Report 2021 on plant biodiversity in Italy: native and alien vascular flora

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Abstract - This paper provides an updated overview, based on nomenclatural, taxonomical and distribution data published in 2021, on the native and alien vascular flora of Italy. The details on the occurrence at national and regional level and the lists of taxa occurring in Italy described in 2021 are provided.

Key words: checklist, endemism, extinction, Mediterranean flora, new taxa, nomenclature, taxonomy.

Riassunto - Rapporto 2021 sulla biodiversità vegetale in Italia: flora vascolare autoctona e alloctona.

Viene presentato un rapporto sulla flora vascolare autoctona e alloctona del territorio italiano basato sugli aggiornamenti nomenclaturali, tassonomici e distributivi pubblicati nel 2021. Vengono inoltre forniti i dettagli sulla presenza dei taxa a livello nazionale e regionale e l'elenco dei taxa descritti nel 2021 presenti sul territorio nazionale.

Parole chiave: checklist, endemismo, estinzione, flora mediterranea, nomenclatura, nuovi taxa, tassonomia.

INTRODUCTION

After the publication of the two checklists of the native and alien vascular flora of Italy (Bartolucci *et al.*, 2018; Galasso *et al.*, 2018), several floristic, systematic, and taxonomic studies were published. Last year, recovering all this data, we published an updated (end of 2020) overview on plant biodiversity in Italy (Bartolucci *et al.* 2021a), showing that the Italian native and alien vascular flora consisted of 9,897 taxa (including casual alien plants), belonging to 1,547 genera and 198 families. The new floristic records of 2021 concerning the distribution of the Italian vascular flora were published in the series "Notulae to the Italian native vascular flora" (Bartolucci *et al.*, 2021b, 2021c) and "Notulae to the Italian alien vascular flora" (Galasso *et al.*, 2021a, 2021b). These series also include nomenclatural, taxonomical, and distribution updates published elsewhere, and corrigenda to the published checklists, provided as supplementary materials. These 2021 data are already included into the information system Portal to the Flora of Italy (2022), as explained by Galasso *et al.* (2020) and Martellos *et al.* (2020).

The aim of this paper is to provide an overview on systematics, taxonomy and distribution (at national and regional level) of the native and alien vascular flora of Italy updated at the end of 2021.

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MATERIAL AND METHODS

The circumscription of families follows Bartolucci *et al.* (2018) and Galasso *et al.* (2018). The family Chenopodiaceae was included in Amaranthaceae based on the recent molecular study by Morales-Briones *et al.* (2021).

The data also include apomictic taxa belonging to *Alchemilla* and *Rubus* (Rosaceae), *Hieracium*, *Pilosella* and *Taraxacum* (Asteraceae), and the *Ranunculus auricomus* group (Ranunculaceae). Taxa at varietal rank were not considered. Hybrids are included only if occurring as aliens. For Italian endemic taxa, we referred to the inventory proposed by Peruzzi *et al.* (2014), which is continuously updated (see http://goo.gl/x8QL4J), and to Bartolucci *et al.* (2018). Following these authors, the "Italian endemic" status was attributed to those taxa occurring only in Italy, or in Italy and Corse (France), or in Italy and Malta.

The distribution is given as presence/absence in each of the 20 administrative regions of Italy (not considering the two enclave-countries Republic of San Marino and Vatican City State), which are coded as follows: Valle d'Aosta, VDA; Piemonte, PIE; Lombardia, LOM; Trentino-Alto Adige, TAA; Veneto, VEN; Friuli Venezia Giulia, FVG; Liguria, LIG; Emilia-Romagna, EMR; Toscana, TOS; Marche, MAR; Umbria, UMB; Lazio, LAZ; Abruz-

zo, ABR; Molise, MOL; Puglia, PUG; Campania, CAM; Basilicata, BAS; Calabria, CAL; Sicilia, SIC; Sardegna, SAR. For each region, the occurrence status of each taxon is provided, according to the categories proposed by Bartolucci *et al.* (2018) and Galasso *et al.* (2018).

RESULTS

To date (end of 2021), the Italian native and alien vascular flora consists of 9,948 taxa (including casual alien plants), belonging to 1,555 genera and 199 families (Tab. 1).

The native vascular flora consists of 8,249 taxa (6,470 species and 1,779 subspecies) belonging to 1,104 genera and 152 families. The taxa certainly occurring in Italy are 7,556 (P, including 51 cryptogenic taxa), while 550 taxa have not been confirmed in recent times (NC, including 2 cryptogenic taxa), 97 are doubtfully occurring (D), and 18 are data deficient (DD) (Tabs. 2, 5). In addition to not confirmed taxa, 28 are considered extinct or possibly extinct (the list is available in Bartolucci *et al.*, 2021a). In addition, the taxa recorded by mistake at national level are 203 (Tabs. 2, 5). The administrative regions showing the highest number of native taxa (Tabs. 1, 2) are: PIE (3,486), TOS (3,422), LOM (3,293), ABR (3,207), VEN (3,183), and TAA (3,119). By including also, the regionally non-native taxa (casual, CAS; naturalized, NAT; invasive, INV), the administrative regions with the highest number of taxa are: PIE (3,564), TAA (3,509), LOM (3,466), TOS (3,458), VEN (3,367), and ABR (3,237). Taxonomically doubtful taxa are 433 (Tab. 5). The increase in the number of taxa from 2020 at regional level is showed in Table 7.

The taxa endemic to Italy are 1,739, grouped in 69 families and 316 genera, 1,483 not considering the taxonomically critical *Hieracium* and *Pilosella* subspecies. Among them, the taxa certainly occurring in Italy are 1,610 (P), while 115 taxa have not been confirmed in recent times (NC), 1 is doubtfully occurring (*Paeonia corsica* Sieber ex Tausch, occurring in Corsica, but doubtfully in Sardegna) (D), and 13 are considered extinct or possibly extinct (EX) (Tab. 3). The administrative regions

Tab. 1 - Number of native and alien taxa occurring in each of the 20 administrative regions in 2021. Native: N+C (native + cryptogenic); N+C+A REG [NAT, INV] (native + cryptogenic + regionally non-native [naturalized, invasive]); N+C+A REG [CAS, NAT, INV] (native + cryptogenic + regionally non-native [casual, naturalized, invasive]); Alien: ARC (archaeophyte, casual aliens included); NEO (neophyte, casual aliens included); ARC ESTABL. (archaeophyte, casual aliens excluded); NEO ESTABL. (neophyte, casual aliens excluded). / Numero dei taxa nativi e alieni presenti nel 2021 in ognuna delle 20 regioni amministrative. Nativi: N+C (nativi + criptogenici); N+C+A REG [NAT, INV] (nativi + criptogenici + alieni regionali [naturalizzati, invasivi]); N+C+A REG [CAS, NAT, INV] (nativi + criptogenici + alieni regionali [casuali, naturalizzati, invasivi]); Alieni: ARC (archeofite, inclusi gli alieni casuali); NEO (neofite, inclusi gli alieni casuali); ARC ESTABL. (archeofite, esclusi gli alieni casuali); NEO ESTABL. (neofite, esclusi gli alieni casuali).

	NUMBER OF TAXA (2021)										
	NATIVE			ALIEN						NATIVE + ALIEN	
	N+C	N+C+A REG [NAT, INV]	N+C+A REG [CAS, NAT, INV]	ARC ESTABL. [NAT, INV]	NEO ESTABL. [NAT, INV]	ARC [CAS, NAT, INV]	NEO [CAS, NAT, INV]	ARC+NEO ESTABL. [NAT, INV]	ARC+NEO [CAS, NAT, INV]	TOTAL (casual excluded)	TOTAL (casual included)
PIE	**3,486**	3,523	3,564	36	277	100	460	313	**560**	3,836	4,102
TOS	**3,422**	3,438	3,458	39	254	124	533	293	**657**	3,731	4,102
LOM	**3,293**	3,326	3,466	43	332	126	681	375	**807**	3,701	4,242
ABR	**3,207**	3,224	3,237	39	117	105	273	156	**378**	3,380	3,604
VEN	**3,183**	3,249	3,367	36	229	113	543	265	**656**	3,514	4,003
TAA	**3,119**	3,215	3,509	23	151	109	507	184	**616**	3,399	4,098
LAZ	**3,045**	3,067	3,092	37	151	99	417	188	**516**	3,255	3,593
LIG	**3,035**	3,063	3,115	26	147	81	411	173	**492**	3,236	3,574
FVG	**2,984**	3,066	3,155	38	156	100	409	194	**509**	3,260	3,666
CAM	**2,829**	2,842	2,846	39	146	101	364	185	**465**	3,027	3,298
EMR	**2,826**	2,850	2,872	33	228	118	467	261	**585**	3,111	3,418
CAL	**2,797**	2,808	2,822	29	133	75	277	162	**352**	2,970	3,158
SIC	**2,765**	2,775	2,791	34	199	84	401	233	**485**	3,008	3,262
BAS	**2,637**	2,644	2,647	27	68	84	164	94	**248**	2,738	2,878
PUG	**2,562**	2,571	2,586	27	111	82	308	138	**390**	2,709	2,962
MAR	**2,528**	2,558	2,574	30	110	98	302	140	**400**	2,698	2,946
UMB	**2,371**	2,391	2,416	25	66	98	208	91	**306**	2,482	2,709
SAR	**2,330**	2,406	2,465	36	177	108	412	213	**520**	2,619	2,963
MOL	**2,319**	2,336	2,342	32	62	69	123	94	**192**	2430	2,525
VDA	**2,299**	2,321	2,345	28	62	37	129	75	**166**	2,396	2,507
ITA	**8,249**	**8,249**	**8,249**	**86**	**759**	**160**	**1539**	**845**	**1,699**	**9,094**	**9,948**

showing the highest number of Italian endemics (Tab. 3), are: SIC (425), SAR (317), CAL (300), ABR (299), BAS (238), and TOS (227).

The alien vascular flora consists of 1,699 taxa (1,598 species, 34 subspecies, 61 hybrids, and 6 Cultivar Groups), i.e. 17.08% of the total Italian flora, belonging to 750 genera and 154 families. The taxa currently established (INV + NAT) in Italy are 845 (243 INV and 602 NAT), while 759 are casual (CAS), 3 are not assessed (CAS?, possibly casual), 5 are data deficient (DD A, unknown regional distribution, possibly casual), 46 have not been confirmed in recent times (NC A), 3 are possibly locally extinct (*Plantago patagonica* Jacq., *Sagittaria platyphylla* (Engelm.) J.G.Sm., and *Themeda triandra* Forssk.), while 38 are doubtfully occurring in the country (D A) (Tabs. 4, 5). The number of taxa recorded by mistake (NP) is 100 (Tabs. 4, 5). Looking at the taxa involved in past domestication processes, 110 taxa are culta, 57 are ferals, while 1 additional taxon is regarded as doubtfully culton. The Italian alien vascular flora includes 1,539 neophytes and 160 archaeophytes (Tab. 1). Twenty-one alien species of EU concern (Regulation (EU) 1143/2014 concerning Invasive Alien Species, Commission Implementing Regulations (EU) 2016/1141, 2017/1263 and 2019/1262) occur in Italy, of which 18 are invasive at national level, 2 are considered as naturalized, while 1 has not been confirmed in recent times (the list is available in Bartolucci *et al.*, 2021a). The administrative regions showing the highest number of alien taxa are: LOM (807, of which 375 established), TOS (657, of which 293 established), VEN (656, of which 256 established), TAA (616, of which 184 established), EMR (585, of which 261 established), and PIE (560, of which 313 established) (Tabs. 1, 4).

DISCUSSION

The native plants of Italy amount to 8,249 species and subspecies, including 53 cryptogenic taxa. This number consolidates the primacy in Europe already highlighted by Bartolucci *et al.* (2018, 2021a). The increase recorded during 2021 consists of 12 taxa (Tab. 7), with variations among administrative regions. This increase represents the balance between 21 newly described taxa (Tab. 6), new records for Italy and several synonymized species (e.g., all the microspecies belonging to the *Portulaca oleracea* group). The decrease, albeit minimal, of the taxa not confirmed in recent times (from 562 to 548) and of the doubtfully occurring taxa (from 99 to 97) reflects the increase in floristic knowledge at national level (Tab. 7). The number of taxa considered extinct has remained unchanged (28) from the end of 2020. Concerning the variation of the Italian endemics, after a balance among taxa recognised as synonyms

Fig. 1 - *Anthyllis apennina* F.Conti & Bartolucci, an Italian endemic described in 2021 (Monte Tricella, Abruzzo, Italy. Photo: Fabio Conti). *Anthyllis apennina* F.Conti & Bartolucci, specie endemica italiana descritta nel 2021 (Monte Tricella, Abruzzo, Italia. Foto: Fabio Conti).

Tab. 2 - Number of native taxa for each occurrence category in the 20 administrative regions in 2021. Occurring: “P”; doubtfully occurring: “D”; no longer recorded (reliable historical record): “NC”; extinct or possibly extinct: “EX”; recorded by mistake: “NP”; cryptogenic: “C”; data deficient: “DD”; alien at regional level: “A” [“CAS” (Casual), “NAT” (Naturalized), “INV” (Invasive)].

	VDA	PIE	LOM	TAA	VEN	FVG	LIG	EMR	TOS	MAR
P	1,769	3,015	2,913	2,755	2,809	2,753	2,634	2,587	3,170	2,328
NC	243	345	196	233	215	160	281	109	72	79
D	233	83	67	79	139	59	97	72	132	84
EX	10	19	98	31	8	4	6	34	18	16
P C	37	23	15	19	11	8	15	21	27	19
NC C	5	1	3	2	1	0	0	0	1	0
D C	1	0	0	0	0	0	2	2	2	2
EX C	1	0	1	0	0	0	0	1	0	0
P A	0	0	1	7	26	67	2	1	1	8
P A CAS	12	31	135	265	82	17	31	16	15	8
P A NAT	22	37	29	93	64	82	28	23	16	30
P A INV	0	0	4	3	2	0	0	1	0	0
NC A	7	6	0	3	7	4	19	4	2	0
D A	0	2	4	19	2	1	0	1	2	0
EX A	5	2	0	0	1	0	0	0	0	0
DD	0	0	0	0	0	0	0	0	0	0
TOT	**2,345**	**3,564**	**3,466**	**3,509**	**3,367**	**3,155**	**3,115**	**2,872**	**3,458**	**2,574**
NP	281	293	345	175	165	141	212	120	245	123

Tab. 3 - Number of Italian endemic taxa for selected occurrence category in the 20 administrative regions in 2021. Occurring: “P”; doubtfully occurring: “D”; no longer recorded (reliable historical record): “NC”; extinct or possibly extinct: “EX”; cryptogenic: “C”.

	VDA	PIE	LOM	TAA	VEN	FVG	LIG	EMR	TOS	MAR
P	12	88	76	96	71	43	68	93	214	161
NC	13	47	27	24	14	12	7	4	4	4
D	0	2	1	2	4	1	1	5	4	5
EX	0	0	6	0	1	0	1	1	4	0
P C	0	0	0	0	0	0	0	0	1	0
TOT	**25**	**137**	**110**	**122**	**90**	**56**	**77**	**104**	**227**	**170**
Exclusive endemics	13	86	44	42	26	30	14	10	81	19

Numero dei taxa nativi presenti nel 2021 in ognuna delle 20 regioni amministrative, suddivisi per categoria di presenza. Presenti: “P”; conosciuti soltanto per record dubbi: “D”; conosciuti soltanto per record storici affidabili: “NC”; estinti o presumibilmente estinti: “EX”; riportati per errore: “NP”; criptogenici: “C”; carenti di dati: “DD”; alieni a livello regionale: “A” [“CAS” (Casuali), “NAT” (Naturalizzati), “INV” (Invasivi)].

	UMB	LAZ	ABR	MOL	CAM	PUG	BAS	CAL	SIC	SAR	ITA
	2,075	2,846	2,900	2,194	2,411	2,209	2,495	2,500	2,579	2,221	**7,505**
	21	98	95	3	281	141	20	76	68	21	**548**
	257	77	160	105	109	167	98	192	78	56	**97**
	0	3	26	0	3	8	2	5	8	1	**28**
	17	19	20	16	20	35	20	18	28	30	**51**
	0	2	2	0	2	0	0	1	2	0	**2**
	1	0	3	1	2	1	1	4	2	1	**0**
	0	0	1	0	1	1	1	1	0	0	**0**
	13	0	1	3	0	0	0	3	5	0	**0**
	9	20	12	3	3	9	3	10	7	57	**0**
	20	21	17	17	11	9	6	11	10	71	**0**
	0	1	0	0	2	0	1	0	0	5	**0**
	1	4	0	0	1	4	0	0	3	1	**0**
	2	1	0	0	0	2	0	1	1	1	**0**
	0	0	0	0	0	0	0	0	0	0	**0**
	0	0	0	0	0	0	0	0	0	0	**18**
	2,416	**3,092**	**3,237**	**2,342**	**2,846**	**2,586**	**2,647**	**2,822**	**2,791**	**2,465**	**8,249**
	190	159	333	53	127	202	80	149	208	100	**203**

Numero dei taxa endemici italiani presenti nel 2021 in ognuna delle 20 regioni amministrative, suddivisi per categoria di presenza. Presenti: “P”; conosciuti soltanto per record dubbi: “D”; conosciuti soltanto per record storici affidabili: “NC”; estinti o presumibilmente estinti: “EX”; criptogenici: “C”.

	UMB	LAZ	ABR	MOL	CAM	PUG	BAS	CAL	SIC	SAR	ITA
	116	207	278	137	185	150	225	277	409	312	**1,610**
	2	8	5	1	16	10	4	7	6	1	**115**
	13	6	15	7	8	11	9	12	5	3	**1**
	0	0	0	0	0	3	0	4	5	1	**13**
	0	0	1	0	0	1	0	0	0	0	**0**
	131	**221**	**299**	**145**	**209**	**175**	**238**	**300**	**425**	**317**	**1,739**
	2	12	71	0	28	41	14	65	304	262	

Tab. 4 - Number of alien taxa for each occurrence category in the 20 administrative regions in 2021. Casual aliens: “CAS”; undefined status, likely casual aliens: “CAS?”; naturalized aliens: “NAT”; invasive aliens: “INV”; no longer recorded aliens: “NC A”; extinct or possibly extinct (in Italy) aliens: “EX A”; doubtfully occurring aliens: “D A”; data deficient aliens: “DD A”; recorded by mistake aliens: “NP”; alien taxa of Union concern: “IAS”.

	VDA	PIE	LOM	TAA	VEN	FVG	LIG	EMR	TOS	MAR
CAS	72	204	416	404	349	271	276	283	296	218
NAT	54	243	261	144	196	157	153	232	228	100
INV	21	70	114	40	69	37	20	29	65	40
CAS?	1	1	0	7	6	10	0	11	5	6
NC A	8	15	1	4	27	18	32	17	35	28
D A	10	13	10	15	9	16	11	7	27	8
EX A	0	14	5	2	0	0	0	6	1	0
DD A	0	0	0	0	0	0	0	0	0	0
TOT	**166**	**560**	**807**	**616**	**656**	**509**	**492**	**585**	**657**	**400**
IAS	3	10	14	8	13	8	5	10	13	2
NP	7	47	68	27	23	15	29	22	38	11

Fig. 2 - A) *Odontarrhena bertolonii* (Desv.) Jord. & Fourr. subsp. *cesalpinoana* Selvi, an Italian endemic described in 2021 (Monte Petroso, Toscana, Italy. Photo: Federico Selvi); B) *Centaurea phalacrica* Brullo, Cambria, Crisafulli, Tavilla & Sciandr., an Italian endemic described in 2021 (Capo Rasocolmo, Sicilia, Italy. Photo: Gianmarco Tavilla). / *Odontarrhena bertolonii* (Desv.) Jord. & Fourr. subsp. *cesalpinoana* Selvi, sottospecie endemica italiana descritta nel 2021 (Monte Petroso, Toscana, Italia. Foto: Federico Selvi); B. *Centaurea phalacrica* Brullo, Cambria, Crisafulli, Tavilla & Sciandr., specie endemica italiana descritta nel 2021 (Capo Rasocolmo, Sicilia, Italia. Foto: Gianmarco Tavilla).

Numero dei taxa alieni presenti nel 2021 in ognuna delle 20 regioni amministrative, suddivisi per categoria di presenza. Alieni casuali: “CAS”; alieni con status non noto, presumibilmente casuali: “CAS?”; alieni naturalizzati: “NAT”; alieni invasivi: “INV”; alieni conosciuti soltanto per record storici affidabili: “NC A”; alieni estinti o presumibilmente estinti (in Italia): “EX A”; alieni conosciuti soltanto per record dubbi: “D A”; alieni carenti di dati: “DD A”; alieni riportati per errore: “NP”; taxa alieni di interesse unionale: “IAS”.

	UMB	LAZ	ABR	MOL	CAM	PUG	BAS	CAL	SIC	SAR	ITA
	193	299	214	92	234	230	140	170	214	281	**759**
	78	146	122	68	138	117	75	114	215	142	**602**
	13	42	34	26	47	21	20	48	18	71	**243**
	8	1	0	2	0	0	4	3	5	5	**3**
	2	17	4	0	31	13	3	16	17	2	**46**
	12	11	3	4	15	9	6	1	16	19	**38**
	0	0	0	0	0	0	0	0	0	0	**3**
	0	0	0	0	0	0	0	0	0	0	**5**
	306	**516**	**378**	**192**	**465**	**390**	**248**	**352**	**485**	**520**	**1,699**
	1	10	1	2	5	4	3	4	6	6	**20**
	10	21	16	8	44	16	6	18	26	22	**100**

Fig. 3 - *Ophrys japigiae* Turco, D’Emerico, Dura, Gennaio & Medagli, an Italian endemic described in 2021 (Ugento, Puglia, Italy. Photo: Francesco Chetta). / *Ophrys japigiae* Turco, D’Emerico, Dura, Gennaio & Medagli, specie endemica italiana descritta nel 2021 (Ugento, Puglia, Italy. Foto: Francesco Chetta).

Tab. 5 - Comparison between data at national level updated to 2021 and those reported in the Report 2020 by Bartolucci *et al.* (2021a). Italian endemics "END" and taxonomically doubtful taxa "T". / Confronto a livello nazionale tra i dati aggiornati al 2021 e quelli riportati nel Report 2020 da Bartolucci *et al.* (2021a). Endemiche italiane "END" e taxa tassonomicamente dubbi "T".

Native			**Alien**		
	ITA 2020	**ITA 2021**		ITA 2020	**ITA 2021**
P	7,474	**7,505**	CAS	744	**759**
NC	562	**548**	NAT	593	**602**
D	99	**97**	INV	227	**243**
EX	28	**28**	CAS?	3	**3**
P C	54	**51**	NC A	48	**46**
NC C	2	**2**	D A	37	**38**
DD	18	**18**	EX A	3	**3**
NP	195	**203**	DD A	5	**5**
T	433	**431**	NP	99	**100**
END	1,727	**1,739**	T	28	**30**
TOT	8,237	**8,249**		1,660	**1,699**

Tab. 6 - New taxa described during 2021. Endemic: "E". / Nuovi taxa descritti tra gennaio e dicembre 2021. Endemici: "E".

Family	**E**	**Taxon**	**References**
Primulaceae		*Androsace saussurei* Dentant, Lavergne, F.C.Boucher & S.Ibanez	Boucher *et al.* (2021)
Primulaceae		*Androsace vesulensis* Dentant, Lavergne, F.C.Boucher & S.Ibanez	Boucher *et al.* (2021)
Asteraceae	E	*Anthemis parlatoreana* Raimondo, Bajona, Spadaro & Di Grist.	Raimondo *et al.* (2021)
Fabaceae	E	*Anthyllis apennina* F.Conti & Bartolucci (Figure 1)	Conti & Bartolucci (2021)
Asteraceae	E	*Centaurea phalacrica* Brullo, Cambria, Crisafulli, Tavilla & Sciandr. (Figure 2B)	Brullo *et al.* (2021a)
Orchidaceae	E	*Epipactis microphylla* (Ehrh.) Sw. subsp. *cossyrensis* Brullo	Brullo *et al.* (2021b)
Orobanchaceae	E	*Euphrasia ultima* J.Hartmann & Schönsw.	Hartmann *et al.* (2021)
Apiaceae	E	*Ferula sommieriana* Cambria, C.Brullo, Tavilla, Sciandr., Minissale, Giusso & Brullo	Cambria *et al.* (2021)
Geraniaceae	E	*Geranium lucarinii* Venanzoni & Wagens.	Wagensommer & Venanzioni (2021)
Asteraceae	E	*Hieracium lachenalii* Suter subsp. *zerbanum* Gottschl. & S.Orsenigo	Gottschlich & Orsenigo (2021)
Asteraceae	E	*Hieracium lesimanum* Gottschl. & S.Orsenigo	Gottschlich & Orsenigo (2021)
Asteraceae	E	*Hieracium prenanthoides* Vill. subsp. *penicense* Gottschl. & S.Orsenigo	Gottschlich & Orsenigo (2021)
Asteraceae	E	*Hieracium scopolii* Gottschl. & S.Orsenigo	Gottschlich & Orsenigo (2021)
Asteraceae	E	*Hieracium scopolioides* Gottschl. & S.Orsenigo	Gottschlich & Orsenigo (2021)
Asteraceae	E	*Hieracium umbrophilum* Gottschl. & S.Orsenigo	Gottschlich & Orsenigo (2021)
Brassicaceae	E	*Odontarrhena bertolonii* (Desv.) Jord. & Fourr. subsp. *cesalpinoana* Selvi (Figure 2A)	Selvi & Vivona (2021); the subspecific epithet published as "*cesalpina*" sholud be corrected in "*cesalpinoana*" according to Art. 60.9(a) of the ICN (Turland *et al.*, 2018)
Orchidaceae	E	*Ophrys japigiae* Turco, D'Emerico, Dura, Gennaio & Medagli (Figure 3)	Turco *et al.* (2021)
Orchidaceae	E	*Serapias ausoniae* Gennaio & Pellegrino	Gennaio & Pellegrino (2021)
Apiaceae	E	*Siler montanum* Crantz subsp. *apuanum* F.Conti & Bartolucci	Conti *et al.* (2021)
Apiaceae	E	*Siler montanum* Crantz subsp. *corrasianum* Bacch., Congiu, F.Conti & Bartolucci	Conti *et al.* (2021)
Apiaceae	E	*Siler montanum* Crantz subsp. *ogliastrinum* Bacch., F.Conti & Bartolucci	Conti *et al.* (2021)

Tab. 7 - Comparison 2020/2021 of native (native + cryptogenic) taxa occurring in each of the 20 administrative regions and increase rate (Bartolucci *et al*., 2021a). / Confronto 2020/2021 dei taxa nativi (nativi + criptogenici) presenti in ognuna delle 20 regioni amministrative e relativi tassi di incremento (Bartolucci *et al*., 2021a).

	N + C 2020	N + C 2021	[N + C 2021] - [N + C 2020] (increase rate)
LIG	3,018	3,035	**+17 (0.56%)**
CAL	2,786	2,797	**+11 (0.39%)**
EMR	2,815	2,826	**+11 (0.39%)**
MAR	2,520	2,528	**+8 (0.32%)**
PUG	2,554	2,562	**+8 (0.31%)**
LAZ	3,038	3,045	**+7 (0.23%)**
PIE	3,479	3,486	**+7 (0.20%)**
BAS	2,631	2,637	**+6 (0.23%)**
MOL	2,314	2,319	**+5 (0.22%)**
LOM	3,286	3,293	**+5 (0.21%)**
SAR	2,327	2,330	**+3 (0.13%)**
VEN	3,181	3,183	**+2 (0.06%)**
TOS	3,424	3,422	**+2 (0.06%)**
VDA	2,298	2,299	**+1 (0.04%)**
SIC	2,764	2,765	**+1 (0.04%)**
ABR	3,206	3,207	**+1 (0.03%)**
TAA	3,119	3,119	**0**
UMB	2,372	2,371	**-1 (-0.04%)**
FVG	2,987	2,984	**-3 (-0.10%)**
CAM	2,835	2,829	**-4 (-0.21%)**
ITA	8,237	8,249	**+12 (0.14%)**

Tab. 8 - Comparison 2020/2021 of alien (archaeophyte + neophyte) taxa occurring in each of the 20 administrative regions and increase rate (Bartolucci *et al*., 2021a). / Confronto 2020/2021 dei taxa alieni (archeofite + neofite) presenti in ognuna delle 20 regioni amministrative e relativi tassi di incremento (Bartolucci *et al*., 2021a).

	ARC + NEO [CAS, NAT, INV] 2020	ARC + NEO [CAS, NAT, INV] 2021	[ARC + NEO 2021] - [ARC + NEO 2020] (increase rate)
EMR	557	585	**+28 (5.03%)**
BAS	237	248	**+11 (4.64%)**
CAM	446	465	**+19 (4.26%)**
UMB	294	306	**+12 (4.08%)**
TAA	592	616	**+24 (4.05%)**
SAR	501	520	**+19 (3.79%)**
LIG	478	492	**+14 (2.93%)**
SIC	473	485	**+12 (2.54%)**
ABR	369	378	**+9 (2.44%)**
PIE	547	560	**+13 (2.38%)**
MAR	381	400	**+9 (2.36%)**
CAL	342	352	**+10 (2.34%)**
LOM	790	807	**+17 (2.15%)**
MOL	188	192	**+4 (2.13%)**
TOS	644	657	**+13 (2.02%)**
VEN	643	656	**+13 (2.02%)**
VDA	163	166	**+3 (1.84%)**
LAZ	508	516	**+8 (1.57%)**
PUG	384	390	**+6 (1.56%)**
FVG	508	509	**+1 (0.20%)**
ITA	1,660	1,699	**+39 (2.35%)**

or occurring also in other geographical areas and newly described Italian endemics, we recorded a small increase by 12 taxa (1,739, +0.69%). A trend towards an increase is also evident in the number of the Italian endemics excluding taxonomically critical *Hieracium* and *Pilosella* subspecies (1,483), compared to that of Peruzzi *et al.* (2014; 1,371 taxa) and Peruzzi *et al.* (2015; 1,400 taxa).

Less comforting is the increase of aliens by 39 taxa (+2,35%) (Tab. 8), which attests for a rapid and worrying increase in allochthones. In some administrative regions, this increase is alarming: +5,03% in EMR, +4,64% in BAS, +4,26 % in CAM, +4,08 % in UMB and +4,05 % in TAA.

REFERENCES

Bartolucci F., Peruzzi L., Galasso G., Albano A., Alessandrini A., Ardenghi N. M. G., Astuti G., Bacchetta G., Ballelli S., Banfi E., Barberis G., Bernardo L., Bouvet D., Bovio M., Cecchi L., Di Pietro R., Domina G., Fascetti S., Fenu G., Festi F., Foggi B., Gallo L., Gottschlich G., Gubellini L., Iamonico D., Iberite M., Jiménez-Mejías P., Lattanzi E., Marchetti D., Martinetto E., Masin R. R., Medagli P., Passalacqua N. G., Peccenini S., Pennesi R., Pierini B., Poldini L., Prosser F., Raimondo F. M., Roma-Marzio F., Rosati L., Santangelo A., Scoppola A., Scortegagna S., Selvaggi A., Selvi F., Soldano A., Stinca A., Wagensommer R. P., Wilhalm T. & Conti F., 2018 – An updated checklist of the vascular flora native to Italy. *Plant Biosystems*, 152 (2): 179-303. <https://doi.org/10.1080/11263504.2017.1419996>

Bartolucci F., Galasso G., Peruzzi L. & Conti F., 2021a – Report 2020 on plant biodiversity in Italy: native and alien vascular flora. *Natural History Sciences*, 8 (1): 41-54. <https://doi.org/10.4081/nhs.2021.520>

Bartolucci F., Domina G., Andreatta S., Argenti C., Bacchetta G., Ballelli S., Banfi E., Barberis D., Barberis G., Bedini G., Bolpagni R., Bonali F., Bovio M., Briozzo I., Brusco A., Caldarella O., Campus G., Cancellieri L., Carotenuto L., Cheli E., Dagnino D., Del Guacchio E., Farris E., Ferretti G., Filibeck G., Foggi B., Gabellini A., Galasso G., Gianguzzi L., Gottschlich G., Gubellini L., Hofmann N., Iamonico D., Laface V. L. A., Lonati M., Lucarini D., Lupoletti J., Marchianò R., Marenzi P., Martignoni M., Mei G., Menini F., Merli M., Musarella C. M., Orsenigo S., Peccenini S., Pennesi R., Peruzzi L., Pica A., Pinzani L., Piovesan G., Pittarello M., Podda L., Ravetto Enri S., Roma-Marzio F., Rosati L., Spampinato G., Stinca A., Tonelli S., Trenchi M., Turcato C., Viciani D. & Lastrucci L., 2021b – Notulae to the Italian native vascular flora: 11. *Italian Botanist*, 11: 77-92. <https://doi.org/10.3897/italianbotanist.11.68048>

Bartolucci F., Domina G., Argenti C., Bacchetta G., Ballelli S., Banfi E., Barberis D., Barberis G., Bertolli A., Bolpagni R., Bonari G., Bonini F., Briozzo I., Brundu G., Bruschi T., Calbi M., Callegari M., Calvia G., Campoccia D., Cancellieri L., Cangelmi G., Carfagno S., Carruggio F., Casazza G., Cavallaro V., Cherchi S., Ciocia B., Conti F., Crisafulli A., Dagnino D., Vecchia A. D., De Fine G., Del Nero V., Di Filippo A., Dunkel F. G., Festi F., Filibeck G., Fois M., Forte L., Fratolin F., Galasso G., Gigante D., Gottschlich G., Gubellini L., Hofmann N., Jiménez-Mejías P., Laface V. L. A., Lonati M., Lozano V., Mainetti A., Mariotti M., Mei G., Minutillo F., Minuto L., Musarella C. M., Nota G., Orsenigo S., Pallanza M.,

Passalacqua N. G., Pazienza G., Pinzani L., Pittarello M., Podda L., Prosser F., Ravetto Enri S., Riva G., Santi F., Scoppola A., Selvaggi A., Selvi F., Spampinato G., Stinca A., Tomaselli V., Tomasi G., Tondi G., Turcato C., Wilhalm T. & Lastrucci L., 2021c – Notulae to the Italian native vascular flora: 12. *Italian Botanist*, 12: 85-103. <https://doi.org/10.3897/italianbotanist.12.78038>

Boucher F. C., Dentant C., Ibanez S., Capblancq T., Boleda M., Boulangeat L., Smyčka J., Roquet C. & Lavergne S., 2021 – Discovery of cryptic plant diversity on the rooftops of the Alps. *Scientific Reports*, 11 (11128): 1-10. <https://doi.org/10.1038/s41598-021-90612-w>

Brullo S., Cambria S, Crisafulli A., Tavilla G. & Sciandrello S., 2021a – Taxonomic remarks on the *Centaurea aeolica* (Asteraceae) species complex. *Phytotaxa*, 483 (1): 9-24. <https://doi.org/10.11646/phytotaxa.483.1.2>

Brullo S., Brullo C., Cambria S., Tavilla G., Pasta S., Scuderi L. & Zimmitti A., 2021b – A new subspecies of *Epipactis microphylla* (Orchidaceae; Epidendroideae) from Pantelleria Island (Sicily). *Phytotaxa*, 512 (2): 83-96. <https://doi.org/10.11646/phytotaxa.512.2.1>

Cambria S., Brullo C., Tavilla G., Sciandrello S., Minissale P., Giusso del Galdo G. & Brullo S., 2021 – *Ferula sommieriana* (Apiaceae), a new species from Pelagie Islands (Sicily). *Phytotaxa*, 525 (2): 89-108. <https://doi.org/10.11646/phytotaxa.525.2.1>

Conti F. & Bartolucci F., 2021 – *Anthyllis apennina* (Fabaceae), a new species from central Apennine (Italy). *PhytoKeys*, 176: 111-129. <https://doi.org/10.3897/phytokeys.176.62774>

Conti F., Bartolucci F., Bacchetta G., Pennesi R., Lakušić D. & Niketić M., 2021 – A taxonomic revision of the *Siler montanum* group (Apiaceae) in Italy and the Balkan Peninsula. *Willdenowia*, 51 (3): 321-347. <https://doi.org/10.3372/wi.51.51301>

Galasso G., Conti F., Peruzzi L., Ardenghi N. M. G., Banfi E., Celesti-Grapow L., Albano A., Alessandrini A., Bacchetta G., Ballelli S., Bandini Mazzanti M., Barberis G., Bernardo L., Blasi C., Bouvet D., Bovio M., Cecchi L., Del Guacchio E., Domina G., Fascetti S., Gallo L., Gubellini L., Guiggi A., Iamonico D., Iberite M., Jiménez-Mejías P., Lattanzi E., Marchetti D., Martinetto E., Masin R. R., Medagli P., Passalacqua N. G., Peccenini S., Pennesi R., Pierini B., Podda L., Poldini L., Prosser F., Raimondo F. M., Roma-Marzio F., Rosati L., Santangelo A., Scoppola A., Scortegagna S., Selvaggi A., Selvi F., Soldano A., Stinca A., Wagensommer R. P., Wilhalm T. & Bartolucci F., 2018 – An updated checklist of the vascular flora alien to Italy. *Plant Biosystems*, 152 (3): 556-592. <https://doi.org/10.1080/11263504.2018.1441197>

Galasso G., Bartolucci F., Conti F., Martellos S., Moro A., Pennesi R., Peruzzi L., Pittao E. & Nimis P. L., 2020 – L'inventario della flora spontanea italiana e il nuovo Portale della Flora d'Italia. In: Al Museo per scoprire il mondo. La ricerca scientifica e le mostre temporanee. Museo di Storia Naturale di Milano 2014-2019. Alessandrello A. & Azuma M. (eds.). *Natura*, 110 (1): 47-56.

Galasso G., Domina G., Andreatta S., Argenti E., Bacchetta G., Bagella S., Banfi E., Barberis D., Bardi S., Barone G., Bartolucci F., Bertolli A., Biscotti N., Bonali F., Bonini F., Bonsanto D., Brundu G., Buono S., Caldarella O., Calvia G., Cambria S., Campus G., Caria M. C., Conti F., Coppi A., Dagnino D., Del Guacchio E., Di Gristina E., Farris E., Ferretti G., Festi F., Fois M., Furlani F., Gigante D., Guarino R., Gubellini L., Hofmann N., Iamonico D., Jiménez-Mejias P., La Rosa A., Laface V. L. A., Lallai A., Lazzaro L., Lonati M., Lozano V., Luchino F., Lupoletti J., Magrini S., Mainetti A., Marchetti D., Marenzi P., Marignani M., Martignoni M., Mei G., Menini F., Merli M., Mugnai M., Musarella C. M., Nicolella G., Noor Hussain A., Olivieri N., Orlandini S., Peccenini S., Peruzzi L., Pica A., Pilon N., Pinzani L., Pittarello M., Podda L., Probo M., Prosser F., Raffaelli C., Ravetto Enri S., Rivieccio G., Rosati L., Sarmati S., Scafidi F., Selvi F., Sennikov A. N., Sotgiu Cocco G., Spampinato G., Stinca A., Tavilla G., Tomaselli V., Tomasi D., Tomasi G., Trenchi M., Turcato C., Verloove F., Viciani D., Villa M., Wagensommer R. P. & Lastrucci L., 2021a – Notulae to the Italian alien vascular flora: 11. *Italian Botanist*, 11: 93-119. <https://doi.org/10.3897/italianbotanist.11.68063>

Galasso G., Domina G., Angiolini C., Bacchetta G., Banfi E., Barberis D., Bardi S., Bartolucci F., Bonari G., Bovio M., Briozzo I., Brundu G., Buono S., Calvia G., Celesti-Grapow L., Cozzolino A., Cuena-Lombraña A., Curuzzi M., D'Amico F. S., Dagnino D., De Fine G., Fanfarillo E., Federici A., Ferraris P., Fiacchini D., Fiaschi T., Fois M., Gubellini L., Guidotti E., Hofmann N., Kindermann E., Laface V. L. A., Lallai A., Lanfredini P., Lazzaro L., Lazzeri V., Lonati M., Loreti M., Lozano V., Magrini S., Mainetti A., Marchini M., Marignani M., Martignoni M., Mei G., Minutillo F., Mondino G. P., Motti R., Musarella C. M., Nota G., Olivieri N., Pallanza M., Passalacqua N. G., Patera G., Pilon N., Pinzani L., Pittarello M., Podda L., Probo M., Ravetto Enri S., Rosati L., Salerno P., Selvaggi A., Soldano A., Sotgiu Cocco G., Spampinato G., Stinca A., Terzi M., Tondi G., Turcato C., Wellstein C. & Lastrucci L., 2021b – Notulae to the Italian alien vascular flora: 12. *Italian Botanist*, 12: 105-121. <https://doi.org/10.3897/italianbotanist.12.78010>

Gennaio R. & Pellegrino G., 2021 – *Serapias ausoniae* (Orchidaceae; Orchideae): a new species from southern Italy confirmed by morphological, cytological and molecular analyses. *Phytotaxa*, 516 (2): 159-168. <https://doi.org/10.11646/phytotaxa.516.2.3>

Gottschlich G. & Orsenigo S., 2021 – New taxa of *Hieracium* (Asteraceae) from Mount Lesima and adjacent regions (Northern Apennine, Italy). *Phytotaxa*, 505 (1): 39-55. <https://doi.org/10.11646/phytotaxa.505.1.2>

Hartmann J., Silbernagl L., Schneeweiss G. M., Barfuss M. H. J., Weiss-Schneeweiss H. & Schönswetter P., 2021 – *Euphrasia ultima*, a new locally endemic diploid species from the Ortler/Ortles range (Italy), is a close relative of widespread allotetraploid *E. minima*. *Plant Biosystems*, 156 (4): 893-907. <https://doi.org/10.1080/11263504.2021.1947409>

Martellos S., Bartolucci F., Conti F., Galasso G., Moro A., Pennesi R., Peruzzi L., Pittao E. & Nimis P. L., 2020 – FlorItaly - the portal to the Flora of Italy. *PhytoKeys*, 156: 55-71. <https://doi.org/10.3897/phytokeys.156.54023>

Morales-Briones D. F., Kadereit G., Tefarikis D. T., Moore M. J., Smith S. A., Brockington S. F., Timoneda A., Yim W. C., Cushman J. C. & Yang Y., 2021 – Disentangling sources of gene tree discordance in phylogenomic data sets: testing ancient hybridizations in Amaranthaceae s.l. *Systematic Biology*, 70 (2): 219-235. <https://doi.org/10.1093/sysbio/syaa066>

Peruzzi L., Conti F. & Bartolucci F. 2014 – An inventory of vascular plants endemic to Italy. *Phytotaxa*, 168 (1): 1-75. <https://doi.org/10.11646/phytotaxa.168.1.1>

Peruzzi L., Domina G., Bartolucci F., Galasso G., Peccenini S., Raimondo F. M., Albano A., Alessandrini A., Banfi E., Barberis G., Bernardo L., Bovio M., Brullo S., Brundu G., Brunu A., Camarda I., Carta L., Conti F., Croce A., Iamonico D., Iberite M., Iiriti G., Longo D., Marsili S., Medagli P., Pistarino A., Salmeri C., Santangelo A., Scassellati E., Selvi F., Soldano A., Stinca A., Villani M., Wagensommer R. P. & Passalacqua N. G., 2015 – An inventory of the names of vascular plants endemic to Italy, their loci classici and types. *Phytotaxa*, 196 (1): 1-217. <https://doi.org/10.11646/phytotaxa.196.1.1>

Portal to the Flora of Italy, 2022 – Portale della flora d'Italia - Portal to the flora of Italy 2021.2. <https://dryades.units.it/floritaly/> (retrieved on 10 March 2022).

Raimondo F. M., Bajona E., Spadaro V. & Di Gristina E., 2021 – Recent and new taxonomic acquisitions in some native genera of Asteraceae from southern Italy and Sicily. *Flora Mediterranea*, 31: 109-122. <https://doi.org/10.7320/FlMedit31.109>

Selvi F. & Vivona L., 2021 – Polyploidy in *Odontarrhena bertolonii* (Brassicaceae) in relation to seed germination performance and plant phenotype, with taxonomic implications. *Plant Biosystems*, 156 (4): 959-968. <https://doi.org/10.1080/11263504.2021.1985001>

Turco A., Medagli P., Wagensommer R. P., D'Emerico S., Gennaio R. & Albano A., 2021 – A morphometric study on *Ophrys* sect. *Pseudophrys* in Apulia (Italy) and discovery of *Ophrys japigiae* sp. nov. (Orchidaceae). *Plant Biosystems*, 156 (2): 560-571. <https://doi.org/10.1080/11263504.2021.1897702>

Turland N. J., Wiersema J. H., Barrie F. R., Greuter W., Hawksworth D. L., Herendeen P. S., Knapp S., Kusber W.-H., Li D.-Z., Marhold K., May T. W., McNeill J., Monro A. M., Prado J., Price M. J. & Smith G. F. (eds.), 2018 – International Code of Nomenclature for algae, fungi, and plants (Shenzhen Code) adopted by the Nineteenth International Botanical Congress Shenzhen, China, July 2017. *Regnum Vegetabile*, 159: 1-254. <https://doi.org/10.12705/Code.2018>

Wagensommer R. P. & Venanzoni R., 2021 – *Geranium lucarinii* sp. nov. and re-evaluation of *G. kikianum* (Geraniaceae). *Phytotaxa*, 489 (3): 252-262. <https://doi.org/10.11646/phytotaxa.489.3.2>