

L. PERUZZI (\*)

## NOMENCLATURAL NOVELTIES AT SECTIONAL LEVEL IN *GAGEA* (LILIACEAE)

**Abstract** - After critical analysis of the available systematic and phylogenetic literature, some adjustment to the current *Gagea* infrageneric classification is proposed, including the two nomenclatural novelties sect. *Triflorae* Peruzzi and sect. *Persicae* (Levichev) Peruzzi. The new setting is made up by at least 14 sections.

**Key words** - *Gagea*, Liliaceae, *Lloydia*, nomenclature, taxonomy.

**Riassunto** - *Novità nomenclaturali a livello di sezione in Gagea (Liliaceae)*. Dopo un'attenta analisi della letteratura sistematica e filogenetica disponibile, vengono proposti alcuni aggiustamenti alla corrente classificazione infragenerica di *Gagea*, incluse le due novità nomenclaturali *Gagea* sect. *Triflorae* Peruzzi e *Gagea* sect. *Persicae* (Levichev) Peruzzi. Il nuovo inquadramento conta almeno 14 sezioni.

**Parole chiave** - *Gagea*, Liliaceae, *Lloydia*, nomenclatura, tassonomia.

### INTRODUCTION

*Gagea* Salisb. (incl. *Lloydia* Salisb. ex Rchb.) is one of the 15 genera currently included in the family Liliaceae (tribe Tulipeae) and has a Boreal distribution (with the only species *G. serotina* (L.) Ker Gawl. outside the Eurasian continent). According to Peruzzi *et al.* (2009a, and literature cited therein) it is the sister group of all the other Tulipeae genera (*Amana* Honda, *Erythronium* L., *Tulipa* L.). Among Liliaceae, *Gagea* is the genus with the highest number of species (ca. 280), a diversity that is presumably due to frequent occurrence of polyploidy and hybridization, combined with propensity for vegetative propagation (Peruzzi, 2008; Peterson *et al.*, 2009). Recent studies in the molecular systematics (Peterson *et al.*, 2004; 2008; 2011; Peruzzi *et al.*, 2008a-b; Zarrei *et al.*, 2009; Peruzzi *et al.*, 2011) have led to an improved understanding of its phylogeny, mostly confirming the sectional classification of the specialist I. G. Levichev (see Peterson *et al.*, 2008), who recognized 13 sections and *Lloydia* as a distinct genus. Some needed nomenclatural change was already done by Peruzzi *et al.* (2008a) in merging of sect. *Fistulosae* (Pascher) Davlianidze with sect. *Didymobulbos* K. Koch, by Peruzzi *et al.* (2008b), concerning the downgrading of the genus *Lloydia* Salisb. ex Rchb. to a *Gagea* section (sect. *Lloydia* (Salisb. ex Rchb.) Peruzzi, J.-M. Tison, A. Peterson & J. Peterson), and by Zarrei *et al.* (2011a),

concerning sect. *Tricholloydia* (Engl.) Zarrei & Wilkin (formerly, a *Lloydia* section). The latter authors also proposed a new infrageneric classification of *Gagea*, by recognizing 7 sections only. However, they did not take into adequate account the massive knowledge on morphoanatomy and ontogeny accumulated by I. G. Levichev in years of study (Levichev, 1990; 1999; 2006). In my opinion, indeed, an alternative, more analytical sectional classification is possible, still recognizing monophyletic, but morpho-anatomically more homogeneous, units respect with the proposal of Zarrei *et al.* (2011a).

At least 14 different lineages can be recognized in *Gagea*, on phylogenetic grounds. Sect. *Anthericoides* A. Terracc., sect. *Gagea*, sect. *Lloydia*, sect. *Plecostigma* (Turcz.) Engler, and sect. *Tricholloydia* are all recognized also by Zarrei *et al.* (2011), and are supported in the same circumscription here.

On the other hand, these authors merge sect. *Bulbiferae* Levichev, sect. *Graminifoliae* Levichev and sect. *Incrustatae* Levichev with sect. *Platyspermum* Boiss. While I fully agree with the phylogenetic inconsistency of sect. *Graminifoliae*, well nested within sect. *Platyspermum*, the other two sections (*Bulbiferae* and *Incrustatae*) form distinct high supported clades (99-100% bootstrap), when ITS regions is used as molecular marker (Peterson *et al.*, 2008; 2011), so that they can be retained at sectional level as well. Sect. *Bulbiferae* is also recognized as monophyletic, with lower statistical support (79%), when the cpDNA markers *psbA-trnH* IGS and *trnL-trnF* IGS are used (Peterson *et al.*, 2011). Zarrei *et al.* (2011a) also merge sect. *Dschungaricae* Levichev, sect. *Minimae* (Pascher) Davlianidze, sect. *Spathaceae* Levichev and sect. *Stipitatae* (Pascher) Davlianidze with sect. *Didymobulbos* K. Koch. Again, while sect. *Dschungaricae* is indeed not phylogenetically consistent, the remaining sections represent each a separate lineage in *Gagea* evolution, with moderate to high statistical support (Peterson *et al.*, 2008; 2011; Zarrei *et al.*, 2009), with the exception of sect. *Stipitatae*, seemingly polyphyletic. Indeed, the clade including the type-species (*G. stipitata* Merckl. ex Bunge, whose correct name is *G. kunawurensis* [Royle] Greuter, according to Zarrei *et al.*, 2011b), *G. capillifolia* Vved., *G. chomutowae* (Pascher) Pascher, *G. lactea* Levichev *nom. nud.*, *G. ova* Stapf and *G. x turanica* Levichev (+ *G. dschungarica* Regel, type-species of sect. *Dschungaricae*) is supported by ITS region + cpDNA data (83% bootstrap; Peter-

(\*) Dipartimento di Biologia, Unità di Botanica Generale e Sistematica, Università di Pisa, via L. Ghini 5, 56126 Pisa, Italy.  
E-mail: lperuzzi@biologia.unipi.it

son *et al.*, 2008). *Gagea* sect. *Stipitatae* species outside this clade, are *G. gageoides* (Zucc.) Vved. (= *G. persica* Boiss.), *G. caelestis* Levichev and *G. pseudominutiflora* Levichev. While the former is rather differentiated from the core *Stipitatae* and it was already included in the distinct series *Persicae* by Levichev (1990), the latter two clearly need further taxonomic studies and may deserve further distinction at sectional level. However, this is premature according to the available data.

Finally, a further species is recognized as an independent phylogenetic lineage by both Peterson *et al.* (2008) and Zarrei *et al.* (2009): *G. triflora* (Ledeb.) Schult. & Schult. f. This species was indeed already recognized as morphologically isolated within the genus by Terracciano (1905), who however avoided to formally name an infrageneric taxon for it.

#### NOMENCLATURAL NOVELTIES

##### sect. *Triflorae* Peruzzi **sect. nov.**

*Gagea* [unranked] *Euspathaceae*. – *Umbella sub-simplex, pedunculata, folium caulinum ab hac longe remotum. Folia radicalia fistulosa. Perigonii segmenta obtusa, glabra. Ovarium obovatum, apice impressum, basi leviter attenuatum. X Bulbus biennis solum foliferus. Umbella potius pauciflora. Perigonii segmenta lanceolato-obtusata, albida v. rosea.* A. Terracc., Bull. Herb. Boiss., ser. 2, 5: 1062 (1905)

Holotypus: *Gagea triflora* (Ledeb.) Schult. & Schult. f.

##### sect. *Persicae* (Levichev) Peruzzi **stat. nov.**

Bas.: *Gagea* sect. *Stipitatae* ser. *Persicae* Levichev, Bot. Zhurn. 75(2): 230 (1990)

#### ACCEPTED INFRAGENERIC TAXONOMIC SETTING IN *GAGEA*

All things considered, I recognize here 14 sections, which could soon increase in number. For a detailed overview of previous infrageneric classifications see Peterson *et al.* (2008; 2011) and Zarrei *et al.* (2009).

*Gagea* Salisb., Ann. Bot. (König & Simms) 2: 555 (1806)

sect. *Anthericoides* A. Terracc., Bull. Soc. Bot. France 52: 24 (1905)

sect. *Bulbiferae* Levichev, Mol. Phylogenet. Evol. 46: 448 (2008)

sect. *Didymobulbos* (K. Koch) Boiss., Fl. Orient. 5: 204 (1882)

= sect. *Fistulosae* (Pascher) Davlian., Not. Syst. Geogr. Inst. Bot. Thbilissiensis 30: 62 (1973)

sect. *Gagea*

sect. *Incrustatae* Levichev, Bot. Zhurn. 75(2): 232 (1990)

sect. *Lloydia* (Salisb. ex Rchb.) Peruzzi, J.-M. Tison, A. Peterson & J. Peterson, Taxon 57(4): 1212 (2008)

sect. *Minimae* (Pascher) Davlian., Not. Syst. Geogr. Inst. Bot. Thbilissiensis 30: 62 (1973)

sect. *Persicae* (Levichev) Peruzzi **stat. nov.**

sect. *Platyspermum* Boiss., Fl. Orient. 5: 204 (1882)

= sect. *Graminifoliae* Levichev, Bot. Zhurn. 75(2): 231 (1990)

sect. *Plecostigma* (Turcz.) Pascher, Lotos 24: 116 (1904)

sect. *Spathaceae* Levichev, Mol. Phylogenet. Evol. 46: 449 (2008)

sect. *Stipitatae* (Pascher) Davlianidze, Not. Syst. Geogr. Inst. Bot. Thbilissiensis 29: 71 (1972)

= sect. *Dschungaricae* Levichev, Mol. Phylogenet. Evol. 46: 448 (2008)

sect. *Tricholloydia* (Engl.) Zarrei & Wilkin, Phytotaxa 15: 53 (2011)

sect. *Triflorae* Peruzzi **sect. nov.**

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