposed here), with successive amphiploidy events (addition of genomes) coming from different subg. and sect. Finally, compared to other *Viola* groups, the sect. *Langsdorffianae* is characterized by X = 6, a very strong polyploidy and a subarctic range. Note that in the N-Hemisphere, it's in this area that the polyploidy is highest (Reese 1958, Brochmann et al 2004, Nève & Verlaque 2010). This S-N-gradient of increasing polyploidy results from the effect of glaciations on plants.

Hybrids. Unknow.

Taxonomy. Amphi-Pacific sect. related to subg. *Violodium* sect. *Bilobatae* and subg. *Viola* subsect. *Mirabiles* by: stipules, axes organization. This is consistent with genetic results and allopolyploidy; the genetic connection with sect. *Plagiostigma* (*V. epipsila*) is morphologically less conspicuous.

Characters. Perennial rhizome ending in a leaf rosette more or less leafy, without flower, producing erect or decumbent flowering stems, more or less developed, that wither after fruiting (Fig. 3C); flowers purple; leaves cordate; stipules free, large, and (sub)entire.

Distribution: [N-Amer.: Subarctic-Amer., W-Canada, NW- & SW-USA; Asia-Temp.: RFE, E-Asia].

35 ***Viola langsdorffii*** **Fisch. ex Ging.**, A.P. de Candolle, Prodr. 1: 296. 1824

S3 – subg. *Nosphinium* sect. *Langsdorffianae* – T2 P3 – GN

Original spelling "*langsdorfii*"; dedicated to G.H. von Langsdorff; orthographic correction "*langsdorffii*" (Rec. 60C.3).

Typification. Loc. cl.: "*in insula Unalaschka*" [ALU: Unalaska Island]. Lectotype here designated: G-DC [G00209432]!h, specimen gathered in "*Analaschka*" by Langsdorff who noted the discovery of a new species of *Viola* on this island in July 1805 (Langsdorff 1814 p. 51). On his return to Russia in 1808, he gave his plant collects to F.E.L. Fischer, director of the botanical garden in Gorenki near Moscow (Langsdorff & Fischer 1810). It is the latter who gave certainly the epithet "*langsdorfii*" in honor of the discoverer in the herbarium collections of St. Petersburg. Several specimens were sent through Europe (K, P, G-DC). The name *V. langdorffii* was published by Gingins in 1824 from the De Candolle's specimen here designated as lectotype, that is also the lectotype of the var. *subacaulis* Ging.

Chromosome Numbers. As *V. ursina*: 2n = c. 60 [KAM] (Sokolovskaya 1963), c. 64 [S-KAM] (Sokolovskaya & Probatova 1986); as *V. langsdorffii*: 2n = c. 72 [S-SAK] (Sokolovskaya & Probatova 1986), up to 90 [N-KUR] (Volkova et al. 2003), c.96 [JAP-HK] (Miyaji 1929), n = 60 bivalents and 2n = c. 120 [Canada: Haida Gwaii = Queen Charlotte Islands] (Taylor & Mulligan 1968). The Japanese count concerns surely *V. kamtschadalorum* (cf. no 36).

Hybrids. Unknow.

Taxonomy. Incl.: *V. kurilensis* Nakai, *V. ursina* Kom., *V. langsdorffii* var. *parviflora* (Regel) Nakai.

Distribution: [RFE: Kamchatka, Commander Is., N- & S-Sakhalin, N- & S-Kuril]; adjacent regions [JAP-HK, ALU, ASK]; general range [N-Amer.: Subarctic-Amer., W-Canada, NW- & SW-USA; Asia-Temp.: E-Asia, RFE].

V. kurilensis Nakai, Bot. Mag. (Tokyo) 36: 33. 1922. Loc. cl.: "*Kuril: Urup*" [KUR: Urup]. Holotype: TI [DB 02255]!p. Nakai described this taxon from specimens gathered by Amatsu in 1904, and noted that it has yellow flowers. It is surely an error due to discolored petals of old original material because *V. langsdorffii* has always purple flowers. The rest of the protologue (in particular bearded lateral petals) and the type specimen complie with the Russian forms of *V. langsdorffii.*

V. ursina Kom., Repert. Spec. Nov. Regni Veg. 13: 235. 1914. Loc. cl.: "*in parte australiore peninsulae Kamtchatka, ubi in pratis inter fruticeta positis in valle fluvii Paratunka, et circa pagum Natshika satis saepe occurit*" [KAM: Yelizovo District]. Lectotype designated (Bezdeleva 1987 p. 122): LE [LE01015934]!p, designated on sheet by Nikitin; isolectotypes: LE [LE01015935, LE01015936, LE01015937, LE01015938]!p. This taxon seems to be a robust form of *V. langsdorffii* (Becker & Hulten 1928). More cyto-morphological investigations are needed to precise its taxonomic status. If counts 2n = 60–64 are confirmed, a specific rank may be given. Distribution: [RFE: Kamchatka, Commander Is.].

V. langsdorffii var. *parviflora* (Regel) Nakai, Bot. Mag. (Tokyo) 36: 56. 1922. Basionym: *V. mirabilis* var. *langsdorffii* lusus *parviflora* Regel, Bull. Soc. Imp. Naturalistes Moscou 34: 487. 1862. Loc. cl.: "*Kamtschatka (Rieder), Insel St Paul (Kussmisscheff)*". Original specimens untraced. In [JAP-HK], plants with scarcely elongated stems at flowering are so named

(Hama 1975, Akiyama et al. 1999, Igari 1996) and can be included under *V. langsdorffii.*

36 *Viola kamtschadalorum* W. Becker & Hulten, Ark. Bot. 22A (3): 6. 1928

S3 – subg. *Nosphinium* sect. *Langsdorffianae* – T2 P3

Typification. Loc. cl.: "*Southern part of Kamtchatka Peninsula and Sachalin*" [KAM, SAK]. This species is considered by Becker et Hulten (1928) as a nom. nov. However the replaced synonym is not clearly indicated: five names are listed without any indication of that is the type: "*Viola Langsdorffii β caulescens Ging. in DC., Prodr. I (1824) p. 297*"; "*Viola mirabilis β Langsdorffii lus. c. caulescens et d. hispidula Regel, Pl. Radd. Dicotyl. Polypet. No 260*"; "*Viola Langsdorffii Komarov, Voy. Kamtsch. p. 416 et in Herb.*"; "*Viola Langsdorffii subsp. sachalinensis Becker in Beih. Bot. Centralbl. 34:2 (1916) p. 253*". Consequently, Art. 41.1 invalids this nom. nov. However *V. kamtschadalorum* is validly published with a Latin description and can be considered as a correct name of a new taxon. I choose the lectotype in the Kamchatka gatherings of the authors conserved in S, that are in accordance with the protologue. Lectotype of *V. kamtschadalorum* here designated: S [S14-15711]!p, leg. Eric Hulten, 13 July 1921, [S-KAM: Boldsheredsk].

Chromosome Numbers. 2n = 72 [S-SAK] (Krivenko et al. 2012)]; 2n = c.72 [S-SAK] as *V. langsdorffii* (Sokolovskaya et al. 1986); 2n = 96 [JAP] as *V. langsdorffii* (Miyaji 1929); 2n = c. 96 [S-SAK] (Sokolovskaya 1960), [S-KUR](Probatova et al. 2007), [S-KAM] (Sokolovskaya 1963).

Hybrids: unknow.

Taxonomy. Incl: *V. franchetii* H. Boissieu, *V. kamtschadalorum* var. *pubescens* Miyabe & Tatew., *V. langsdorffii* var. *caulescens* Ging., *V. langsdorffii* subsp. *sachalinensis* W. Becker. This species grows in milder environmental conditions than *V. langsdorffii* which is an Arctic taxon. Becker & Hulten (1928) have firmly established morphological differences between *V. kamtschadalorum* and *V. langsdorffii*. *V. superba* M.S. Baker is an American species [N-Amer.: NW-USA, Oregon] morphologically similar to *V. kamtschadalorum.*

Distribution: [RFE: Kamchatka, N- & S-Sakhalin, N- & S-Kuril, Amgun (Shantar islands)]; adjacent regions [JAP-HK, ALU?]; general range [E-Asia: JAP, RFE].

V. franchetii H. Boissieu, Bull. Soc. Bot. France 47: 321. 1901. Loc. cl.: "137, *talus du chemin de fer de Sapporo à Otaru; mai 1885*" [JAP-HK: Sapporo]. Holotype: P [P02141087]!h; leg. Franchet no 137, 25 May 1885 as *V. sapporensis* Franch. ined. Isotype: G [ranked as *V. langsdorffii*]!h.This taxon firmly corresponds to *V. kamtschadalorum* and not to *V. rossii* as suggested by Akiyama et al. (1999).

V. langsdorffii subsp. *sachalinensis* W. Becker, Beih. Bot. Centralbl. 34: 253. 1916. Loc. cl.: "*Sachalin, in turfosis ubique communis (loc. Soriofka)*" [SAK]. Two syntypes are indicated. Lectotype here designated: P [P04672271]!h; leg. Faurie no 542, 5 August 1908, in [SAK]. Syntype: P [P04672270]!h; leg. Faurie no 541. These two specimens were attached to *V. kamtschadalorum* by Becker on sheets (1928).

V. kamtschadalorum var. *pubescens* Miyabe & Tatew., Trans. Sapporo Nat. Hist. Soc. 15: 206. 1938. Loc. cl.: "*S. Kuriles. Isl. Etorofu: Rubetsu*" [KUR: Iturup], only one specimen cited (holotype) "*K. Tanno, VII. 1935*". Holotype: SAPS!p.

V. langsdorffii var. *caulescens* Ging., in A.P. de Candolle, Prodr. 1: 297. 1824. Loc. cl. cited for the species only: "*in insula Unalaschka*" [ALU]. Specimen cited: "*V. peduncularis Langsdorff ex Fisch. in litt. (v. s.)*". Holotype: G-DC [G00209431]!h, as "*Viola peduncularis Langsd.*", uncertain provenance "*ex ins. Unalaschka?*". This specimen is clearly the only one specimen used by the author; the abbreviation "*v. s.*" [= *visa sicca*] used in the protologue and the Fischer's label prove that.

***Viola* subg. *Chamaemelanium* (Ging.) Juz.**, Schischkin & Bobrov (ed.), Fl. URSS 15: 446. 1949

Basionym: *V.* sect. *Chamamelanium* Ging., Mém. Soc. Phys. Genève 2(1): 25. 1823.

Type: *V. canadensis* L. The only one species cited by Gingins (1823).

Chromosome Numbers. Estimated ploidy level at the beginning of *Viola* lineage: 2x (Marcussen et al. 2015); primary base number: x = 6 (Miyaji 1929, Clausen 1964); diploid: 2n = 12; auto- or allopolyploids: 2n = 18, 24, 36, 48, 72; errors or aneuploids: 2n = 20, 34, 35, c.40

Hybrids. Some natural inter-subsect. hybrids (Clausen 1964); only one hybrid between sect. *Chamaemelanium* × *Dischidium* (cf. *V. biflora* no 41).

Taxonomy. Subg. *Chamaemelanium* here designated consists of sect. *Chamaemelanium* as defined by Clausen (1964) expanded by the addition of sect. *Kitamianae* and *Memorabiles.*

Characters. Flowers yellow at least on the throat entrance of the spurred petal, mostly entirely yellow, sometimes white, purple or variegated; stipules free, small, generally entire or slightly toothed; styles and leaves with various shapes.

Distribution: [N-Amer.; Eur.; Asia-Temp.: W-, M- & E-Asia, Cauc., Sib., China, RFE; Asia-Trop.: Indi., Indo-China, Malesia].

***Viola* sect. *Chamaemelanium* Ging.**, Mém. Soc. Phys. Genève 2 (1): 25, tab. 1. 1823.

Type: *V. canadensis* L. The only species cited by Gingins (1823)

Equally Ranked Synonym. *V.* sect. *Erectae* (W. Becker) Ching J. Wang, Fl. Reipubl. Popularis Sin. 51: 123. 1991.

Chromosome Numbers. Same as subg. *Chamaemelanium.*

Hybrids. Within this sect. some natural hybrids between subsect. (Clausen 1964): *Purpureae* × *Nuttalianae*, *Chrysanthae* × *Purpureae*, *Chrysanthae* × *Nuttalianae.*

Taxonomy. The subsect. *Nudicaules* is Amphi-Pacific; the other subsect. have American ranges.

Characters. Apical part of the style capitate, bearded on the both sides, not beaked at apex; lateral petals bearded; spur of anterior petal saccate, short.

Distribution: [N-Amer.; Asia-Temp.: M- & E-Asia, Sib., China, RFE].

***Viola* subsect. *Nudicaules* (W. Becker) Espeut, stat. nov.**

Basionym: *V.* "*Untergruppe*" *Nudicaules* W. Becker, Beih. Bot. Centralbl., Abt. 2, 36(2): 45. 1918.

Type here designated: *V. uniflora* L.

Chromosome Numbers. 2n = 12; auto- or allopolyploids: 2n = 24

Hybrids. Only one natural hybrid cited with sect. *Dischidium* (cf. *V. biflora* no 41). 2n = 18 [JAP] for *V. brevistipulata* represents surely a hybrid.

Characters. Rhizome ending in a rosette of few leaves, without flower, producing annual erect stems (Fig. 3D), with leaves and flowers mostly on the upper part; flowers always yellow.

Distribution: [N-Amer.; Asia-Temp.: M- & E-Asia., Sib., China, RFE].

37 *Viola uniflora* L., Sp. Pl. 2: 936. 1753

S3 – subg. *Chamaemelanium* sect. *Chamaemelanium* subsect. *Nudicaules* – T2 P3 – GN

Typification. Loc. cl.: "*Habitat in Sibiria*", [Sib.]. No type, no gathering and no synonym are indicated in protologue. On sheet, the Linnaeus's script "*uniflora 17*" agrees with the numbering of *Sp. Pl.* Lectotype here designated: LINN [Herb. Linn. no 1052.18]!p.

Chromosome Numbers. 2n = 12 [KRA]; 2n = 24 [TVA, WSB]. The number 2n = 12 was only obtained by Krogulevich (1976) in [KRA: Putoran Mountains]. The citation of Gershoy (1934) in Fedorov (1969) is wrong, because this author did not count this species but only presumed its chromosome number: p. 13 "*V. uniflora (2n = ?)*" and p. 23 "*2n = probably 12*".

Hybrids. Unknown.

Distribution: [RFE: Bureya (Becker 1918 p. 50), Ussuri]; adjacent regions [YAK, CTA]; general range [Sib., MON, RFE]. Incorrect usages for *V. uniflora*: auct. [KOR] non L. = *V. orientalis* (Maxim.) W. Becker; auct. [M-Asia] non L. = *V. acutifolia* (Kar. & Kir.) W. Becker.

38 ***Viola muehldorfii* Kiss,** Bot. Közlem. 19: 92. 1921

S2a – subg. *Chamaemelanium* sect. *Chamaemelanium* subsect. *Nudicaules* – T1 P3

Original spelling "*Mühldorfi* "; dedicated to Anton Muehldorf; orthographic correction "*muehldorfii*" (Art. 60.8b and Rec. 60C.3).

Typification. Loc. cl.: "*Habitat secus rivulos in humidis silvarum semper gregarie sat frequens prope oppid. Nikolsk-Ussurisk in Siberia orientali*" [PRM: Ussuri]. Lectotype here designated: BU[45175]!p, leg. Kiss, 1 June 1920, "*opp. Nikolsk-Ussurisk*".

Chromosome Numbers. 2n = 24 [RFE] (Probatova et al. 2004, 2016a, 2017a).

Hybrids. Unknown.

Taxonomy. Incl. *V. lasiostipes* Nakai. *V. muehldorfii* is perhaps a polyploid form of *V. brevistipulata*, and closely related with it.

Distribution: [RFE: Lower-Zeya,Ussuri]; adjacent regions [CHM, KOR-NK]; general range [China, E-Asia, RFE].

V. lasiostipes Nakai, Bot. Mag. (Tokyo) 36: 32. 1922. Loc. cl.: "*Hab. in Corea: Taichuri prov. Kankyo austr.*", [KOR-NK: South Hamgyong]. Holotype (Akiyama & Ohba 2001) TI [DB 02265]!p, leg. T. Ishidoya no 2759, 23 May 1918. This taxon should not be placed in synonym of *V. brevistipulata* subsp. *minor* as proposed by some Japanese or Korean authors because the lowest cauline leave has no flower at its axil as *V. muehldorfii.*

39 ***Viola orientalis* (Maxim.) W. Becker, in B. Fedtschenko,** Fl. Aziat. Ross. 8: 95. 1915

S2a – subg. *Chamaemelanium* sect. *Chamaemelanium* subsect. *Nudicaules* – T2 P3 – GN

Basionym: *V. uniflora* var. *orientalis* Maxim., Enum. Pl. Mongolia 1: 81. 1889.

Typification. Loc. cl.: "*Mandshuria austrorientalis et Japonia*", [RFE, JAP]. No type and no specimen cited in the protologue. This species was described by Maximowicz from specimens gathered in [RFE: Ussuri, JAP: Nagasaki] during his second travel (1859–1864). Becker (1915) classifies these plants to the rank of species and creates in 1918 the var. *conferta* from Russian gatherings including those of Maximowicz "*It. Secund. (1860) Mandshuria austro-orientalis, ad Ussuri superiorem*". Lectotype designated (Byalt 2018): LE [LE01010477]!p, leg. Maximowicz in *Iter Secundum*, "*ad Ussuri super. infra ostium fl. Sfitucha silvis ripae sinistrae*" [PRM: upstream portion of Ussuri river], as "*Viola uniflora L. var. orientalis m. capsula pubescente*". Syntype: P [P04697006]!h. Japanese syntypes belong to the var. *xanthopetala*: LE [LE01010378, LE01010379]!p, P [P04671654]!p. For this lectotypification, Byalt did not follow the Rec. 9A.4 because this lectotype is also a syntype of *V. orientalis* var. *conferta* W. Becker.

Chromosome Numbers. 2n = 12 [JAP] as *V. orientalis*; [RFE] as *V. xanthopetala* and *V. orientalis*; 2n = 24 only one count [KOR] as *V. xanthopetala* (Lee 1967 n.v.).

Hybrids. Unknown.

Taxonomy. Incl. *V. orientalis* var. *conferta* W. Becker, *V. xanthopetala* Nakai. The northernmost Russian populations represent the subsp. *orientalis*, the southern ones the subsp. *xanthopetala.*

Distribution: [RFE: Ussuri]; adjacent regions [CHM, KOR-NK]; general range [China, E-Asia, RFE].

V. orientalis var. *conferta* W. Becker, Beih. Bot. Centralbl., Abt. 2, 36(2): 50. 1918. Loc. cl.: "*Ussuri-Gebiet*" [PRM: region of Ussuri river]. Two syntypes: "*Maxim. It. secund. (1860): Mandshuria austro-orientalis, ad Ussuri superiorem*"; "*Komarov Fl. Manshur. nr. 1117*". I choose the same lectotype (Art. 26.2 Ex. 3) as *V. uniflora* var. *orientalis,* lectotype here designated: LE [LE01010477]!p. Syntype: P [P04697006]!h. Homotypic synonyms: *V. conferta* (W. Becker) Nakai, Bot. Mag. (Tokyo) 36: 31. 1922; *V. orientalis* subsp. *orientalis*. Distribution: [RFE: Ussuri up to SE-Khabarovskii Krai].

V. xanthopetala Nakai, Bot. Mag. (Tokyo) 36: 29. 1922. Many syntypes from [CHM, KOR, JAP]. Lectotype designated (Akiyama & Ohba 2001): TI [DB 02361]!p, leg. M. Furumi no 18, 30 April 1914, "*Manchuria: Sekka*", [CHM: Liaoning, Jinzhou District]. Many syntypes in TI. Japanese authors (Maekawa 1954, Akiyama et al. 1999) used for a long time this name as synonym of *V. orientalis* s.s.

Approved Infraspecific Taxa

***V. orientalis* subsp. *orientalis*.** Homotypic synonyms: *V. uniflora* var. *orientalis* Maxim., *V. orientalis* var. *conferta* W. Becker, *V. conferta* (W. Becker) Nakai. Distribution: [RFE: Ussuri up to SE-KHA].

***V. orientalis* subsp. *xanthopetala* (Nakai) Espeut, comb. & stat. nov.** Basionym: *V. xanthopetala* Nakai in Bot. Mag. (Tokyo) 36(423): 29. 1922. Distribution: [CHM, KOR, JAP, RFE: S-Ussuri].

Key to subsp. of *V. orientalis*:

1 Cauline leaves 2(3), subsessile; capsules pubescent .... **subsp. *orientalis***
– Cauline leaves generally 3, the lowest one distinctly petiolate; capsules glabrous .... **subsp. *xanthopetala***

40 ***Viola brevistipulata* (Franch. & Sav.) W. Becker,** Beih. Bot. Centralbl., Abt. 2, 34 (2): 265. 1916

S3 – subg. *Chamaemelanium* sect. *Chamaemelanium* subsect. *Nudicaules* – T1 P3 – GN

Basionym: *V. pubescens* var. *brevistipulata* Franch. & Sav., Enum. Pl. Jap. 2: 288. 1878.

Typification. Loc. cl.: "*Hab. in monte Hakousan*" [JAP: Honshu, mount Haku]. Holotype untraced, leg. Dr Savatier, no 2806 (single specimen cited).

Chromosome Numbers. n = 6 [JAP]; diploids 2n = 12 [JAP] as var. *brevistipulata*, var. *kishidae*, var. *acuminata*, subsp. *minor*, subsp. *hidakana*, *V. yubariana*, *V. kishidae*; [RFE] as *V. brevistipulata* (Probatova et al. 2001); triploids 2n = 18 [JAP] as var. *ciliata*. Two closely related species, *V. glabella* Nutt. ex Torr. & A. Gray and *V. muehldorfii* (cf. no 38) are tetraploids 2n = 24.

Hybrids. Unknown.

Taxonomy. Incl.: *V. flaviflora* Nakai, *V. hidakana* Nakai, *V. kishidae* Nakai, *V. laciniata* (H. Boissieu) Koidz., *V. yubariana* Nakai. Misapplied names: *V. glabella* auct. [JAP, RFE] non Torr. & A.Gray: Maximowicz (1877), Becker (1918), Juzepczuk (1949). *V. glabella* Nutt. ex Torr. & A.Gray is an American species, first identified in ASK (Sitka Island), as *V. canadensis* (Bongard 1833). Regel (1862 as *V. biflora* var. *sitchensis*) seems to be the first to cite it in [KAM] from Fischer's specimen "*Herb. Fischer sub V. biflora β acutifolia*". Maximowicz (1877) identified this taxon in the Sitka Island as *V. glabella* but excluded Fischer's specimen from [KAM].

For him, *V. glabella* is only present in [N-JAP, ASK: Sitka Island, USA]. In [KUR: Urup island] this species is reported for the first time by Becker (1918), and then by Juzepczuk (1949). Later Russian authors don't cite it, including Barkhalov (2009). In [JAP], *V. brevistipulata* was confused for a long time with *V. glabella*, therefore I think that the taxon of Urup Island is certainly *V. brevistipulata*. Akiyama & Ohba (2001) report its presence in [S-KUR] and Bezdeleva et al. (2006) in [PRM: Ussuri, Khasansky District]. *V. glabella* can be distinguished from *V. brevistipulata* by its large membranous scales in upper part of rhizome and lower part of stems (Becker 1918). *V. brevistipulata* is very variable, especially in the shape, texture, hairiness and leaf color. Many infraspecific taxa were described (Akiyama & Ohba 2001).

Distribution: [RFE: Ussuri, S-Kuril]; adjacent regions [JAP-HK]; general range [RFE, E-Asia: JAP, KOR].

***V. glabella* Nutt. ex Torr. & A. Gray,** Fl. N. Amer. 1: 142. 1838. Loc. cl.: "*Shady woods of the Oregon*" [NW-USA: Oregon]. Lectotype undesignated. 2n = 24. Distribution: [N-Amer.: Subarctic Amer., W-Canada, NW- & SW-USA].

Key to *V. brevistipulata* – *V. glabella*:

1 Scales (upper part of rhizome and lower part of stems) and stipules 7–15 mm long .... ***V. glabella***

– Scales and stipules ≤ 6 mm long .... ***V. brevistipulata***

***Viola* sect. *Dischidium* Ging.**, Mém. Soc. Phys. Genève 2 (1): 25, tab. 1. 1823

Type: *V. biflora* L. The only species cited by Gingins (1823).

Chromosome Numbers. Diploid 2n = 12; auto- or allopolyploids: 2n = 24, 48; errors or aneuploids: 2n = 20, 34–35, c.40.

Hybrids. Only one natural hybrid cited with sect. *Chamaemelanium*.

Taxonomy. Clausen (1929) was the first to include the sect. *Dischidium* in the subg. *Chamaemelanium*. He used a new name, *V.* [unranked] *Biflorae*, which is actually a homotypic syn. of *V.* [unranked] *Biflorae* Kitt., Taschenb. Fl. Deutschl., ed. 2, 943. 1844. In addition, subsect. *Biflorae* (Clausen 1964) is invalid because the author doesn't give a full and direct reference of the basionym (Art. 41.5) for this name at a new rank. Phylogenetic trees (Liang & Xing 2010, Marcussen et al. 2015) confirm this taxonomic treatment.

Characters. Apical part of the style 2-lobed, without a beak; flowers yellow sometimes tinged with purple, lateral petals beardless; lower petal spur of varying size; rhizome ending in a rosette of few leaves, without flower, producing annual erect flowering stems (Fig. 3D).

Distribution: [N-Amer.; Eur.; Asia-Temp.: W-Asia, Cauc., M- & E-Asia., Sib., China, RFE; Asia-Trop.: Indi., Indo-China, Malesia].

41 ***Viola biflora* L.,** Sp. Pl. 936. 1753

S3 – subg. *Chamaemelanium* sect. *Dischidium* – T2 P5 – GN

Typification. Loc. cl.: "*Habitat in Alpibus Lapponiae, Austriae, Helvetiae, Angliae.*" Eur. Lectotype designated (Qaiser & Omer 1985): LINN][Herb. linn. 1052.16]!p, "*Lapp*" [N-Eur.: Lapland].

Chromosome Numbers. n = 6 [EHM, JAP], 9 [EHM], 10 [EHM]; 2n = 12 [AUT, BUL, China, E-Eur., Sib., EHM, FIN, FRA, GER, JAP, MON, NOR, RFE, SPA, UKR, WSB, BRY]; 20 [EHM]; c.24 [China]; 34–35 [Cauc.]; c.40 [RFE]; 48 [W-Canada] as subsp. *carlottae*. Diploid number 2n = 12 covers all the Palearctic area, from [SPA to JAP]. Polyploid populations can be attributed to others taxa: (aneu) triploids n = 9, 10, 2n = 20 [EHM] to *V. cameleo* H. Boissieu, because Chatterjee & Sharma (1972) indicate specimens with purple flowers (*V. cameleo* is the only one known *Dischidium* species with such flowers in this region); hexaploid 2n = 34–35 [Cauc.] to *V. caucasica*; octoploid 2n = c.40 [RFE] (Sokolovskaya & Probatova 1986) to *V. crassa* s.l. and perhaps also 2n = 48 six counts [W-Canada: Queen Charlotte Islands) as *V. biflora* subsp *carlottae* (Taylor & Mulligan 1968)] (cf. no 42). Tetraploid 2n = c. 24 [China: Qinghai] (Huang et al. 1996) could not be reported to a precise taxon.

Hybrids. Unknown.

Taxonomy. Incl.: *V. chingiana* W. Becker, *V. jizushanensis* S.H. Huang, *V. microceras* Rupr., *V. nudicaulis* (W. Becker) S.Y. Chen, *V. rockiana* W. Becker, *V. schulzeana* W. Becker, *V. crassa* var. *vegeta* Nakai.

Distribution: [RFE: Anadyr-Penzhina, Koryak, Okhotsk, Aldan, Nyukzha, Dauria, Kamchatka, N-Sakhalin, N-Kuril, Upper- and Lower-Zeya, Bureya, Amgun, Ussuri, S-Sakhalin, S-Kuril]; adjacent regions [YAK, CTA, CHI, CHM, KOR-NK, JAP-HK, ASK]; general range [N-Amer.: Subarctic-Amer., W-Canada, NW-USA; Eur.; Asia-Temp.: W-Asia, M- & E-Asia., Sib., China, RFE; Asia-Trop.: Indi., Indo-China, Malesia]. *V. biflora* is a circumboreal species, located in mountains in low-latitude regions.

42 ***Viola crassa* Makino,** Bot. Mag. (Tokyo) 19: 87. 1905

S4 – subg. *Chamaemelanium* sect. *Dischidium* – T2 P3

Typification. Loc. cl.: "*Hab. Prov. Rikuchû: Mt. Iwate*" [JAP-HN: Iwate Prefecture, Mount Iwate]. Holotype: MAK [MAK029925]!p, leg. G. Toba no 63, 12 August 1904. Makino cites only one specimen that must be considered as holotype. Only one synonym is noted: V. *biflora* var. *crassifolia* Makino in Bot. Mag. (Tokyo) 16: 139. 1902. The protologue of *V. crassa* is very short and incomplete while that of var. *crassifolia* is very detailed.

Chromosome Numbers. n = 24 [JAP]; 2n = c. 40 [RFE] as *V. avatchensis*, 2n = 48 [JAP], [W-CAN] as *V. biflora* subsp. *carlottae*.

Hybrids. With sect. *Chamaemelanium*: *V. biflora* subsp. *carlottae* × *V. glabella* (Douglas et al. 2000).

Taxonomy. Incl. *V. avatschensis* W. Becker & Hulten; *V. biflora* subsp. *carlottae* Calder & Roy L.Taylor. *V. crassa* is an octoploid (8x) derivate from *V. biflora*. Takahashi (1974) described four subsp. in [JPN]: e.g. subsp. *crassa* growing only in [JPN-HN], and the northernmost subsp. *borealis* [JPN-HK], surely also present in [KUR]. *V. crassa* s.l. has flowers, capsules and seeds larger than those of *V. biflora*; its sepals are often tinged with purple-red vs. green for *V. biflora*. *V. biflora* subsp. *carlottae* possesses all these characteristics (Little & McKinney 2015), as well as 2n = 48. Further studies are needed to confirm its taxonomic position.

Distribution: [RFE: Koryak, Okhotsk, Kamchatka, Commander Is., N-Sakhalin, N- & S-Kuril]; adjacent regions [KOR-NK, JAP-HK]; general range [N-Amer.: W-Canada; Asia-Temp.: RFE, E-Asia].

V. avatschensis W. Becker & Hulten, Ark. Bot. 22A (3): 1. 1928. Loc. cl.: [KAM]. Eight syntypes cited in the protologue. Lectotype here designated: S [S-G-6367]!p, leg. Hulten no 582a, 30 July 1920, "*Kamtchatka australis: Avatcha volcano 900 m*" [KAM: Yelizovsky District, Avatcha volcano]; designated as type by Hulten on sheet. Several syntypes from [KAM]: S [S11-31901, S11-31902, S11-31903, S11-31904, S11-31906, S11-31907]!p. Becker & Hulten (1928) noted that this taxon is closely related to *V. crassa*. It differs from *V. crassa* by minor characters: leave hairiness more important, smaller size (Juzepczuk 1949). Thefore, and because their polyploid numbers are comparable, I include this taxon under *V.crassa*.

V. crassa var. *vegeta* Nakai, Bot. Mag. (Tokyo) 42: 565. 1928. Loc. cl.: "*Etrup: Sokiya*" [KUR: Iturup, Sokiya – Porosu]. Holotypus: SAPS [Miyake & Tanaka 21 July 1910]!p. I agree with Akiyama et al. (1999) to include this taxon under *V. biflora.*

V. crassa var. *shikkensis* Miyabe & Tatew., Trans. Sapporo Nat. Hist. Soc. 15: 133. 1938. Loc. cl.: "*Habit. S. Saghalien. Distr. Shikka: Kotannoshike, Kitashiretoko Penins.*" [SAK: Shikka Distr., Nushike]. Only one specimen cited. Holotypus: SAPS [Sugawara 24 July 1935]!p. This taxon is described with leaves "*supra ad nervum hispidulo-puberula*", then I include it in subsp. *avatschensis.*

Approved Infraspecific Taxa:

V. crassa **subsp.** ***borealis*** **Takah.**, Bull. Kanagawa Pref. Mus., Nat. Sci. 7: 19. 1974. Holotypus: KPM [Takahashi 20 July 1973 no 56123]n.v. Loc. cl.: [JAP-HK: Prov. Ishikari, Hokuchin-dake]. This subsp. is noted in [KUR] (Takahashi 1974).

V. crassa **subsp.** ***avatschensis*** **(W. Becker) Espeut, comb. & stat. nov.** Basionym: *V. avatschensis* W. Becker & Hulten, Ark. Bot. 22A (3): 1. 1928. Incl.: *V. crassa* var. *shikkensis* Miyabe & Tatew. Distribution: [RFE: Anadyr-Penzhina, Koryak (Verkhoturov Island), Okhotsk (Magadan), Kamchatka, Commander Is. (Bering Island), S-Sakhalin].

Key to subsp. of ***V. crassa*****:**

1 Leaves glabrescent on both sides .... ***V. crassa*** **subsp.** ***borealis***

– Leaves distinctly pubescent above, more slightly beneath .... ***V. crassa*** **subsp.** ***avatchensis***

Viola sect. *Kitamianae* Espeut, sect. nov.

Type here designated: *V. kitamiana* Nakai.

Chromosome Numbers. 2n = 12.

Hybrids. Unknown.

Taxonomy. *V. kitamiana* is the only known species of this sect. Its style is morphologically close to that of *V. kusnezowiana* (no 44).

Characters. Plagiotropic, perennial, branching rhizome with few radical leaves and annual flowering stems at apex (Fig. 3D); style suberect, tubular, slightly geniculate at base, slightly curved at top (illustration Hama 1975 pl. 33, fig. 6).

Distribution: [Asia-Temp.: RFE, E-Asia].

43 *Viola kitamiana* Nakai, Bot. Mag. (Tokyo) 42: 564. 1928

S2b – subg. *Chamaemelanium* sect. *Kitamianae* – T2 P3

Typification: Loc. cl.: "*Yeso: in monte Iwô peninsule Shiretoko prov. Kitami*" [JAP-HK: Shiretoko Peninsula, Mount Iwo]. Holotype: SAPS [Gluber 20 July 1928]!p.

Chromosome Numbers. 2n = 12 [JAP].

Hybrids. Unknown.

Taxonomy. Incl. *V. bezdelevae* Vorosch. *V. kitamiana* is a Japanese species described from [JAP-HK]. It was discovered in [KUR: Iturup] by Voroschilov (1987) but published under *V. bezdelevae*. Barkalov (2009) establish that the two names correspond to the same taxon. In the subg. *Chamaemelanium,* this species appears morphologically remarkable by its style and white corollas with yellow center.

Distribution: [RFE: S-Kuril]; adjacent regions [JAP-HK]; general range [RFE, E-Asia].

V. bezdelevae Vorosch., Byull. Moskovsk. Obshch. Isp. Prir., Otd. Biol. 92: 134. 1987. Loc. cl.: "*Insula Iturup (Kuriles) in scoriis vulcanicis ad summitatem vulcani Stokap*" [KUR: Iturup]. Holotype: MHA [Egorova & Russanovicz 30 July 1981]n.v.

Viola sect. *Memorabiles* (W. Becker) Juz., Schischkin & Bobrov (ed.), Fl. URSS 15: 407. 1949

Basionym: *V.* "*Группа*" *Memorabiles* W. Becker in B. Fedtschenko, Fl. Aziat. Ross. 8: 19, 86. 1915.

Type: *V. kusnezowiana* W. Becker. The only species cited by Becker (1915).

Chromosome Numbers. 2n= 20.

Hybrids. Unknown.

Taxonomy. *V. kusnezowiana* is the only known species of this sect. Its style is morphologically close to that of *V. kitamiana* (no 43).

Characters. Rhizome long creeping, producing directly flowers and leaves, without annual stems (Fig. 3B); style tubular, slightly arched at top (Becker 1915 p. 88, fig. 22; Becker 1925 p. 366, no 7).

Distribution: [RFE].

44 *Viola kusnezowiana* W. Becker, in B. Fedtschenko, Fl. Aziat. Ross. 8: 88. 1915

S2b – subg. *Chamaemelanium* sect. *Memorabiles* – T2 P3

Typification. Loc. cl.: [AMU: Bureya river] [KHA: Pymena river]. Two syntypes are cited in the protologue. Lectotype designated (Bezdeleva 1987 p. 107): LE [LE01015994]!p, leg. I.W. Kusnezow, 15 July 1910, as *V. biflora*, Iter Bolon-Odshalense [KHA: upper course of river Pymena]; this specimen was studied by Becker in 1912 and lectotypified by Nikitin on sheet. Syntype F. Schmidt 1862 from [AMU]: LE [LE01015997, LE01015998]!p. Becker (1916a) cites other specimens gathered by Prokhorov and Kuzeneva: LE [LE01015995, LE01015996]!p.

Chromosome Numbers. 2n = 20 [RFE: KHA] (Probatova et al. 2017b).

Hybrids. Unknown.

Taxonomy: Shape and color of flowers and stipules are characteristic of sect. *Chamaemelanium.* By contrast, the style (gradually enlarged upward and slightly curved at summit, neither capitate nor marginate), the absence of erect flowering stems (only a horizontally creeping rhizome) and the hairiness of lateral and lower petals clearly support its status of separate species.

Distribution: [RFE: Upper- and Lower-Zeya, Bureya, Amgun, Ussuri]; general range [RFE].

Viola subg. *Melanium* (Ging.) Peterm., Deutschl. Fl. 65. 1849

Basionym: *V.* sect. *Melanium* Ging. in Mém. Soc. Phys. Genève 2(1): 23. 1823.

Type: *V. tricolor* L., the only species cited by Gingins (1823).

Chromosome Numbers. Primary base numbers x uncertain; probable secondary base numbers x' = 6, 10 (Clausen 1931b); frequent (aneu)polyploidy compose a reticulate evolution: 2n = 4, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 32, 33, 34, 36, 40, 42, 44, 48, 50, 51, 52, 54, c.64, 68, c.96, c.104, 120, c.128. Marcussen et al. (2015) estimate that allotetraploids are at the beginning of this lineage. However, they study in subg. *Melanium* only: *V. calcarata* L., *V. dirimliensis* Blaxland and *V. bicolor* Pursh, but neither *V. argenteria* Moraldo & Forneris (2n = 14) nor *V. parvula* Tin. (2n = 10) considered as primitive species, and true diploides (Küpfer 1971) with pollen grains 3-aperturate (Espeut obs. pers.).

Hybrids. Many natural or experimental hybrids described in subg. (Wittrock 1897, Becker 1910a, Clausen 1931b, Erben 1985).

Taxonomy. The complex reticulate evolution of this subg. is an obstacle to elaborate its phylogeny, however two major lineages may be established (Clausen 1931b): sect. *Tricolores* (x = 6) and sect. *Calcaratae* (x = 10).

Characters. Flowers yellow, yellowish white, purple, violet, often variegated, purple striate on lateral and lower petals, generally yellow on the throat entrance of the spurred petal; characteristic throat with hairs irregularly covered with nodules on which pollen grains attach (except sect. *Pseudorupestres,* Espeut pers. obs.); lateral petals always bearded; styles capitate, bearded on both sides, with large stigma hole; stipules dentate, lobed or divided.

Distribution: [N-Amer.; S-Amer.: S- & W-South Amer.; Afr.: N-Afr., Macaronesia; Eur.; Asia-Temp.: W- & M-Asia, Cauc., Sib., China, MON]. *V. altaica* Ker Gawl. is the only one native *Melanium* species present in [China, MON]; *V. monochroa* Klokov is the more oriental species: [Sib.: BRY].

***Viola* sect. *Melanium* Ging.**, Mém. Soc. Phys. Genève 2 (1): 23, tab. 1. 1823.

Type: *V. tricolor* L., the only species cited by Gingins (1823).

Equally Ranked Synonym. *V.* sect. *Tricolores* (Borbás) Drabble in J. Bot. 47, suppl. 2: 6. 1909.

Chromosome Numbers. Probable main base number $x = 6$; polyploids: $2n = 24, 36, 48$; dysploids or/and aneuploids: $2n = 4, 8, 10, 14, 16, 26, 34, 50, 52$.

Hybrids. Many natural and experimental hybrids within this sect., some natural hybrids with sect. *Calcaratae*.

Taxonomy. This sect. is equivalent to *Tricolores* sensu Clausen (1931b p. 699).

Characters. Spur of lower petal short or medium (up to 10 mm long); stipules palmately or pinnately divided with several lateral lobes and a terminal leaf-like division bigger than lateral ones.

Distribution of native species: like the subg. *Melanium,* minus [China, MON]. [S-Eur.] is the differentiation center of this sect. with many species; vs. few species present in Asia and N-Afr., a single in N-Amer. (*V. bicolor* Pursh), a single in S-Amer. (*V. andina* W. Becker). *V. tricolor* s.l. is the more eastern species: [Sib: ALT].

45 ***Viola tricolor* L.,** Sp. Pl. **2**: 935. 1753

S4 – subg. *Melanium* sect. *Melanium* – T2 P6 – GN

Typification. Loc. cl.: "*Habitat in Europae cultis*". Lectotype (Banerjee & Pramanik, in Jain et al. 1983. *Fasc. Fl. India* 12 p. 36): LINN [Herb. linn. 1052.21]!p.

Chromosome Numbers. $n = 13$; or $2n = 26$ many counts in [Eur.], [Sib.] (Krivenko et al. 2015), as *V. disjuncta* (Zuev 1996). Other counts come from natural or experimental hybrids: $2n = 37–38$ FRA (Verlaque & Espeut 2007); $2n = 42, 46$ EHM (Chatterjee & Sharma 1972). Sometimes, aneuploids with $2n = 25$ or 27 were recorded (Krahulcova et al. 1996) or possible back-crossing hybrids with *V. arvensis*: $2n = 28$ (Strid 1980).

Hybrids. Within this sect. with: *V. aetolica*, *V. arvensis*, *V. lutea*. With sect. *Calcaratae* between: *V. dacica*, *V. babunensis*, *V. epirota*, *V. orphanidis*, *V. calcarata*, *V. altaica* (Nikitin 2002 as *V.* × *tigirekica* Vl.V. Nikitin), *V. oreades* (Nikitin 1998 as *V.* × *wilhelmii* Vl.V. Nikitin).

Taxonomy. Incl. *V. atroviolacea* W. Becker, *V. disjuncta* W. Becker, *V. elisabethae* Klokov, *V. kupfferi* Klokov, *V. livonica* Vl.V. Nikitin, *V. macedonica* Boiss. & Heldr., *V. matutina* Klokov, *V. saxatilis* F.W. Schmidt, *V. tarbagataica* Klokov, *V. vespertina* Klokov. Misapplied name: *V. litoralis* auct. non Spreng.: Juzepczuk (1949). In N-Eur., within sect. *Melanium*, Wittrock (1897) and Clausen (1922, 1926) proved the existence of two biologic species, *V. tricolor* and *V. arvensis,* whose differentiation seems rather easy. However, in [C-Eur.] (Nauenburg 1990) and in [S-FRA] (Espeut 1996), this distinction is more difficult due to the presence of *V. arvensis* populations with large flowers, often confused with annual forms of *V. tricolor.* The grouping of coastal (*V. curtisii* s.l.) and mountain plants (*V. saxatilis* s.l.) with the annual *V. tricolor* was first considered by Clausen (1927 p. 692) then agreed by Nauenburg (1986). Here, I generalize this approach on the general range of *V. tricolor* s.l. by relating many taxa described by Jordan and Boreau in FRA, Drabble in GRB, Formanek and Schur in C-Eur. and Klokov in Russia.

Distribution of native populations: [Eur.; Asia-Temp.: Cauc., W-Asia, C-Asia, Sib.]. Naturalised populations [RFE: Ussuri, S-Sakhalin, S-Kuril (Barkalov 2009, Fukuda et al. 2014)]. In [E-Asia] *V. tricolor* escaped from cultivation (Fukuda et al. 2014 p. 24 tab.1) growing in ruderal communities as in [IRK] (Krivenko et al. 2015). Nearest native populations also live in [ALT] as *V. atroviolacea, V. disjuncta.*

46 ***Viola arvensis* Murray,** Prodr. Stirp. Gotting. 73. 1770

S3 – subg. *Melanium* sect. *Melanium* – T1 P5 – GN

Typification. Loc. cl.: "*Basel, inter segetes*" [SWI: Basel]. Lectotype designated (Nauenburg 1991): BAS n.v. in Bauhin herbarium.

Chromosome Numbers. $n = \underline{17}$; $2n = \underline{34}$: many counts in[Eur.: WSB] (Krivenko et al. 2012). Cytotype $2n = 34$ is widespread around the world and boosted by agricultural practices. Moreover, some fertile and normal euploid plants with $2n = 36$ was discovered in natural Mediterranean meadows in [FRA] (Verlaque & Espeut 2007). Considering the close relationships between *V. arvensis* and *V. tricolor*, and their chromosome numbers, both come from the same distant ancestor with $X = 6$. Both are aneuploid cytotypes, but probably created by different ways. *V. tricolor* seems to be a hypertetraploid (24 giving 26), while *V. arvensis* rather corresponds to a hypohexaploid (36 giving 34).

Hybrids. Within the sect. with *V. tricolor*. *V. contempta* Jord. should not be considered as a nothotaxon: it was cultivated and described by Jordan (1851) as a fully fertile plants, then treated as *V. arvensis* subsp. *megalantha* Nauenb. (Nauenburg 1990, Espeut 1996). *V. contempta* auct. non Jord.: Fothergill (1944), Valentine et al. (1968), Nikitin (1996, 2002, 2007 as *V.* × *maribelenae* Vl.V. Nikitin) is surely a hybrid *V. arvensis* × *V. tricolor*. Chromosome numbers of *V. arvensis* × *V. tricolor* vary between $2n = 30$ to 46 (Clausen 1926); the count $2n = 40$ as *V. contempta* (Fothergill 1944), make from botanic garden material, should correspond to this hybrid. The oldest correct name for the hybrid *V. arvensis* × *V. tricolor* is *V.* × *norvegica* Wittr. (Wittrock 1897).

Taxonomy. Many European taxa as *V. contempta* Jord. are included under *V. arvensis* (Becker 1910a, Nauenburg 1990). The distinction with *V. tricolor* is sometimes difficult due to *V. arvensis* populations with large colorful flowers (Nauenburg 1990, Espeut 1996). *V. kitaibeliana* Schult. is also a closely related species, sometimes confused with *V. arvensis*. Like the latter, there are *V. kitaibeliana* populations with large colorful corollas e.g *V. hymettia* Bois., *V. nemausensis* Jord., *V. lavrenkoana* Klokov, and *V. cretacea* Klokov (Espeut 1996, 2014).

Distribution of native populations: [Eur.; Asia-Temp.: Cauc., W-Asia, Sib.]. This taxon has become a world agricultural weed favored by the globalization of agricultural practices: [RFE: Kamchatka, N-Sakhalin, Ussuri, S-Sakhalin (Barkalov & Taran 2004)]; noted also as weed in [TAI] (Chen et al. 2007) but not in [JAP] (Akiyama & Ohba 1999).

DISCUSSION

This revision on the *Viola* spp. from the [RFE] has advanced the knowledge of this genus on nomenclatural, taxonomic and biogeographic fields.

Taxonomy and Nomenclature. I proposed and defined 4 new infrageneric taxa and 21 nomenclatural novelties (Table 2) concerning 7 infrag. and 14 infrasp. taxa. I typified 33 species or infrasp. taxa in 15 different herbaria (Table 3) and 8 infrag. taxa. (Table 4). I gave the list of taxa not yet typified

(Table 5) and listed and traced the types of 81 species or infrasp. taxa (Table 6). To facilitate the determination of the 46 species listed in the [REF], I built a general specific key and then 17 keys to differentiate infrasp. taxa and related species. Finally, I proposed or specified numerous synonyms (Table A1).

I included two non-classified species, *V. kusnezowiana* and *V. kitamiana*, in the subg. *Chamaemelanium*. This last subg. including about 50 species in the world, has two speciation centers, one in N-Amer. and the other in SE-Asia. In this subg., 8 species (17 %, Fig. 6A) of this subg. occur in the [RFE].

Based on genetic, cytological and morphological data, I raised the Hawaiian sect. *Nosphinium* to subg. rank, and I grouped it with the Amphi-Pacific sect. *Langsdorffianae* and the American sect. *Mexicanae*, *Pedatae* and *Boreali-Americanae*. The subg. *Nosphinium* is now composed of about 40 species. *V. langsdorffii* is the only one Amphi-Pacific species of this group; it has certainly migrated from Asia to America. A strong polyploidization event followed this geographic expansion.

I put sect. *Plagiostigma*, *Brachycerae*, *Vaginatae*, *Bilobatae*, *Australasiaticae*, and *Diffusae* together into the subg. *Violidium* that I isolated from the subg. *Viola*, with which it was always associated. This subg. is composed of about 100 species whose the speciation center located in SE-Asia. It is the most represented group of the [RFE]: 24 *Viola* species (52 %).

Table 2. List of nomenclatural and taxonomic novelties.

Taxa	Nomenclatural novelties
V. subgen. *Nosphinium* (W. Becker) Espeut	stat. nov.
V. sect. *Boreali-Americanae* (W. Becker) Espeut	stat. nov.
V. sect. *Langsdorffianae* (W. Becker) Espeut	stat. nov.
V. sect. *Mexicanae* (W. Becker) Espeut	stat. nov.
V. sect. *Pedatae* (Pollard) Espeut	stat. nov.
V. subsect. *Raddeanae* (W. Becker) Espeut	stat. nov.
V. subsect. *Nudicaules* (W. Becker) Espeut	stat. nov.
V. acuminata subsp. *grandistipulata* (W. Becker) Espeut	comb. & stat. nov.
V. acuminata var. *austroussuriensis* (W. Becker) Espeut	stat. nov.
V. albida var. *eizanensis* (Makino) Espeut	comb. nov.
V. albida var. *sieboldiana* (Maxim.) Espeut	stat. nov.
V. brachyceras var. *blandiformis* (Nakai) Espeut	comb. & stat. nov.
V. crassa subsp. *avatschensis* (W. Becker) Espeut	comb. & stat. nov.
V. mirabilis var . *strigosa* (W. Becker) Espeut	stat. nov.
V. orientalis subsp. *orientalis*	autonym
V. orientalis subsp. *xanthopetala* (Nakai) Espeut	comb. & stat. nov.
V. pallens subsp. *hultenii* (W.Becker & Hulten) Espeut	comb. & stat. nov.
V. tenuicornis subsp. *ircutiana* (Turcz.) Espeut	comb. & stat. nov.
V. tokubuchiana var. *crassicornis* (W. Becker & Hulten) Espeut	comb. & stat. nov.
V. tokubuchiana var. *extremiorientalis* (Vorosch. & N.S.Pavlova) Espeut	comb. & stat. nov.
V. variegata subsp. *primorskajensis* (W. Becker) Espeut	comb. nov.
V. sect. *Brachycerae* Espeut	sect. nov.
V. sect. *Kitamianae* Espeut	sect. nov.
V. subsect. *Amuricae* Espeut	subsect. nov.
V. subsect. *Grypocerae* Espeut	subsect. nov.

Table 3. List of infraspecific and specific taxa here typified. The reason of certain lectotypifications is noted with a reference to ICN article. Herbaria (listed by their codes) where the specimens are deposited; illust. = lectotypification with an illustration; N° = order number of the approved species in the text.

Taxa	ICN	Herbarium	N°
Here lectotypified			
V. alata Burgersd.		L	32
V. alisoviana Kiss		BU	21
V. arcuata Blume		L	32
V. avatschensis W. Becker & Hulten		S	42
V. canina L. (new lectotype)	[Art. 9.19c]	BM	10
V. dactyloides Schult.		HAL	13
V. epipsila Ledeb.		MU	27
V. gmeliniana Schult.		HAL	15
V. hirtipes S. Moore		K	16
V. hultenii W. Becker		S	28
V. kamtschadalorum W. Becker & Hulten		S	36
V. komarovii W. Becker (new lectotype)	[Art. 9.19c]	LE	5
V. langsdorffii Fisch. ex Ging.		G-DC	35
V. langsdorffii subsp. *sachalinensis* W. Becker		P	36
V. mandshurica W. Becker	[Art. 8.2]	LE	19
V. micrantha Turcz. “Rasse” *grandistipulata* W. Becker		G	9
V. muehldorfii Kiss		BU	38
V. multifida Willd.		HAL	11
V. mutsuensis W. Becker		G	2
V. orientalis var. *conferta* W. Becker		LE	39
V. patrinii DC.	[Art. 9.22]	G-DC	
V. philippica Cav.		MA	21
V. philippica subsp. *malesica* W. Becker		BR	21
V. pinnata L.		illust.	11
V. prionantha Bunge (second lectotype)	[Art. 9.17]	LE	22
V. selkirkii Pursh ex Goldie		K	23
V. selkirkii fa. *brevicalcarata* W. Becker		LE	23
V. selkirkii var. *glabrescens* W. Becker & Hulten		S	23
V. tenuicornis W. Becker		G	26
V. uniflora L.		LINN	37
V. verecunda A. Gray		K	32
Here neotypified			
V. ruppii All.		TO	10
V. variegata Fisch. ex Link		G-DC	25

Biogeography. Species of the [RFE] can be divided into 5 biogeographical groups (Table 7): 1) Amphi-Pacific: species occurring in Asia and N-America; 2) Palearctic: species present from [W-Eur.] to [RFE]; 3) E-Palearctic: species present from [W-Sib. to RFE]; 4) SE-Palearctic: species absent or rare in [S-Sib.], present in [China, KOR, JAP, S-RFE], rare in [N-RFE]; 5) Far E-Palearctic: species present in [RFE, JAP, KOR, CHM], absent from [Sib., W-, C- & S-China]. Naturalized species are not taken into account. The Far E-Palearctic group is the largest with 14 species (32 %, Fig. 6B). They are endemic to this area that corresponds nearly to the Zone of Pacific monsoon, described by Galanin & Belikovich (2009). These species are adapted to a continental climate with humid summer (oceanic influences). E-Paleartic species are also well represented (30 %). The comparative study with NW-American species established that *V. pallens* (incl. *V. hultenii*), *V. brachyceras* (incl. *V. renifolia*) and *V. crassa* (incl. *V. biflora* subsp. *carlottae*) could also be considered as Amphi-Pacific species which count 7 species (16 %). The SE-Palearctic group (14 %) is com-

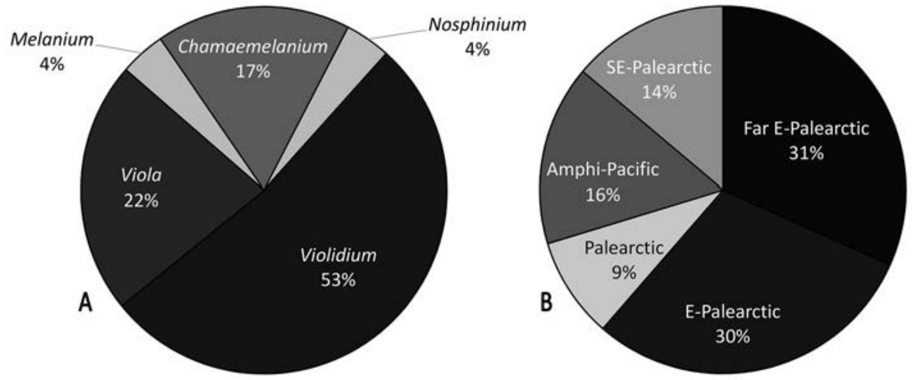

Figure 6 Subgenus ratio (A) and biogeographical categorie ratio (B) of species of *Viola* in the Russian Far East

Table 4. List of infrageneric taxa here typified. The reason of the typification is noted with a reference to ICN article.

Taxa	**Type**	**ICN**
V. subgen. *Nosphinium* (W. Becker) Espeut	*V*. *chamissoniana* Ging.	·
V. sect. *Bilobatae* (W. Becker) Juz.	*V*. *arcuata* Blume	·
V. sect. *Brachycerae* Espeut	*V*. *brachyceras* Turcz.	·
V. sect. *Kitamianae* Espeut	*V*. *kitamiana* Nakai	·
V. subsect. *Arosulatae* (Borbás) Juz.	*V*. *pumila* Vill.	[art. 10.5]
V. subsect. *Bilobatae* (W. Becker) W. Becker	*V*. *arcuata* Blume	·
V. subsect. *Grypocerae* Espeut	*V*. *grypoceras* A. Gray	·
V. subsect. *Nudicaules* (W. Becker) Espeut	*V*. *uniflora* L.	·

Table 5. List of Taxa not typified. N° – order number of the approved species where the taxon is placed.

Taxa	**N°**
V. brainerdii Greene	29
V. epipsila subsp. *palustroides* W. Becker	27
V. glabella Nutt. ex Torr. & A.Gray	40
V. grypoceras A. Gray	6
V. kamtschatika Ging.	23
V. mirabilis var. *glaberrima* W. Becker	8
V. mirabilis var. *subglabra* Ledeb.	8
V. patrinii fa. *hispida* W. Becker	18
V. pinnata L. var. *sieboldiana* Maxim.	14
V. pinnata var. *chaerophylloides* Regel	14
V. rupestris var. *glaberrima* Murb.	4
V. takedana Makino	24
V. yazawana Makino	30
V. yedoensis Makino	21

posed of species adapted to warmer climates; they are at the northern limits of their distribution. The Palearctic group includes only 4 species (9 %), which are also present in France.

CONCLUSION

This study highlights the botanical interest of the [RFE]. This sector is cleaved by two major biogeographical zones: the Circumboreal Region and the Eastern Asiatic Region (Takhtajan 1986). In the genus *Viola*, this partition is effective: some species, such as *V. albida*, *V. grypoceras*, *V. mandchurica* and *V. phalacrocarpa* do not reach the Siberian forests and are limited to the hottest territories; *V. arcuata* and *V. philippica*, that reach here their northern limits, are also tropical species. Others like *V. dactyloides*, *V. gmeliniana*, *V. mauritii*, *V. patrinii*, *V. sacchalinensis* are common in the boreal region; *V. biflora*, *V. epipsila*, and *V. selkirkii* even reaches [Eur.] and [N-Amer.]. Several species are located along the Pacific coast: *V. brevistipulata*, *V. diamantiaca*, *V. hirtipes*, *V. kamtschadalorum*, *V. kusanoana*, *V. muehldorfii*, *V. orientalis*, *V. mariae*, *V. pacifica*, *V. tokubuchiana*, *V. yazawana*. They belong to the flora of the monsoon zone of Pacific Russia. Note that *V. kitamiana* is endemic of this area, characterized by a restricted distribution and its unique morphology. The Amur river basin is a biodiversity hotspot on the borderline between temperate and boreal regions: *V. raddeana*, *V. amurica* and *V. kusnezowiana* are endemic species of this zone which is also heavily subject to oceanic influences. They all show singular morphological characteristics.

ACKNOWLEDGEMENTS

I would like, first of all, to thank Dr. Nina S. Probatova (Federal Scientific Center of Biodiversity of the East Asian Terrestrial Biota FEB RAS, Vladivostok, Russia) for her encouragement, and her interest, suggestions and assistance throughout this study. I also wish to thank Dr. V. Yu. Barkalov for having sent many field photographs of *Viola*.

I express my gratitude to the directors, curators, and staff of the following herbaria for having allowed me to consult the collections as a visitor: P, G and in particular Florian Jabbour (P) and Nicolas Fumeaux (G). I would also like to thank the staff of herbaria BP, LE, MAH, NDG, S, SAPS, TI, TO, VLA for mailing specimen pictures and more particularly Marina V. Legchenko, Irina D. Illarionova from LE for their kindness and availability. I thank Régine Verlaque for the pertinence and courage she showed in correcting a long and arduous text.

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Table 6. List of infraspecific and specific taxa previously typified or whose holotype has been traced. The reason for the change in status of certain types is noted with a reference to ICN article 9.1 note 1. Herbaria are listed by herbarium code; illust. = lectotypification with an illustration; N° = order number of the approved species in the text; H = holotype; N = neotype; L = lectotype; L* = Byalt's lectotypification (2018).

Taxa	ICN	Herbarium: typification	N°
V. achyrophora Greene	+	NDG: H	27
V. acuminata subsp. austroussuriensis W. Becker		LE: L	9
V. acuminata var. dentata W. Becker		LE: L	9
V. albida Palib.		LE: L	14
V. albida subsp. *marginata* W. Becker		LE: H	14
V. amurica W. Becker	+	LE: H	33
V. arenaria DC.	+	G-DC: H	4
V. arvensis Murray		BAS: L	46
V. baicalensis W. Becker	+	LE: H	25
V. barkalovii Bezd.		VLA: H	32
V. bezdelevae Vorosch.		MHA: H	43
V. biflora L.		LINN: L	41
V. blandiformis Nakai		TI: L	29
V. brachyceras Turcz.		LE: L*	29
V. brachysepala Maxim.	+	LE: H	8
V. carnosula W. Becker	+	LE: H	23
V. chassanica Kork.		VLA: H	30
V. collina Besser		LE: L	1
V. confusa Champ. ex Benth.		K: L	21
V. crassa Makino	+	MAK: H	42
V. crassa subsp. *borealis* Takah.		KPM: H	42
V. crassa var. *shikkensis* Miyabe & Tatew.	+	SAPS: H	42
V. crassa var. *vegeta* Nakai		SAPS: H	42
V. crassicornis W. Becker & Hulten		S: H	24
V. dactyloides var. *multipartita* W. Becker		LE: L*	13
V. diamantiaca Nakai		TI: L	31
V. dissecta Ledeb.		LE: L	11
V. dissecta var. *takahashii* Nakai		TI: L	14
V. extremiorientalis Vorosch. & N.S.Pavlova		MHA: H	24
V. fissifolia Kitag.		TI: H	12
V. franchetii H. Boissieu		P: H	36
V. hirtipes var. *pubescens* Bezd.		VLA: H	16
V. incisa Turcz.		LE: L	12
V. ircutiana Turcz.		LE: L	26
V. kamtschadalorum var. *pubescens* Miyabe & Tatew.	+	SAPS: H	36
V. keiskei subsp. *transmaritima* W. Becker	+	LE: H	17
V. kitamiana Nakai		SAPS: H	43
V. koraiensis Nakai		TI: L	5
V. kurilensis Nakai		TI: H	35
V. kusanoana Makino		TI: L	2
V. kusnezowiana W. Becker		LE: L	44
V. langsdorffii var. *caulescens* Ging.	+	G-DC: H	36
V. lasiostipes Nakai		TI: H	38
V. mariae W. Becker	+	LE: H	7
V. mauritii Tepl.		LE: L	3
V. micrantha Turcz.		LE: L	9
V. milanae Vl.V. Nikitin		LE: H	11
V. mirabilis fa. *strigosa* W. Becker		LE: L*	8
V. mirabilis L.		LINN: L	8
V. miranda W. Becker	+	LE: H	5
V. miyakei Nakai		SAPS: H	2
V. montana L.		LINN: L	9
V. nemoralis Kütz.		illust.: L	9
V. patrinii var. *macrantha* Maxim.		LE: L*	18
V. patrinii var. *subsagittata* Maxim.		LE: L*	18
V. phalacrocarpa Maxim.		LE: L	20
V. phalacrocarpa subsp. *alexandrowiana* W. Becker	+	LE: H	17
V. phalacrocarpa subsp. *brevicalcarata* W. Becker	+	LE: H	17
V. philippica subsp. *munda* W. Becker		LE: L*	21
V. pinnata var. *chaerophylloides* Regel		LE: N	14
V. prionantha Bunge		LE: L	22
V. pseudojaponica Nakai		TI: H	21
V. raddeana Regel		LE: L*	34
V. repens Turcz. ex Trautv. & C.A. Mey.		LE: L	27
V. rotundifolia var. *pallens* Banks ex Ging.		BM: L	28
V. rupestris F.W. Schmidt		BP: L	4
V. sacchalinensis H. Boissieu		LE: L	5
V. sacchalinensis var. *alpina* H. Hara		TI: H	5
V. selkirkii var. *angustistipulata* W. Becker		LE: L*	23
V. seoulensis Nakai		TI: L	22
V. silvestriformis W. Becker		LE: L*	2
V. tenuicornis subsp. *primorskajensis* W. Becker		LE: L*	25
V. tenuicornis subsp. *trichosepala* W. Becker		LE: L*	26
V. teplouchovii Juz.		LE: L*	3
V. tokubuchiana Makino		TI: L	24
V. tricolor L.		LINN: L	45
V. uniflora var. *orientalis* Maxim.		LE: L*	39
V. ursina Kom.		LE: L	35
V. vorobievii Bezd.		VLA: H	32
V. woroschilovii Bezd.		VLA: H	22
V. xanthopetala Nakai		TI: L	39

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Table 7. Geographical areas of *Viola* spp. from [RFE]. **Floristic districts**: 1, Chukotka; 2, Anyuy; 3, Anadyr-Penzhina; 4, Koryak; 5, Kolyma,; 6, Okhotsk; 7, Aldan; 8, Nyukzha; 9, Dauria; 10, Kamchatka; 11, Commander Is.; 12, N-Sakhalin; 13, N-Kuril; 14, Upper-Zeya; 15, Lower-Zeya; 16, Bureya; 17, Amgun; 18, Ussuri; 19, S-Sakhalin; 20, S-Kuril. **Bordering regions**: J, Japan (Hokkaido Island); C, China (Mandchouria); K, N-Korea; S, Siberia; A, Alaska (USA).

Species	**Subgenus**	**Floristic districts of the [RFE]**																				**Adjacent regions**					**Biogeographical groups**
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**J**	**C**	**K**	**S**	**A**	
V. acuminata	*Viola*	·	·	·	·	·	·	·	·	·	·	·	x	·	x	x	x	x	x	x	x	x	x	x	x	·	E-Palearctic
V. albida	*Violidium*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	x	·	·	x	·	·	·	x	x	·	·	SE-Palearctic
V. amurica	*Violidium*	·	·	·	·	·	·	·	x	·	·	·	·	·	x	x	·	·	x	x	·	·	x	·	x	·	E-Palearctic
V. arcuata	*Violidium*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	x	x	·	x	x	x	x	x	x	·	·	SE-Palearctic
V. arvensis	*Melanium*	·	·	·	·	·	·	·	·	·	x	·	x	·	·	·	·	·	x	x	·	·	·	·	·	·	naturalized
V. biflora	*Chamaemelanium*	·	·	x	x	·	x	x	x	x	x	·	x	x	x	x	x	x	x	x	x	x	x	x	x	x	Amphi-Pacific
V. brachyceras	*Violidium*	·	·	·	·	x	x	x	·	x	·	·	·	·	x	x	x	·	x	·	·	x	·	x	x	x	Amphi-Pacific
V. brevistipulata	*Chamaemelanium*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	x	·	x	x	·	·	·	·	Far E-Palearctic
V. canina	*Viola*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	?	·	?	·	·	·	·	·	·	x	·	Palearctic
V. collina	*Viola*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	x	x	x	x	x	x	x	x	x	x	·	Palearctic
V. crassa	*Chamaemelanium*	·	·	x	x	·	x	·	·	·	x	x	x	x	·	·	·	·	·	·	x	x	·	·	·	·	Amphi-Pacific
V. dactyloides	*Violidium*	·	·	·	·	·	·	x	·	x	·	·	·	·	x	x	x	·	x	·	·	·	x	·	x	·	E-Palearctic
V. diamantiaca	*Violidium*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	x	·	·	·	x	x	·	·	Far E-Palearctic
V. epipsila	*Violidium*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	Amphi-Pacific
V. gmeliniana	*Violidium*	·	·	·	·	·	x	x	x	x	·	·	·	·	x	x	x	x	x	·	·	·	x	·	x	·	E-Palearctic
V. grypoceras	*Viola*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	x	x	x	x	·	·	·	SE-Palearctic
V. hirtipes	*Violidium*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	x	·	·	x	x	x	·	·	Far E-Palearctic
V. incisa	*Violidium*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	x	·	·	x	·	·	·	x	·	x	·	E-Palearctic
V. kamtschadalorum	*Nosphinium*	·	·	·	·	·	·	·	·	·	x	·	x	x	·	·	·	x	·	x	x	x	·	·	·	·	Far E-Palearctic
V. kitamiana	*Chamaemelanium*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	x	x	·	·	·	·	Far E-Palearctic
V. kusanoana	*Viola*	·	·	·	·	·	·	·	·	·	·	·	x	·	·	·	·	·	x	x	x	x	·	·	·	·	Far E-Palearctic
V. kusnezowiana	*Chamaemelanium*	·	·	·	·	·	·	·	·	·	·	·	·	·	x	x	x	x	x	·	·	·	·	·	·	·	Far E-Palearctic
V. langsdorffii	*Nosphinium*	·	·	·	·	·	·	·	·	·	x	x	x	x	·	·	·	·	·	x	x	x	·	·	·	x	Amphi-Pacific
V. mandshurica	*Violidium*	·	·	·	·	·	·	·	·	x	·	·	·	·	x	x	x	·	x	·	x	x	x	x	·	·	SE-Palearctic
V. mariae	*Viola*	·	·	·	·	·	·	·	·	·	·	·	x	·	·	·	·	·	·	·	·	·	·	·	·	·	Far E-Palearctic
V. mauritii	*Viola*	·	·	·	·	x	x	x	·	x	·	·	·	·	·	x	·	·	·	·	·	·	·	·	x	·	E-Palearctic
V. mirabilis	*Viola*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	x	x	·	x	·	·	x	x	x	x	·	Palearctic
V. muehldorfii	*Chamaemelanium*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	x	·	·	x	·	·	·	x	x	·	·	Far E-Palearctic
V. multifida	*Violidium*	·	·	·	·	·	·	·	·	x	·	·	·	·	·	x	·	·	x	·	·	·	x	·	x	·	E-Palearctic
V. orientalis	*Chamaemelanium*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	x	·	·	·	x	x	·	·	Far E-Palearctic
V. pacifica	*Violidium*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	x	·	·	x	·	·	·	·	·	·	·	Far E-Palearctic
V. pallens	*Violidium*	·	·	·	·	·	·	·	·	·	x	·	·	x	·	·	·	·	·	·	x	x	·	·	·	x	Amphi-Pacific
V. patrinii	*Violidium*	·	·	·	·	·	·	·	·	x	·	·	·	·	x	x	x	x	x	x	x	x	x	x	x	·	E-Palearctic
V. phalacrocarpa	*Violidium*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	x	·	x	x	·	x	x	x	x	·	·	SE-Palearctic
V. philippica	*Violidium*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	x	·	·	x	·	·	·	x	x	·	·	SE-Palearctic
V. prionantha	*Violidium*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	x	·	·	·	x	x	x	·	E-Palearctic
V. raddeana	*Violidium*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	x	x	·	x	·	·	x	x	x	·	·	Far E-Palearctic
V. rupestris	*Viola*	·	·	·	·	·	x	x	x	x	·	·	x	·	x	x	x	x	x	x	·	·	·	·	x	·	Palearctic
V. sacchalinensis	*Viola*	·	·	·	x	x	x	x	x	x	x	·	x	x	x	x	x	x	x	x	x	x	x	x	x	·	E-Palearctic
V. selkirkii	*Violidium*	·	·	·	·	·	x	x	·	·	x	·	x	x	·	x	x	x	x	x	x	x	x	x	x	x	Amphi-Pacific
V. tenuicornis	*Violidium*	·	·	·	·	·	·	·	·	x	·	·	·	·	·	x	·	·	x	·	·	·	x	x	x	·	E-Palearctic
V. tokubuchiana	*Violidium*	·	·	·	·	·	·	·	·	·	x	·	·	·	·	·	·	·	x	·	·	x	x	x	·	·	Far E-Palearctic
V. tricolor	*Melanium*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	x	x	·	·	·	·	·	·	naturalized
V. uniflora	*Chamaemelanium*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	x	·	x	·	·	·	·	·	x	·	E-Palearctic
V. variegata	*Violidium*	·	·	·	·	·	·	·	·	x	·	·	·	·	·	x	x	·	x	x	·	·	x	x	x	·	E-Palearctic
V. yazawana	*Violidium*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	x	·	·	·	·	x	·	·	Far E-Palearctic

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Index to taxa of *Viola* mentioned in the text