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.

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,
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 (≥ 50 taxa) and genera (≥ 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

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### NUMBER OF TAXA (2020)

| N-C | N+C REG [NAT, INV] | N+C REG [CAS, NAT, INV] | ARC ESTABL [NAT, INV] | NEO ESTABL [NAT, INV] | ARC | NEO | ARC+NEO REG [CAS, NAT, INV] | NEO+ARC REG [CAS, NAT, INV] | TOTAL (casual excluded) | TOTAL (casual included) |
|-----|-------------------|--------------------------|-----------------------|-----------------------|-----|-----|----------------------------|----------------------------|--------------------------|------------------------|
| PIE | 3,479             | 3,525                    | 3,554                 | 36                    | 273 | 98  | 449                        | 309                       | 547                      | 4,010                  |
| TOS | 3,424             | 3,445                    | 3,458                 | 38                    | 243 | 124 | 520                        | 282                       | 644                      | 4,102                  |
| LOM | 3,286             | 3,322                    | 3,452                 | 43                    | 323 | 127 | 663                        | 366                       | 790                      | 4,242                  |
| ABR | 3,206             | 3,224                    | 3,235                 | 39                    | 117 | 105 | 264                        | 156                       | 369                      | 3,604                  |
| VEN | 3,181             | 3,281                    | 3,360                 | 36                    | 221 | 112 | 531                        | 257                       | 643                      | 4,003                  |
| TAA | 3,119             | 3,241                    | 3,506                 | 22                    | 157 | 108 | 484                        | 179                       | 592                      | 4,098                  |
| LAZ | 3,038             | 3,065                    | 3,085                 | 36                    | 139 | 98  | 410                        | 175                       | 508                      | 3,593                  |
| LIG | 3,018             | 3,067                    | 3,097                 | 26                    | 141 | 81  | 397                        | 167                       | 478                      | 3,575                  |
| FVG | 2,987             | 3,141                    | 3,158                 | 38                    | 155 | 100 | 408                        | 193                       | 508                      | 3,666                  |
| CAM | 2,835             | 2,849                    | 2,852                 | 38                    | 143 | 99  | 347                        | 181                       | 446                      | 3,298                  |
| EMBR| 2,815             | 2,845                    | 2,861                 | 33                    | 219 | 115 | 442                        | 252                       | 557                      | 3,418                  |
| CAL | 2,786             | 2,805                    | 2,816                 | 25                    | 118 | 74  | 268                        | 143                       | 342                      | 2,948                  |
| SIC | 2,764             | 2,783                    | 2,789                 | 34                    | 194 | 85  | 388                        | 218                       | 473                      | 3,262                  |
| BAS | 2,631             | 2,638                    | 2,641                 | 27                    | 67  | 84  | 153                        | 94                        | 237                      | 2,878                  |
| PUG | 2,554             | 2,569                    | 2,578                 | 27                    | 110 | 81  | 303                        | 137                       | 384                      | 2,962                  |
| MAR | 2,520             | 2,558                    | 2,565                 | 30                    | 110 | 98  | 283                        | 140                       | 381                      | 2,946                  |
| UMB | 2,372             | 2,408                    | 2,415                 | 24                    | 60  | 97  | 197                        | 84                        | 294                      | 2,709                  |
| SAR | 2,327             | 2,406                    | 2,462                 | 35                    | 165 | 108 | 393                        | 200                       | 501                      | 2,963                  |
| MOL | 2,314             | 2,334                    | 2,337                 | 32                    | 61  | 69  | 119                        | 93                        | 188                      | 2,525                  |
| VDA | 2,298             | 2,332                    | 2,344                 | 13                    | 60  | 37  | 126                        | 73                        | 163                      | 2,507                  |
| ITA | 8,237 (56 C)      | 8,237                    | 8,237                 | 85                    | 735 | 160 | 1,500                      | 820                       | 1,660                    | 9,897                  |
Siculosciadium (Apiaceae). Three genera are endemic to Sardegna and Corse (France): Morisia (Brassicaceae), Castroviejoa, and Nanthea (Asteraceae). The most represented families (≥ 20 taxa) and genera (≥ 10 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 (3,452), 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 (3,452), 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 (3,452), 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 (3,452), 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 (3,452), 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 (3,452), 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 (3,452), VEN (3,360), and ABR (3,235).
Fig. 1 - *Hieracium tolstoii* 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).
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 (≥ 20 taxa) and genera (≥ 15 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 (DA) (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 culto. 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. 3 - Most represented families (≥ 20 taxa) and genera (≥ 15 taxa) of the Italian endemic vascular flora in 2020.

| Families         | Genera          |
|------------------|-----------------|
| Asteraceae       | Hieracium       |
| Plumbaginaceae   | Limonium        |
| Caryophyllaceae  | Centaurea       |
| Orchidaceae      | Ophrys          |
| Fabaceae         | Genista         |
| Brassicaceae     | Ranunculus      |
| Poaceae          | Taraxacum       |
| Ranunculaceae    | Silene          |
| Rosaceae         | Dianthus        |
| Apiaceae         | Allium          |
| Lamiaceae        | Viola           |
| Boraginaceae     | Campanula       |
| Amaryllidaceae   | Epipactis       |
| Campanulaceae    | Armeria         |
| Rubiaceae        | Festuca         |
| Plantaginaceae   | Astragalus      |
| Iridaceae        | Erysimum        |
| Violaceae        | Saxifraga       |
| Orobanchaceae    | Alchemilla      |
| Pilosella        |                 |

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 (≥ 25 taxa) and genera (≥ 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 (DA) (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 culto. 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. 6 - Number of native taxa for each occurrence category in the 20 administrative regions in 2020. / Numero dei taxa nativi 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. 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.

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. (Photo: / Foto: Fabrizio Bartolucci). B) Gymnospermium scipetarum Paparisto & Qosja ex E.Mayer & Pulević subsp. eddae Rosati, Farris, Fascetti & Selvi. Endemic to Italy, described in 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).

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

| Region code | VDA | PIE | LOM | TAA | VEN | PAV | LIG | EMR | TOS | MAR | UBR | LAV | 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 | 744 |
| NAT         | 52  | 241 | 254 | 139 | 189 | 156 | 148 | 225 | 222 | 91  | 72  | 136 | 122 | 67  | 135 | 116 | 74  | 109 | 210 | 137 | 593 |
| INV         | 21  | 68  | 112 | 40  | 68  | 37  | 39  | 27  | 60  | 40  | 12  | 39  | 34  | 26  | 47  | 21  | 20  | 35  | 18  | 63  | 227 |
| CAS?        | 1   | 1   | 0   | 7   | 6   | 10  | 0   | 11  | 7   | 6   | 1   | 0   | 2   | 0   | 0   | 4   | 3   | 5   | 4   | 3   |
| NC A        | 8   | 15  | 1   | 4   | 28  | 18  | 33  | 18  | 35  | 28  | 2   | 17  | 4   | 0   | 33  | 13  | 3   | 16  | 18  | 2   | 48  |
| D A         | 10  | 12  | 10  | 15  | 9   | 16  | 10  | 8   | 27  | 8   | 13  | 11  | 4   | 4   | 13  | 9   | 6   | 2   | 16  | 19  | 37  |
| EX A        | 0   | 14  | 5   | 2   | 0   | 0   | 0   | 6   | 1   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| DD A        | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| TOT         | 163 | 547 | 790 | 592 | 643 | 508 | 478 | 557 | 644 | 381 | 294 | 508 | 369 | 188 | 446 | 384 | 237 | 342 | 473 | 501 | 1,660 |
| IAS         | 3   | 10  | 14  | 8   | 13  | 8   | 5   | 10  | 2   | 1   | 10  | 1   | 2   | 5   | 4   | 3   | 4   | 6   | 6   | 20  |
| NP          | 7   | 46  | 69  | 27  | 21  | 15  | 30  | 23  | 41  | 11  | 10  | 22  | 16  | 8   | 33  | 16  | 6   | 17  | 26  | 20  | 99  |
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     | Acacia saligna (Labill.) H.L.Wendl.        |                      | INV        |
| Simaroubaceae| Ailanthus altissima (Mill.) Swingle        |                      | INV        |
| Amaranthaceae| Alternanthera philoxeroides (Mart.) Griseb.|                      | INV        |
| Apocynaceae  | Asclepias syriaca L.                       |                      | NAT        |
| Asteraceae   | Baccharis halimifolia L.                   |                      | INV        |
| Sapindaceae  | Cardiospermum grandiflorum Sw.             |                      | NAT        |
| Poaceae      | Conchorus setaceus (Forssk.) Morrone       | CAS TOS, INV CAL     | INV        |
| Hydrocharitaceae | Elodea nuttallii (Planch.) H.St.John     |                      | INV        |
| Asteraceae   | Gymnocooronis spilanthoides (D.Don ex Hook. & Am.) DC. | | NAT        |
| Apiaceae     | Heracleum mantegazzianum Sommier & Lever   |                      | INV        |
| Cannabaceae  | Humulus japonicus Siebold & Zucc.         |                      | INV        |
| Araliaceae   | Hydrocotyle ranunculoides L.f.             |                      | INV        |
| Balsaminaceae| Impatiens glandulifera Royle               |                      | INV        |
| Hydrocharitaceae | Lagarosiphon major (Ridl.) Moss     |                      | INV        |
| Onagraceae   | Ludwigia hexapetala (Hook. & Am.) Zardini, H.Y.Gu & P.H.Raven | NAT LAZ           | INV        |
| Onagraceae   | Ludwigia peploides (Kunth) P.H.Raven subsp. montevidensis (Spreng.) P.H.Raven | | INV        |
| Haloragaceae | Myriophyllum aquaticum (Vell.) Verdc.      | CAS FVG, INV TOS    | INV        |
| Pontederiaceae| Pontederia crassipes Mart.                 |                      | INV        |
| Fabaceae     | Pueraria lobata (Wild.) Ohwi               |                      | INV        |
| Salviniaeae  | Salvinia molesta 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 | ITA (Bartolucci et al. 2018a) | ITA (2020) | Alien | ITA (Galasso et al. 2018a) | ITA (2020) |
|--------|------------------------------|------------|-------|---------------------------|------------|
| P      | 7,483                        | 7,528      | CAS   | 705                        | 744        |
| NC     | 568                          | 564        | NAT   | 570                        | 593        |
| D      | 99                           | 99         | INV   | 221                        | 227        |
| EX     | 26                           | 28         | CAS?  | 4                          | 3          |
| P C    | 53                           | 54         | NC A  | 47                         | 48         |
| NC C   | 2                            | 2          | D A   | 40                         | 37         |
| DD     | 19                           | 18         | EX A  | 3                          | 3          |
| NP     | 177                          | 195        | DD A  | 7                          | 5          |
| T      | 430                          | 433        | NP    | 86                         | 99         |
| TOT    | 8,195                        | 8,237      |       | 1,597                      | 1,660      |
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 |    | *Alchemilla greta-gregorii* S.E. Fröhner & Prosser | Fröhner & Prosser (2019)                                                  |
| Brassicaceae   | E |    | *Allyssum rossetii* Španiel, Bovio & K.Kaplan | Španiel et al. (2018)                                                     |
| Orchidaceae    | E |    | *Anacamptis berica* Doro                    | Doro (2020)                                                               |
| Brassicaceae   |    | A | *Arabidopsis halleri* (L.) O’Kane & Al-Shehbaz subsp. *occidentalis* Šrámková & Marhold | Šrámková et al. (2019)                                                   |
| Chenopodiaceae |    | A | *Arthrocaulon meridionale* Es.Ramirez, Rufo, Sánchez Mata, V.Fuente | Ramírez et al. (2019)                                                   |
| Brassicaceae   | E |    | *Brassica tardarae* Ilardi, Geraci & Troia   | Ilardi et al. (2020)                                                     |
| Asteraceae     | E |    | *Centaurea akroteriensis* Gennaio & Q.G.Manni | Gennaio & Manni (2020)                                                   |
| Asteraceae     | E |    | *Centaurea heywoodiana* Raimondo, Spadaro & Di Grist. | Raimondo et al. (2020)                                                   |
| Papaveraceae   | E |    | *Corydalis densiflora* C.Presl subsp. *apennina* F.Conti, Bartolucci & Uzunov | Conti et al. (2019)                                                   |
| Plantaginaceae | E |    | *Cymbalaria mulleri* (Moris) A.Chev. subsp. *villosa* Carnicero | Carnicero et al. (2019)                                                   |
| Orchidaceae    | E |    | *Epipactis cordigera* S.Hertel & Presser    | Hertel & Presser (2019)                                                  |
| Orchidaceae    | E |    | *Epipactis garganica* S.Hertel               | Hertel & Presser (2019)                                                  |
| Orchidaceae    | E |    | *Epipactis hygrophiila* S.Hertel             | Hertel & Presser (2019)                                                  |
| Orchidaceae    | E |    | *Epipactis majellensis* Presser & S.Hertel   | Hertel & Presser (2019)                                                  |
| Orchidaceae    | E |    | *Epipactis torqueta* Presser, S.Hertel & V.A.Romano | Hertel & Presser (2019)                                                  |
| Fabaceae       | E |    | *Genista desoleana* Vals. subsp. *martellii* Bacch., Brullo & Giusso | Bacchetta et al. (2020)                                                  |
| Fabaceae       | E |    | *Genista nuragica* Bacch., Brullo & Giusso   | Bacchetta et al. (2020)                                                  |
| Fabaceae       | E |    | *Genista salzmannii* DC. subsp. *limbarae* Bacch., Brullo & Giusso | Bacchetta et al. (2020)                                                  |
| Poaceae        | E |    | *Glyceria spicata* Guss. subsp. *onubensis* J.López & Devesa | López & Devesa (2019)                                                   |
| Berberidaceae  | E |    | *Gymnospermium scipetarum* Paparisto & Qosja ex E.Mayer & Pulević subsp. *eddiae* Rosati, Farris, Fascetti & Selvi (Fig. 2B) | Rosati et al. (2018)                                                   |
| Asteraceae     | E |    | *Hieracium atratum* Fr. subsp. *pergrandifrons* Zahn ex Gottschl. | Gottschlich (2019)                                                     |
| Asteraceae     | E |    | *Hieracium racemosum* Waldst. & Kit. ex Willd. subsp. *amideii* Gottschl., Gonnelli & Zoccola | Gonnelli et al. (2019)                                                  |
| Asteraceae     | E |    | *Hieracium racemosum* Waldst. & Kit. ex Willd. subsp. *lucanum* Di Grist., Domina, Gottschl. & Scalfidi | Di Gristina et al. (2019)                                               |
| Poaceae        | E |    | *Poa magellensis* F.Conti & Bartolucci (Fig. 2A) | Conti et al. (2020)                                                     |
| Rosaceae       |    | A | *Rubus maurei* Király, Trávn. & Žíla         | Király et al. (2019)                                                     |
| Rosaceae       | E |    | *Rubus vallis-cembræ* Prosser & Király       | Prosser & Király (2019)                                                  |
| Crassulaceae   | A |    | ×*Sedeveria mauroi* L.Gallo, Merli & Jankalski | Gallo et al. (2020)                                                     |
| Caryophyllaceae|    | A | *Stellaria ruderalis* M.Lepši, P.Lepši, Z.Kaplan & P.Koutecký | Lepši et al. (2019)                                                   |
| Fabaceae       | E |    | *Vicia brulloi* Sciandr., Giusso, Salmeri & Miniss. | Sciandrello et al. (2019)                                               |
| Violaceae      | E |    | *Viola cassinensis* Strobl subsp. *lucana* Silletti, Perrino, Wagens. & Erben | Perrino et al. (2018)                                                  |
| Ulmaceae       |    | A | *Ulmus minor* Mill. subsp. *canescens* Bartolucci & Galasso | Bartolucci et al. (2019a)                                               |
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 26, 13 of which are endemic to Italy. Unfortunately, the number of taxa considered extinct has slightly increased from 26 to 28, 13 of which are endemic to Italy during the next few years. 

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 (archeofite + neofite) presenti in ognuna delle 20 regioni amministrative e relativi tassi di incremento.

| Region | N + C 2018 | N + C 2020 | N + C 2020-2018 (increasing rate) |
|--------|------------|------------|-----------------------------------|
| CAL    | 267        | 342        | +75 (28.09%)                      |
| FVG    | 436        | 508        | +72 (16.51%)                      |
| TOS    | 580        | 644        | +64 (11.03%)                      |

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