

# Report 2020 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, on the native and alien vascular flora of Italy, with details on the occurrence at national and regional administrative level. Recently described taxa occurring in Italy, which were not included in the checklists published in 2018, are listed. The list of extinct or possibly extinct native taxa and that of alien taxa of EU concern are updated.

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

**Riassunto** - Rapporto 2020 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 ultimi aggiornamenti nomenclaturali, tassonomici e distributivi. Vengono forniti i numeri di dettaglio sulle presenze a livello nazionale e regionale. Inoltre sono elencati i taxa nuovi per la scienza presenti in Italia e non inclusi nelle checklist pubblicate nel 2018. Viene infine aggiornato l'elenco nazionale delle entità autoctone estinte o probabilmente estinte e delle entità aliene invasive di interesse unionale.

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

## INTRODUCTION

After the publication of the two checklists of the native and alien vascular flora of Italy (Bartolucci *et al.*, 2018a;

Galasso *et al.*, 2018a), several floristic, systematic and taxonomic studies were published. Most of the new floristic records (based on herbarium specimens kept in Natural History Museum of Florence -FI- and in other public herbaria) concerning the distribution of the Italian vascular flora are published in the series “Notulae to the Italian native vascular Flora” (Bartolucci *et al.*, 2018b, 2018c, 2019a, 2019b, 2020a, 2020b) and “Notulae to the Italian alien vascular Flora” (Galasso *et al.*, 2018b, 2018c, 2019a, 2019b, 2020b, 2020c). These series also include nomenclatural, taxonomical and distribution updates published elsewhere, and corrigenda to the published checklists (as supplementary material). After the publication of the checklists, the data were organized into the information system “FlorItaly - Portal to the Flora of Italy” (Galasso *et al.*, 2020a; Martellos *et al.*, 2020), which is accessible online at the address <http://dryades.units.it/floritaly>. FlorItaly is updated every six months with data coming from the Notulae.

The aim of this contribution is to provide an updated overview on systematics, taxonomy and distribution (at national and administrative regional level) of the native and alien vascular flora of Italy, ca. three years after the publication of the Italian checklists.

## MATERIAL AND METHODS

The circumscription of families follows Bartolucci *et al.* (2018a) and Galasso *et al.* (2018a). 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 for the alien vascular flora. 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.* (2018a). Following these authors, the “Italian endemic” status was attributed to those that occur 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,

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TOS; Marche, MAR; Umbria, UMB; Lazio, LAZ; Abruzzo, 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 the categories proposed by Bartolucci *et al.* (2018a) and Galasso *et al.* (2018a).

## RESULTS

To date (end of 2020, FlorItaly version 2020.2), the Italian native and alien vascular flora consists of 9,897 taxa (including casual alien plants), belonging to 1,547 genera and 198 families (Tab. 1).

The native vascular flora consists of 8,237 taxa (6,461 species and 1,776 subspecies) belonging to 1,103 genera and 153 families. The most represented families ( $\geq 50$  taxa) and genera ( $\geq 40$  taxa) are reported in Table 2. The taxa endemic to Italy are 1,727, grouped in 318 genera and 70 families (Tabs. 3, 4). Among them, the taxa certainly occurring in Italy are 1,594 (P), while 119 taxa have not been confirmed in recent times (NC), 1 is doubtfully occurring (*Paeonia corsica* Sieber ex Tausch, occurring in Corse and doubtfully in Sardegna, D) and 13 are considered extinct or possibly extinct (EX) (Tabs. 4, 7). Four genera are narrowly endemic to Italy: *Eokochia* (Chenopodiaceae), *Rhizobotrya* (Brassicaceae), *Petagnaea*, and

Tab. 1 - Number of native and alien taxa occurring in each of the 20 administrative regions in 2020. 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 2020 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 (archoefite, inclusi gli alieni casuali); NEO (neofite, inclusi gli alieni casuali); ARC ESTABL. (archoefite, esclusi gli alieni casuali); NEO ESTABL. (neofite, esclusi gli alieni casuali).

NUMBER OF TAXA (2020)											
	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	3,479	3,525	3,554	36	273	98	449	309	547	3,834	4,101
TOS	3,424	3,445	3,458	38	243	124	520	282	644	3,726	4,102
LOM	3,286	3,322	3,452	43	323	127	663	366	790	3,688	4,242
ABR	3,206	3,224	3,235	39	117	105	264	156	369	3,380	3,604
VEN	3,181	3,281	3,360	36	221	112	531	257	643	3,538	4,003
TAA	3,119	3,241	3,506	22	157	108	484	179	592	3,420	4,098
LAZ	3,038	3,065	3,085	36	139	98	410	175	508	3,240	3,593
LIG	3,018	3,067	3,097	26	141	81	397	167	478	3,234	3,575
FVG	2,987	3,141	3,158	38	155	100	408	193	508	3,334	3,666
CAM	2,835	2,849	2,852	38	143	99	347	181	446	3,030	3,298
EMR	2,815	2,845	2,861	33	219	115	442	252	557	3,097	3,418
CAL	2,786	2,805	2,816	25	118	74	268	143	342	2,948	3,158
SIC	2,764	2,783	2,789	34	194	85	388	218	473	3,001	3,262
BAS	2,631	2,638	2,641	27	67	84	153	94	237	2,732	2,878
PUG	2,554	2,569	2,578	27	110	81	303	137	384	2,706	2,962
MAR	2,520	2,558	2,565	30	110	98	283	140	381	2,698	2,946
UMB	2,372	2,408	2,415	24	60	97	197	84	294	2,492	2,709
SAR	2,327	2,406	2,462	35	165	108	393	200	501	2,606	2,963
MOL	2,314	2,334	2,337	32	61	69	119	93	188	2,427	2,525
VDA	2,298	2,332	2,344	13	60	37	126	73	163	2,405	2,507
ITA	8,237 (56 C)	8,237	8,237	85	735	160	1,500	820	1,660	9,057	9,897

Tab. 2 - Most represented families of the Italian vascular flora in 2020: Native: ( $\geq 50$  taxa) and genera ( $\geq 40$  taxa); Alien: ( $\geq 25$  taxa) and genera ( $\geq 10$  taxa). / Famiglie (Native:  $\geq 50$  taxa; Aliene:  $\geq 25$  taxa) e generi (Nativi:  $\geq 40$  taxa; Alieni:  $\geq 10$  taxa) maggiormente rappresentati nel 2020 nella flora vascolare italiana.

Native				Alien			
Families		Genera		Families		Genera	
Asteraceae	2,219	<i>Hieracium</i>	1,172	Poaceae	170	<i>Amaranthus</i>	30
Poaceae	554	<i>Taraxacum</i>	162	Asteraceae	168	<i>Oenothera</i>	29
Fabaceae	502	<i>Carex</i>	126	Fabaceae	79	<i>Opuntia</i>	22
Caryophyllaceae	359	<i>Centaurea</i>	119	Rosaceae	74	<i>Solanum</i>	22
Brassicaceae	333	<i>Limonium</i>	112	Solanaceae	60	<i>Cyperus</i>	21
Rosaceae	317	<i>Ranunculus</i>	110	Asparagaceae	47	<i>Euphorbia</i>	18
Apiaceae	262	<i>Ophrys</i>	104	Brassicaceae	45	<i>Centaurea</i>	16
Orchidaceae	242	<i>Pilosella</i>	100	Cactaceae	39	<i>Avena</i>	13
Lamiaceae	239	<i>Alchemilla</i>	97	Amaranthaceae	38	<i>Bidens</i>	13
Ranunculaceae	231	<i>Silene</i>	86	Lamiaceae	38	<i>Eucalyptus</i>	13
Cyperaceae	188	<i>Festuca</i>	81	Onagraceae	34	<i>Oxalis</i>	13
Plantaginaceae	163	<i>Trifolium</i>	81	Polygonaceae	32	<i>Triticum</i>	13
Orobanchaceae	142	<i>Allium</i>	69	Crassulaceae	30	<i>Phyllostachys</i>	12
Plumbaginaceae	136	<i>Saxifraga</i>	65	Cyperaceae	30	<i>Rosa</i>	12
Boraginaceae	115	<i>Euphorbia</i>	62	Amaryllidaceae	26	<i>Salvia</i>	11
Campanulaceae	98	<i>Galium</i>	59	Iridaceae	26	<i>Symphyotrichum</i>	11
Rubiaceae	95	<i>Campanula</i>	58			<i>Cotoneaster</i>	10
Amaryllidaceae	93	<i>Viola</i>	57			<i>Vitis</i>	10
Primulaceae	81	<i>Vicia</i>	55				
Asparagaceae	76	<i>Dianthus</i>	54				
Juncaceae	70	<i>Genista</i>	49				
Gentianaceae	68	<i>Astragalus</i>	45				
Saxifragaceae	68	<i>Potentilla</i>	45				
Euphorbiaceae	67	<i>Veronica</i>	44				
Chenopodiaceae	63	<i>Crepis</i>	43				
Crassulaceae	63	<i>Salix</i>	43				
Dipsacaceae	62	<i>Rosa</i>	42				
Polygonaceae	60	<i>Rubus</i>	41				
Iridaceae	58	<i>Cerastium</i>	40				
Violaceae	57	<i>Juncus</i>	40				
Cistaceae	55	<i>Orobanche</i>	40				

*Siculosciadium* (Apiaceae). Three genera are endemic to Sardegna and Corse (France): *Morisia* (Brassicaceae), *Castroviejoa*, and *Nananthea* (Asteraceae). The most represented families ( $\geq 20$  taxa) and genera ( $\geq 15$  taxa) concerning Italian endemics are reported in Table 3. The administrative regions showing the highest number of Italian endemics (Tab. 5), are: SIC (424), SAR (319), CAL (300), ABR (299), BAS (240), and TOS (227). The native taxa certainly occurring in Italy are 7,528 (P), while 564 taxa have not been confirmed in recent times (NC), 99 are doubtfully occurring (D), and 18 are data deficient (DD) (Tabs. 6, 10). Out of the not confirmed taxa, 28 are considered extinct or possibly extinct (Tab. 7, Fig. 1). In

addition, the taxa recorded by mistake at national level are 195. The administrative regions with the highest number of native taxa (Tab. 1), also considering the regionally non-native (casual, CAS; naturalized, NAT; invasive, INV) taxa, are: PIE (3,554), TAA (3,506), TOS (3,458), LOM (3,452), VEN (3,360), and ABR (3,235). By excluding the regionally non-native taxa (CAS, NAT, INV), the regions with the highest number of taxa are: PIE (3,479), TOS (3,424), LOM (3,286), ABR (3,206), VEN (3,181), and TAA (3,119). Cryptogenic taxa are 56, while 433 taxa are taxonomically doubtful (Tabs. 6, 10). The increase in the number of taxa from 2018 at regional level is showed in Table 12.



Fig. 1 - *Hieracium tolstoidii* Fen. & Zahn. Endemic to Italy, recognized as extinct in 2019. / Specie endemica italiana dichiarata estinta nel 2019 (FI051948; Scan / Scansione: Erbario dell'Università di Firenze).

Tab. 3 - Most represented families ( $\geq 20$  taxa) and genera ( $\geq 15$  taxa) of the Italian endemic vascular flora in 2020. / Famiglie ( $\geq 20$  taxa) e generi ( $\geq 15$  taxa) maggiormente rappresentati nel 2020 nella flora vascolare endemica italiana.

Families		Genera	
Asteraceae	589	<i>Hieracium</i>	340
Plumbaginaceae	119	<i>Limonium</i>	101
Caryophyllaceae	97	<i>Centaurea</i>	76
Orchidaceae	92	<i>Ophrys</i>	60
Fabaceae	86	<i>Genista</i>	33
Brassicaceae	78	<i>Ranunculus</i>	33
Poaceae	66	<i>Taraxacum</i>	32
Ranunculaceae	56	<i>Silene</i>	29
Rosaceae	43	<i>Dianthus</i>	28
Apiaceae	38	<i>Allium</i>	25
Lamiaceae	36	<i>Viola</i>	21
Boraginaceae	33	<i>Campanula</i>	20
Amarylidaceae	29	<i>Epipactis</i>	20
Campanulaceae	27	<i>Armeria</i>	17
Rubiaceae	27	<i>Festuca</i>	17
Plantaginaceae	24	<i>Astragalus</i>	16
Iridaceae	23	<i>Erysimum</i>	16
Violaceae	21	<i>Saxifraga</i>	16
Orobanchaceae	20	<i>Alchemilla</i>	15
		<i>Pilosella</i>	15

The alien vascular flora consists of 1,660 taxa (1,574 species, 32 subspecies, and 54 hybrids), i.e. 16.16% of the total Italian flora, belonging to 741 genera and 154 families. The most represented families ( $\geq 25$  taxa) and genera ( $\geq 10$  taxa) are reported in Table 2. The taxa currently established (NAT + INV) in Italy are 820 (593 NAT and 227 INV), while 744 are casual (CAS), 3 are not assessed (CAS?, possibly casual), 5 are data deficient (DD A, unknown regional distribution, possibly casual), 48 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.), and 37 are doubtfully occurring in the country (D A) (Tabs. 8, 10). The number of taxa recorded by mistake (NP) is 99 (Tab. 10). Looking at the taxa involved in past domestication processes, 107 taxa are culta, 54 are ferals, while 1 additional taxon is regarded as doubtfully culton. The Italian alien flora includes 1,500 neophytes and 160 archaeophytes (Tab. 1). Twenty 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 16 are invasive at national level, 3 are considered as naturalized, while 1 is not confirmed in recent times (Tab. 9). The administrative regions with the highest number of alien taxa are LOM (790, of which 366 established), TOS (644, of which 282 established), VEN (643, of which 257 established), TAA (592, of which 179 established), EMR (547, of which 252 established), and PIE (547, of which 309 established) (Tab. 1). The increase in the number of taxa from 2018 at regional level is showed in Table 13.

Tab. 4 - Number of Italian endemic taxa for selected occurrence category in the 20 administrative regions in 2020. Occurring: "P"; doubtfully occurring: "D"; no longer recorded (reliable historical record): "NC"; extinct or possibly extinct: "EX"; cryptogenic: "C". / Numero dei taxa endemici italiani presenti nel 2020 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".

	VDA	PIE	LOM	TAA	VEN	FVG	LIG	EMR	TOS	MAR	UMB	LAZ	ABR	MOL	CAM	PUG	BAS	CAL	SIC	SAR	ITA
<b>P</b>	12	88	75	95	72	43	66	88	213	160	115	205	278	136	185	148	225	277	407	314	<b>1,594</b>
<b>NC</b>	13	48	27	24	14	12	7	4	5	4	2	8	5	1	17	11	4	7	6	1	<b>119</b>
<b>D</b>	0	2	1	2	4	1	1	5	4	6	13	7	15	7	8	14	11	12	6	3	<b>1</b>
<b>EX</b>	0	0	7	0	1	0	1	1	4	0	0	0	0	0	0	3	0	4	5	1	<b>13</b>
<b>PC</b>	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	<b>0</b>
<b>TOT</b>	<b>25</b>	<b>138</b>	<b>110</b>	<b>121</b>	<b>91</b>	<b>56</b>	<b>75</b>	<b>98</b>	<b>227</b>	<b>170</b>	<b>130</b>	<b>220</b>	<b>299</b>	<b>144</b>	<b>210</b>	<b>177</b>	<b>240</b>	<b>300</b>	<b>424</b>	<b>319</b>	<b>1,727</b>

Tab. 5 - Number of Italian endemic taxa in the 20 administrative regions in 2020. / Numero dei taxa endemici italiani presenti nel 2020 in ognuna delle 20 regioni amministrative.

SIC	SAR	CAL	ABR	BAS	TOS	LAZ	CAM	PUG	MAR	MOL	PIE	UMB	TAA	LOM	EMR	VEN	LIG	FVG	VDA
424	319	300	299	240	227	220	210	177	170	144	138	130	121	110	98	91	75	56	25

Tab. 6 - Number of native taxa for each occurrence category in the 20 administrative regions in 2020. 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)]. / Numero dei taxa nativi presenti nel 2020 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)].

	P	NC	D	EX	P C	NC C	D C	EX C	PA	PA CAS	PA NAT	PA INV	NC A	D A	EX A	DD	TOT	NP
VDA	1,764	245	233	10	37	7	1	1	0	12	22	0	7	0	5	0	2,344	283
PIE	2,995	355	86	18	24	1	0	0	0	29	36	0	6	2	2	0	3,554	289
LOM	2,907	196	67	98	14	3	0	1	1	130	27	4	0	4	0	0	3,452	315
TAA	2,752	233	79	32	20	2	1	0	7	265	90	3	3	19	0	0	3,506	175
VEN	2,803	216	140	7	14	1	0	0	26	79	64	1	7	2	0	0	3,360	162
FVG	2,754	160	59	4	10	0	0	0	67	17	82	0	4	1	0	0	3,158	141
LIG	2,604	290	100	6	16	0	2	0	2	30	28	0	19	0	0	0	3,097	212
EMR	2,570	111	74	34	22	0	3	1	1	16	23	1	4	1	0	0	2,861	120
TOS	3,161	72	140	18	30	1	2	0	1	13	16	0	2	2	0	0	3,458	234
MAR	2,319	79	85	16	19	0	2	0	8	7	30	0	0	0	0	0	2,565	124
UMB	2,071	21	262	0	17	0	1	0	13	7	20	0	1	2	0	0	2,415	189
LAZ	2,833	99	80	3	21	2	0	0	0	20	21	1	4	1	0	0	3,085	159
ABR	2,896	96	162	26	20	2	3	1	1	11	17	0	0	0	0	0	3,235	331
MOL	2,189	3	106	0	15	0	1	0	3	3	17	0	0	0	0	0	2,337	53
CAM	2,412	282	109	3	23	3	2	1	0	3	11	1	1	1	0	0	2,852	122
PUG	2,202	140	168	8	34	0	1	1	0	9	9	0	4	2	0	0	2,578	202
BAS	2,489	21	98	2	18	1	1	1	0	3	6	1	0	0	0	0	2,641	80
CAL	2,489	76	197	5	13	1	4	1	3	11	15	0	0	1	0	0	2,816	142
SIC	2,574	69	78	8	31	2	2	0	5	6	10	0	3	1	0	0	2,789	210
SAR	2,213	21	58	1	33	0	1	0	0	56	71	5	1	2	0	0	2,462	94
ITA	7,528	564	99	28	54	2	0	0	0	0	0	0	0	0	0	18	8,237	195

## DISCUSSION

The native plants of Italy amount to 8,237 species and subspecies, including 56 cryptogenic taxa. This number consolidates the primacy in Europe already highlighted by Bartolucci *et al.* (2018a), Italy being the European country that hosts the highest number of native plants. The increase recorded since March 2018 (Bartolucci *et al.* 2018a) to December 2020 consists of 42 taxa (0.51%), with consistent variation among administrative regions (Tab. 12). Some have an increase rate greater than 1%, such as e.g. TOS (1.60%), BAS (1.35%), and LAZ

(1.16%). The increase at national level is mostly due to the 31 newly described taxa (including the validation of the name *Ulmus minor* subsp. *canescens* Bartolucci & Galasso), in most cases Italian endemics (Tab. 11). This increase documents the good state of floristic research in Italy. In 2018 (from March to December), 3 new vascular plants were described from Italy (e.g. Fig. 2B), 19 taxa in 2019, and 9 taxa in 2020 (e.g. Fig. 2A). Most of them belong to taxonomically critical genera such as *Epipactis* (5 species), *Genista* (1 species and 2 subspecies), *Hieracium* (3 subspecies), and *Rubus* (2 species).





Fig. 2 - A) *Poa magellensis* F.Conti & Bartolucci. Endemic to Italy, described in 2020. / Specie endemica italiana descritta nel 2020. (Photo: / Foto: Fabrizio Bartolucci). B) *Gymnospermium scipetarum* Papparisto & Qosja ex E.Mayer & Pulević subsp. *eddae* Rosati, Farris, Fascetti & Selvi. Endemic to Italy, described in 2018. / Sottospecie endemica italiana descritta nel 2018. (Photo: / Foto: Leonardo Rosati).

Tab. 7 - List of extinct or possibly extinct native taxa; 2020 data. In bold, taxa not considered as extinct by Bartolucci *et al.* (2018a). / Elenco dei taxa nativi estinti o presumibilmente estinti; dati del 2020. In grassetto quelli non considerati estinti da Bartolucci *et al.* (2018a).

Family	Italian endemic	Taxon
Droseraceae		<i>Aldrovanda vesiculosa</i> L.
Fabaceae	E	<i>Anthyllis hermanniae</i> L. subsp. <i>corsica</i> Brullo & Giusso
Fabaceae	E	<i>Anthyllis hermanniae</i> L. subsp. <i>sicula</i> Brullo & Giusso
Poaceae		<i>Bromus grossus</i> Desf. ex DC.
Cyperaceae		<i>Bulbostylis cioniana</i> (Pi.Savi) Lye
Alismataceae		<i>Caldesia parnassifolia</i> (Bassi) Parl.
Brassicaceae		<i>Camelina alyssum</i> (Mill.) Thell. subsp. <i>alyssum</i>
Cyperaceae		<b><i>Carex pediformis</i></b> C.A.Mey. subsp. <b><i>pediformis</i></b>
Asteraceae		<i>Carlina acanthifolia</i> All. subsp. <i>utzka</i> (Hacq.) Meusel & Kästner
Asteraceae	E	<i>Castroviejoa frigida</i> (Labill.) Galbany, L.Sáez & Benedi
Ranunculaceae		<i>Clematis integrifolia</i> L.
Asteraceae		<b><i>Crepis mollis</i></b> (Jacq.) Asch. subsp. <b><i>mollis</i></b>
Cistaceae		<i>Helianthemum syriacum</i> (Jacq.) Dum.Cours. subsp. <i>thibaudii</i> (Pers.) Meikle
Apiaceae		<i>Helosciadium repens</i> (Jacq.) W.D.J.Koch
Caryophyllaceae	E	<i>Herniaria fontanesii</i> Gay subsp. <i>empedocleana</i> (Lojac.) Brullo
Asteraceae	E	<b><i>Hieracium tolstoii</i></b> Fen. & Zahn (Fig. 1)
Asteraceae		<i>Launaea nudicaulis</i> (L.) Hook.f.
Plumbaginaceae	E	<i>Limonium catanense</i> (Tineo ex Lojac.) Brullo
Plumbaginaceae	E	<i>Limonium intermedium</i> (Guss.) Brullo
Plumbaginaceae	E	<i>Limonium peucetium</i> Pignatti
Ranunculaceae	E	<i>Ranunculus fiorii</i> Pignatti
Ranunculaceae	E	<i>Ranunculus fraelensis</i> Dunkel
Ranunculaceae	E	<i>Ranunculus hostiliensis</i> Pignatti
Ranunculaceae		<i>Ranunculus monspeliacus</i> L. subsp. <i>saxatilis</i> Nyman
Ranunculaceae	E	<i>Ranunculus mutinensis</i> Pignatti
Asteraceae		<i>Sonchus palustris</i> L.
Hydrocharitaceae		<i>Stratiotes aloides</i> L.
Chenopodiaceae	E	<i>Suaeda kocheri</i> Guss. ex C.Brullo, Brullo & Giusso

Tab. 8 - Number of alien taxa for each occurrence category in the 20 administrative regions in 2020. 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”. / Numero dei taxa alieni presenti nel 2020 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”.

	VDA	PIE	LOM	TAA	VEN	FVG	LIG	EMR	TOS	MAR	UMB	LAZ	ABR	MOL	CAM	PUG	BAS	CAL	SIC	SAR	ITA
CAS	71	196	408	385	343	271	268	262	292	208	187	304	205	89	218	225	130	177	206	276	<b>744</b>
NAT	52	241	254	139	189	156	148	225	222	91	72	136	122	67	135	116	74	109	210	137	<b>593</b>
INV	21	68	112	40	68	37	19	27	60	40	12	39	34	26	47	21	20	35	18	63	<b>227</b>
CAS?	1	1	0	7	6	10	0	11	7	6	8	1	0	2	0	0	4	3	5	4	<b>3</b>
NCA	8	15	1	4	28	18	33	18	35	28	2	17	4	0	33	13	3	16	18	2	<b>48</b>
DA	10	12	10	15	9	16	10	8	27	8	13	11	4	4	13	9	6	2	16	19	<b>37</b>
EXA	0	14	5	2	0	0	0	6	1	0	0	0	0	0	0	0	0	0	0	0	<b>3</b>
DDA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	<b>5</b>
TOT	<b>163</b>	<b>547</b>	<b>790</b>	<b>592</b>	<b>643</b>	<b>508</b>	<b>478</b>	<b>557</b>	<b>644</b>	<b>381</b>	<b>294</b>	<b>508</b>	<b>369</b>	<b>188</b>	<b>446</b>	<b>384</b>	<b>237</b>	<b>342</b>	<b>473</b>	<b>501</b>	<b>1,660</b>
IAS	3	10	14	8	13	8	5	10	13	2	1	10	1	2	5	4	3	4	6	6	<b>20</b>
NP	7	46	69	27	21	15	30	23	41	11	10	22	16	8	33	16	6	17	26	20	<b>99</b>



Tab. 9 - Alien taxa of Union concern in compliance with Regulation (EU) 1143/2014, Commission Implementing Regulations (EU) 2016/1141, 2017/1263, and 2019/1262. New regional records after Galasso *et al.* (2018a) are reported. / Taxa alieni di interesse unionale in base al Regolamento (UE) 1143/2014 e ai Regolamenti di esecuzione della Commissione (UE) 2016/1141, 2017/1263 e 2019/1262. Vengono evidenziate le nuove segnalazioni regionali successive a Galasso *et al.* (2018a).

Family	Taxon	New regional records	Status ITA
Fabaceae	<i>Acacia saligna</i> (Labill.) H.L.Wendl.		INV
Simaroubaceae	<i>Ailanthus altissima</i> (Mill.) Swingle		INV
Amaranthaceae	<i>Alternanthera philoxeroides</i> (Mart.) Griseb.		INV
Apocynaceae	<i>Asclepias syriaca</i> L.		NAT
Asteraceae	<i>Baccharis halimifolia</i> L.		INV
Sapindaceae	<i>Cardiospermum grandiflorum</i> Sw.		NAT
Poaceae	<i>Cenchrus setaceus</i> (Forssk.) Morrone	CAS TOS, INV CAL	INV
Hydrocharitaceae	<i>Elodea nuttallii</i> (Planch.) H.St.John		INV
Asteraceae	<i>Gymnocoronis spilanthoides</i> (D.Don ex Hook. & Arn.) DC.		NAT
Apiaceae	<i>Heracleum mantegazzianum</i> Sommier & Levier		INV
Cannabaceae	<i>Humulus japonicus</i> Siebold & Zucc.		INV
Araliaceae	<i>Hydrocotyle ranunculoides</i> L.f.		INV
Balsaminaceae	<i>Impatiens glandulifera</i> Royle		INV
Hydrocharitaceae	<i>Lagarosiphon major</i> (Ridl.) Moss		INV
Onagraceae	<i>Ludwigia hexapetala</i> (Hook. & Arn.) Zardini, H.Y.Gu & P.H.Raven	NAT LAZ	INV
Onagraceae	<i>Ludwigia peploides</i> (Kunth) P.H.Raven subsp. <i>montevidensis</i> (Spreng.) P.H.Raven		INV
Haloragaceae	<i>Myriophyllum aquaticum</i> (Vell.) Verdc.	CAS FVG, INV TOS	INV
Pontederiaceae	<i>Pontederia crassipes</i> Mart.		INV
Fabaceae	<i>Pueraria lobata</i> (Willd.) Ohwi		INV
Salviniaceae	<i>Salvinia molesta</i> D.S.Mitch.		Not confirmed

Tab. 10 - Comparison between data at national level updated to 2020 and those reported by Bartolucci *et al.* (2018a) and Galasso *et al.* (2018a). Taxonomically doubtful taxa: "T". / Confronto a livello nazionale tra i dati aggiornati al 2020 e quelli riportati da Bartolucci *et al.* (2018a) e Galasso *et al.* (2018a). Taxa tassonomicamente dubbi: "T".

	Native			Alien	
	ITA (Bartolucci <i>et al.</i> 2018a)	ITA (2020)		ITA (Galasso <i>et al.</i> 2018a)	ITA (2020)
P	7,483	<b>7,528</b>	CAS	705	<b>744</b>
NC	568	<b>564</b>	NAT	570	<b>593</b>
D	99	<b>99</b>	INV	221	<b>227</b>
EX	26	<b>28</b>	CAS?	4	<b>3</b>
P C	53	<b>54</b>	NC A	47	<b>48</b>
NC C	2	<b>2</b>	DA	40	<b>37</b>
DD	19	<b>18</b>	EX A	3	<b>3</b>
NP	177	<b>195</b>	DD A	7	<b>5</b>
T	430	<b>433</b>	NP	86	<b>99</b>
			T	26	<b>28</b>
<b>TOT</b>	8,195	<b>8,237</b>		1,597	<b>1,660</b>

Tab. 11 - New taxa described between March 2018 and December 2020, not included in Bartolucci *et al.* (2018a) and Galasso *et al.* (2018a). Endemic: “E”; alien: “A”. / Nuovi taxa descritti tra marzo 2018 e dicembre 2020, non inclusi in Bartolucci *et al.* (2018a) e Galasso *et al.* (2018a). Endemici: “E”; alieni: “A”.

Family	E	A	Taxon	References
Rosaceae	E		<i>Alchemilla gretae-gregorii</i> S.E.Fröhner & Prosser	Fröhner & Prosser (2019)
Brassicaceae	E		<i>Alyssum rossetii</i> Španiel, Bovio & K.Kaplan	Španiel <i>et al.</i> (2018)
Orchidaceae	E		<i>Anacamptis berica</i> Doro	Doro (2020)
Brassicaceae			<i>Arabidopsis halleri</i> (L.) O’Kane & Al-Shehbaz subsp. <i>occidentalis</i> Šrámková & Marhold	Šrámková <i>et al.</i> (2019)
Chenopodiaceae			<i>Arthrocaulon meridionale</i> Es.Ramírez, Rufo, Sánchez Mata, V.Fuente	Ramírez <i>et al.</i> (2019)
Brassicaceae	E		<i>Brassica tardarae</i> Ilardi, Geraci & Troia	Ilardi <i>et al.</i> (2020)
Asteraceae	E		<i>Centaurea akroteriensis</i> Gennaio & Q.G.Manni	Gennaio & Manni (2020)
Asteraceae	E		<i>Centaurea heywoodiana</i> Raimondo, Spadaro & Di Grist.	Raimondo <i>et al.</i> (2020)
Papaveraceae	E		<i>Corydalis densiflora</i> C.Presl subsp. <i>apemina</i> F.Conti, Bartolucci & Uzunov	Conti <i>et al.</i> (2019)
Plantaginaceae	E		<i>Cymbalaria mulleri</i> (Moris) A.Chev. subsp. <i>villosa</i> Carnicero	Carnicero <i>et al.</i> (2019)
Orchidaceae	E		<i>Epipactis cordigera</i> S.Hertel & Presser	Hertel & Presser (2019)
Orchidaceae	E		<i>Epipactis garganica</i> S.Hertel	Hertel & Presser (2019)
Orchidaceae	E		<i>Epipactis hygrophila</i> S.Hertel	Hertel & Presser (2019)
Orchidaceae	E		<i>Epipactis majellensis</i> Presser & S.Hertel	Hertel & Presser (2019)
Orchidaceae	E		<i>Epipactis torqueta</i> Presser, S.Hertel & V.A.Romano	Hertel & Presser (2019)
Fabaceae	E		<i>Genista desoleana</i> Vals. subsp. <i>martellii</i> Bacch., Brullo & Giusso	Bacchetta <i>et al.</i> (2020)
Fabaceae	E		<i>Genista nuragica</i> Bacch., Brullo & Giusso	Bacchetta <i>et al.</i> (2020)
Fabaceae	E		<i>Genista salzmannii</i> DC. subsp. <i>limbarae</i> Bacch., Brullo & Giusso	Bacchetta <i>et al.</i> (2020)
Poaceae			<i>Glyceria spicata</i> Guss. subsp. <i>onubensis</i> J.López & Devesa	López & Devesa (2019)
Berberidaceae	E		<i>Gymnospermium scipetarum</i> Papparisto & Qosja ex E.Mayer & Pulević subsp. <i>eddae</i> Rosati, Farris, Fascetti & Selvi (Fig. 2B)	Rosati <i>et al.</i> (2018)
Asteraceae			<i>Hieracium atratum</i> Fr. subsp. <i>pergrandifrons</i> Zahn ex Gottschl.	Gottschlich (2019)
Asteraceae	E		<i>Hieracium racemosum</i> Waldst. & Kit. ex Willd. subsp. <i>amideii</i> Gottschl., Gonnelli & Zoccola	Gonnelli <i>et al.</i> (2019)
Asteraceae	E		<i>Hieracium racemosum</i> Waldst. & Kit. ex Willd. subsp. <i>lucanum</i> Di Grist., Domina, Gottschl. & Scafidi	Di Gristina <i>et al.</i> (2019)
Poaceae	E		<i>Poa magellensis</i> F.Conti & Bartolucci (Fig. 2A)	Conti <i>et al.</i> (2020)
Rosaceae			<i>Rubus maureri</i> Király, Trávn. & Žíla	Király <i>et al.</i> (2019)
Rosaceae	E		<i>Rubus vallis-cembrae</i> Prosser & Király	Prosser & Király (2019)
Crassulaceae		A	× <i>Sedeveria mauroi</i> L.Gallo, Merli & Jankalski	Gallo <i>et al.</i> (2020)
Caryophyllaceae			<i>Stellaria ruderalis</i> M.Lepší, P.Lepší, Z.Kaplan & P.Koutecký	Lepší <i>et al.</i> (2019)
Fabaceae	E		<i>Vicia brulloi</i> Sciandr., Giusso, Salmeri & Miniss.	Sciandrello <i>et al.</i> (2019)
Violaceae	E		<i>Viola cassinensis</i> Strobl subsp. <i>lucana</i> Silletti, Perrino, Wagens. & Erben	Perrino <i>et al.</i> (2018)
Ulmaceae			<i>Ulmus minor</i> Mill. subsp. <i>canescens</i> Bartolucci & Galasso	Bartolucci <i>et al.</i> (2019a)

Tab. 12 - Comparison 2018/2020 of native (native + cryptogenic) taxa occurring in each of the 20 administrative regions and increasing rate. / Confronto 2018/2020 dei taxa nativi (nativi + criptogenici) presenti in ognuna delle 20 regioni amministrative e relativi tassi di incremento.

	N + C 2018	N + C 2020	N + C 2020-2018 (increasing rate)
TOS	3,370	3,424	+54 (1.60%)
BAS	2,598	2,631	+33 (1.35%)
LAZ	3,003	3,038	+35 (1.16%)
SAR	2,305	2,327	+22 (0.95%)
MAR	2,497	2,520	+23 (0.92%)
CAM	2,813	2,835	+22 (0.78%)
CAL	2,768	2,786	+18 (0.65%)
EMR	2,798	2,815	+17 (0.61%)
MOL	2,301	2,314	+13 (0.56%)
LIG	3,002	3,018	+16 (0.53%)
ABR	3,190	3,206	+16 (0.50%)
PIE	3,463	3,479	+16 (0.46%)
LOM	3,272	3,286	+14 (0.43%)
FVG	2,975	2,987	+12 (0.40%)
VDA	2,289	2,298	+9 (0.39%)
VEN	3,169	3,181	+12 (0.38%)
UMB	2,364	2,372	+8 (0.34%)
TAA	3,116	3,119	+3 (0.10%)
PUG	2,552	2,554	+2 (0.08%)
SIC	2,763	2,764	+1 (0.04%)
ITA	8,195	8,237	+42 (0.51%)

Less comforting is the increase of alien taxa by 63 (+3.94%), which documents a rapid and worrying increase in allochthones, most significant being the increase of 23 new naturalized and 6 invasive aliens. In some administrative regions the increase is alarming (Tab. 13): +28.09% in CAL, +16.51% in FVG, +11.03% in TOS. These values are probably due to the intensification of exploration, however these are substantial changes, which deserve great attention.

The taxa not confirmed for Italy have slightly decreased, from 568 to 564. These taxa will be the object of a project undertaken by the working group for Floristics, Systematics and Evolution of the Italian Botanical Society, aimed at verifying their occurrence in Italy during the next few years. Unfortunately, the number of taxa considered extinct has slightly increased from 26 to 28, 13 of which are endemic to Italy (Tab. 7). Three taxa were newly reported as extinct in Italy [*Carex pediformis* C.A.Mey. subsp. *pediformis*; *Crepis mollis* (Jacq.) Asch. subsp. *mollis*; *Hieracium tolstoii* Fen. & Zahn, Fig. 1], while the taxonomic status of *Puccinellia gussonei* Parl. (extinct in Bartolucci *et al.* 2018a), was revised, being now considered as a synonym of *P. festuciformis* (Host) Parl. subsp. *lagascana* M.A.Juliá & J.M.Monts. (Bartolucci *et al.* 2020b; Abeli *et al.* 2021). The knowledge that will be acquired in the coming years will be crucial to better understand the conservation status of the Italian flora.

Tab. 13 - Comparison 2018/2020 of alien (archaeophyte + neophyte) taxa occurring in each of the 20 administrative regions and increasing rate. / Confronto 2018/2020 dei taxa alieni (archoefite + neofite) presenti in ognuna delle 20 regioni amministrative e relativi tassi di incremento.

	ARC + NEO [CAS, NAT, INV] 2018	ARC + NEO [CAS, NAT, INV] 2020	ARC + NEO 2020-2018 (increasing rate)
CAL	267	342	+75 (28.09%)
FVG	436	508	+72 (16.51%)
TOS	580	644	+64 (11.03%)
VDA	149	163	+14 (9.39%)
SIC	437	473	+36 (8.24%)
BAS	220	237	+17 (7.73%)
MAR	356	381	+25 (7.02%)
PUG	361	384	+23 (6.37%)
ABR	350	369	+19 (5.43%)
LAZ	482	508	+26 (5.39%)
LIG	456	478	+22 (4.82%)
SAR	481	501	+20 (4.16%)
VEN	618	643	+25 (4.04%)
PIE	526	547	+21 (3.99%)
EMR	537	557	+20 (3.72%)
CAM	433	446	+13 (3.00%)
UMB	286	294	+8 (2.80%)
TAA	577	592	+15 (2.60%)
LOM	776	790	+14 (1.80%)
MOL	185	188	+3 (1.62%)
ITA	1,597	1,660	+63 (3.94%)

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