

**VICIA INCISA (FABACEAE): TAXONOMICAL AND CHOROLOGICAL NOTES**IBERITE M.¹, ABBATE G.¹, IAMONICO D.^{2,*}¹ Department of Environmental Biology, University of Rome Sapienza, 00185 Roma, Italy;² Department PDTA, University of Rome Sapienza, 00196 Rome, Italy;* Corresponding author: Telephone: +390649919368; email: d.iamonico@yahoo.it

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ABSTRACT – The classification of the *Vicia sativa* aggregate is unsatisfactory. Concerning the taxonomic value and choice of rank of some of these taxa, there are disagreements among botanists. *Vicia incisa*, which was originally described at species level, was mostly treated at subspecies rank of *V. sativa*. However, chemical and molecular data pointed out that this taxon, not only should be treated at species rank, but it should be removed from the group of *V. sativa*, being more related to *V. barbazitae*, *V. grandiflora*, and *V. sepium*. Based on morphometric measurements and cultivation tests, as well as nomenclatural investigations, the present research was carried out with the main aim to define the better taxonomic rank for the studied taxon. The results obtained support the published molecular data concerning both the recognition of the studied taxon at species level and the morphological similarity among *V. incisa*, *V. barbazitae*, *V. grandiflora* and *V. sepium*.

KEYWORDS: DISJUNCTION DISTRIBUTION, EUROPE, SPECIES RANK, TYPIFICATION, *VICIA PIMPINELLOIDES*, *V. SATIVA*

INTRODUCTION

Vicia L. (Faboideae Rudd, Fabaceae Lindley) is a genus of 140–215 species mainly distributed in temperate regions of the northern hemisphere, and non-tropical South America (Gunn, 1979; APG IV, 2016; Gonzáles et al., 2013). The European flora includes 94 *Vicia* species (ILDIS World Database of Legumes, 2010) of which 45 occur in Italy (Conti et al., 2005, 2007), and 34 in Lazio region, Central Italy (Anzalone et al., 2010).

The *Vicia sativa* aggregate has been subject of various studies, but there are disagreements among authors concerning its classification. In fact, this group is still not clarified at present and it is critical from the taxonomic point of view due to its high morphological variability which has led nomenclatural disorders and misapplication of names (dozens of names were published during the time; see e.g., Wouw et al., 2001; IPNI, 2012+).

According to the Euro+Med Plan Base (ILDIS World Database of Legumes, 2010), 7 subspecies and 1 variety are currently recognized. However, the taxonomic value of

some of these taxa remain controversial (see e.g., Ball, 1968; Hollings & Stace, 1978; Gunn, 1979; Vavilov, 1997; Bomble & Loos, 2004). The member originally described as *Vicia incisa* M.Bieb., a rare species mainly occurring in Eastern Europe and often used as good forage plant, was mostly treated at subspecies rank of *V. sativa* (see e.g., Ball, 1968; Pignatti, 1982; Romero Zarco, 1999). However, both data regarding both the isozymes variation (e.g., Jaaska, 2008; 2015), and DNA sequences (e.g., Wouw et al., 2001; Potokina et al., 2002), highlighted that taxon *incisa* is a species which does not belong to the group of *V. sativa*, but it is more related to *V. barbazitae* Ten. & Guss., *V. grandiflora* Scop., and *V. sepium*. A further taxonomic complication is at section rank: while *V. sativa s.lat.* (incl. *V. incisa*), *V. barbazitae*, and *V. grandiflora* are currently placed in the sect. *Vicia* (see e.g., Maxted, 1990, 1993; Kupicha, 1976; Tzvelev, 1980), the molecular data suggested that the three species, together with *V. sepium* and *V. incisa*, should be included in the sect. *Atossa* (Alef.) Asch. & Graebn.

The present paper focuses on *Vicia sativa* subsp. *incisa* and the related species *V. barbazitae*, *V. grandiflora*, and *V. sepium* with the main aim to define the better taxonomic rank for the taxon *incisa*, through nomenclatural and morphometric data (never published before), which can support the molecular ones.

The work is part of the researches carried out by the authors within the initiative “*Italian Loci Classici Census*” (Domina et al., 2012), and the studies about the Flora of Lazio, Central Italy (e.g., Abbate et al., 2009; Anzalone et al., 2010; Iamónico, 2017; Iberite et al., 2014).

MATERIAL AND METHODS

The work was carried out by personal field investigations, examination of the specimens kept in the Herbaria FI, HFLA, LE, P, and RO (acronyms according to Thiers, 2017+), and extensive analysis of literature (protologues included).

A morphological analysis, based on the 21 characters (3 qualitative and 18 quantitative; see Table 1), was performed on 80 specimens (about 20 specimens per species). The data matrix so obtained was processed by means of the software NCSS 2007. The variability of the characters is illustrated by box plots. The description of the species is based on personal observations of exiccata and living plants.

Cultivation tests have been performed during the last 15 years [both by us and by the Prof. B. Anzalone (1921-2007), Professor of Botany at the University of Rome Sapienza] using seeds collected from the Italian populations of *Vicia sativa* subsp. *incisa* at Miralago, in the Albano Laziale municipality, Rome province, Lazio region, Central Italy (see e.g., Abbate et al., 2009).

Table 1. Characters measured.

Leaves	1. Number of leaflets pairs
	2. Minimum width of smaller leaflet
	3. Maximum length of smaller leaflet
	4. Ratio 2/3
	5. Minimum width of greater leaflet
	6. Maximum width of greater leaflet
	7. Ratio 5/6
	8. Occurrence of mucrone*
Calyx	9. Symmetry (actinomorphic/zygomorphic)*
	10. Shape of teeth
	11. Length of teeth
	12. Length of tube
	13. Ratio 11/12
Corolla	14. Total length (11+12)
	15. Symmetry (actinomorphic/zygomorphic)*
	16. Shape of teeth
	17. Length of teeth
Fruit	18. Length of fruit
	19. Width of fruit
	20. Ratio 18/19
	21. Number of seeds per fruit

RESULTS AND DISCUSSION

Typification of names

On the basis of our examination of literature, 2 names which are related to *V. incisa*, were traced and need a clarification from the nomenclatural point of view: “*Vicia incisiformis*” (Stefanoff, 1966), and *V. pimpinelloides* Mauri. The typification of the three names follows.

Bieberstein (1819: 471) described *Vicia incisa* through a short diagnosis and provided the provenance (“Habitat in Tauriâ maxime meridionali”). We found at LE one sheet bearing one plant and the following original label: “*Vicia incisa* MB | *ex Tauria meridionalis* | ... 1816”. There are other five labels on the LE specimen: “Specimen authentium”, “TYPUS!”, and “Lectotypus” (printed), “*V. sativa* L. spp. | Determinavit”, and “... 70 [1970] II 10 Teste A. Pagnee?”. The label reporting “Lectotypus” cannot be considered as effective publication for a typification according to the Art. 7.9. We consider the LE specimen as part of the original material used by Bieberstein to describe *V. incisa*. Since no further exsiccata were traced, and as the LE specimen morphologically matches the Bieberstein’s diagnosis, we here designate it as the lectotype of the name *Vicia incisa*. One year later than Bieberstein (1819), Mauri (1820: 35) published the name *Vicia pimpinelloides* giving a short diagnosis (“Leguminibus sessilibus sub-solitariis; foliis inciso-crenatis, superioribus integerrimis”), a detailed description, and the locality “*Ad Albano nella Galleria di sotto di Castel Gandolfo, e nella Macchia di Marino*” (= “at Albano in the arcade below Castel Gandolfo, and in the scrub of Marino”, where Albano, Castel Gandolfo and Marino are three towns located in the Rome Province territory); Mauri (l.c.) also provided an illustration (“Tab. 1”, Fig. 1) which is part of the original material for the name *Vicia pimpinelloides* and eligible as lectotype (Arts. 9.2, and 9.3). We traced only one specimen deposited at RO (Mauri’s collection) which could be considered for the typification purpose. This specimen bears a plant collected at Albano, which is one of the localities cited in the protologue. Unfortunately, since it dates from after the date of the original publication (may 1827 vs. 1820), it cannot be considered as part of the original material and it is not eligible as lectotype (Arts. 9.2, and 9.3). No further useful specimen was found, and the only extant original material is the Mauri’s illustration (Mauri 1820: “Tab. 1”) which is here designated as the lectotype of the name *Vicia pimpinelloides*. According to the Art. 9.8 we here designate an epitype from the Anzalone’s collection (RO-HA-25348) (Fig. 2). Stefanoff (1966: 266) published the name *Vicia incisiformis* as a new species from Bulgaria. Unfortunately, the type indication was omitted and, as a consequence, the Stefanoff’s name was not validly published (Art. 40.1). However, on the basis of the diagnosis, and specifically concerning the

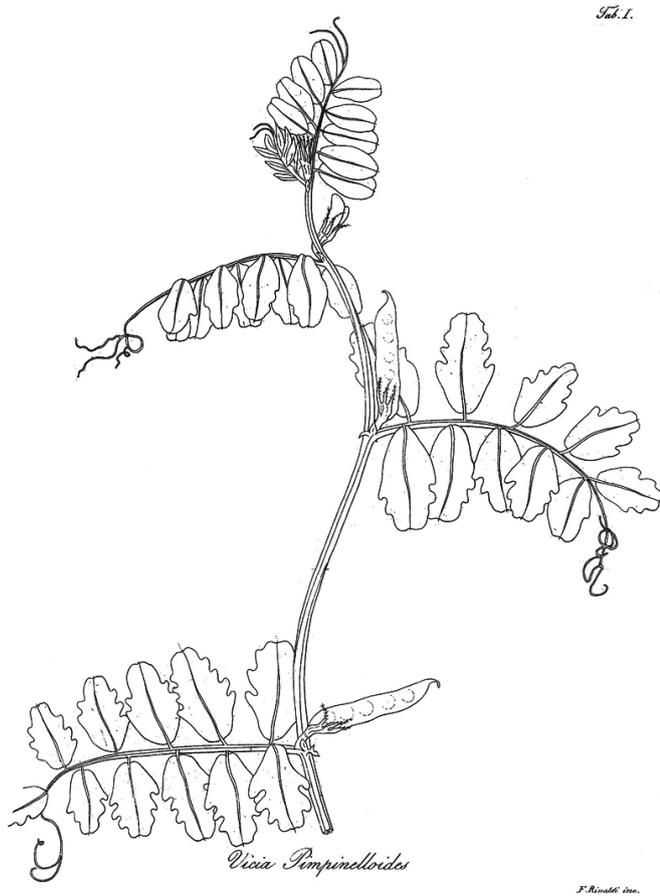


Fig. 1. Lectotype of the name *Vicia pimpinelloides* Mauri (1820: "Tab. 1").

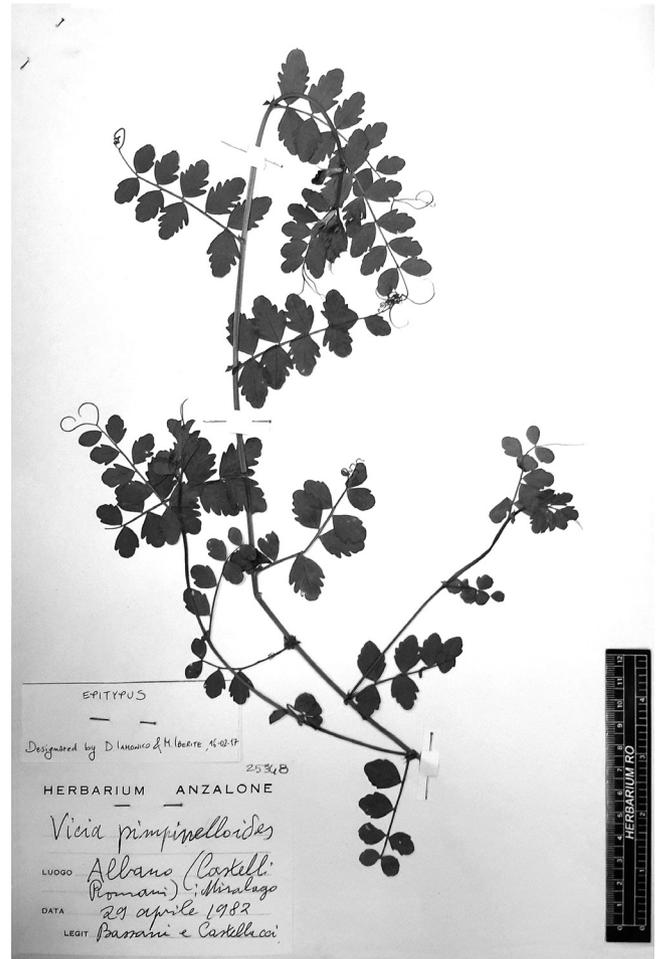


Fig. 2. Epitype of the name *Vicia pimpinelloides* (RO!).

characters of the leaves, we can ascribe the Stefanoff's concept of his *V. incisiformis* to *V. incisa* with certainty.

Morphological remarks

Vicia sativa is a species complex which currently includes 8 taxa according to ILDIS World Database of Legumes (2010): subsp. *amphicarpa* (Dorthe) Asch., subsp. *cordata* (Hoppe) Batt., subsp. *devia* J.G.Costa, subsp. *incisa* (M.Beib.) Arcang., subsp. *macrocarpa* (Moris) Arcang., subsp. *nigra* (L.) Ehrh., subsp. *sativa* var. *platysperma*, and subsp. *sativa* var. *sativa*. On the basis of the literature (see e.g., Ball, 1968; Hollings & Stace, 1978; Gil & Cubero, 1993; Romero Zarco, 1999; Bumble & Loos, 2004), and our personal observations of specimens and living plants, the members of the *Vicia sativa* group are distinguished mainly by characters of flowers (total length, corolla and calyx lengths, size of calyx teeth, shape of

leaflets), fruit (width, shape, and colour), and seed (diameter, and surface pattern). Overall, by measuring flowers, fruits and seeds of specimens and living plants, we highlighted that the taxon *incisa* is not morphologically similar to a single *V. sativa* subspecies, displaying features which are comparable with subsp. *cordata* (ratio length calyx teeth/calyx tube), subsp. *nigra* (length of corolla), or subsp. *sativa* (width of fruit). Furthermore, there is a feature that allows to separate the taxon *incisa* from all the infraspecific taxa belonging to *V. sativa*, that is the shape of the inferior and median leaves whose blades are crenate-lobed (3-4 lobes per side).

Concerning *Vicia barbatae*, *V. grandiflora* and *V. sepium* the box-plot analyses allow us to better separate *V. sativa* subsp. *incisa* from the other considered species. Three characters are significant: ratio length calyx teeth/calyx tube, length of the calyx teeth (Fig. 3A–B), and margin of the leaf blade (Fig. 4). The ratio length calyx teeth/calyx tube ranging from 1.00 to

2.00 in *V. sativa* subsp. *incisa*, while it is up to 1 in the other species: (0.5–)0.7–1.0 in *V. barbazitae*, (0.15–)0.20–0.65 in *V. grandiflora*, (0.2–)0.60–1.00 in *V. sepium*. As regard the length of the calyx teeth, the subsp. *incisa* displays teeth (5.9–)6.5–9.5(–12) mm long, the other species having teeth shorter: (5–)5.5–6.4(–7) in *V. barbazitae*, 2.8–3.9(–5.1) mm in *V. grandiflora*, (2.2–)2.7–3.8(–4.0) in *V. sepium*.

The cultivation tests, which we performed on plants referring to *Vicia sativa* subsp. *incisa*, showed that the character of leaves margins is maintained through the successive generations. This fact leads us to hypotesize that the leaf character is genetically fixed.

Chorology of the species and origin of the Italian populations

Based on field surveys, examination of specimens and analysis of literature, we were able to provide, for the first time, the distribution area of *Vicia sativa* subsp. *incisa*. 16 sites were traced in five countries (Table 2). Being an annual taxon with barocorous dispersion, it can't easily disperse. Concerning the origin of the Italian population at Miralago locality (Lazio region, Central Italy), Giovi et al. (2003) and Abbate et al. (2009) formulated an interesting historical hypothesis about its introduction 1800 years ago by means

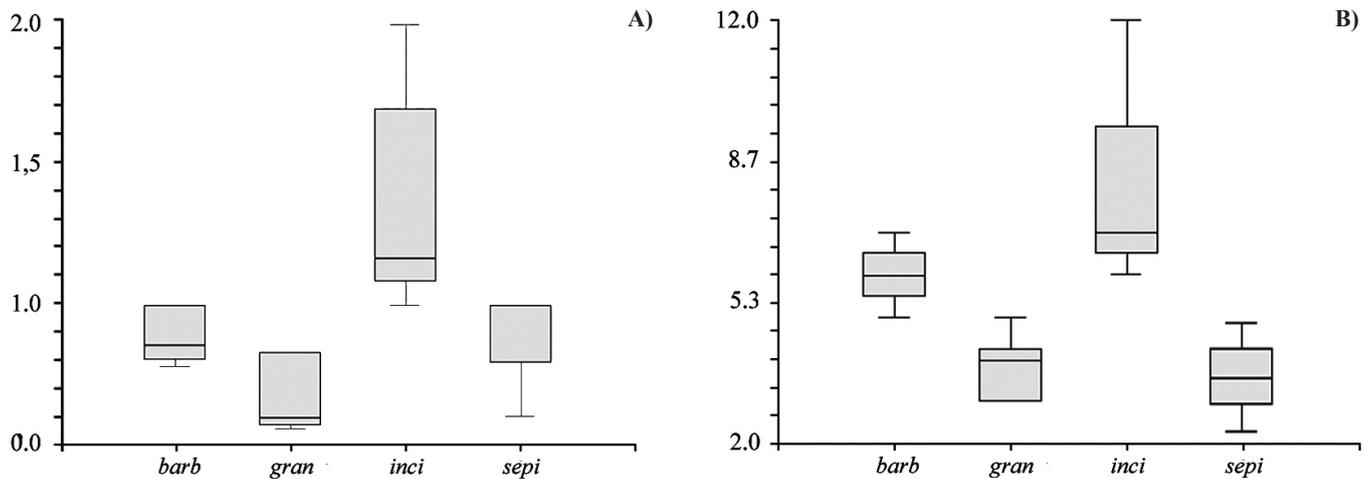


Fig. 3. Box plots for the diagnostic characters (measurements are in mm): (A) and ratio length calyx teeth/calyx tube, (B) length of the calyx teeth.

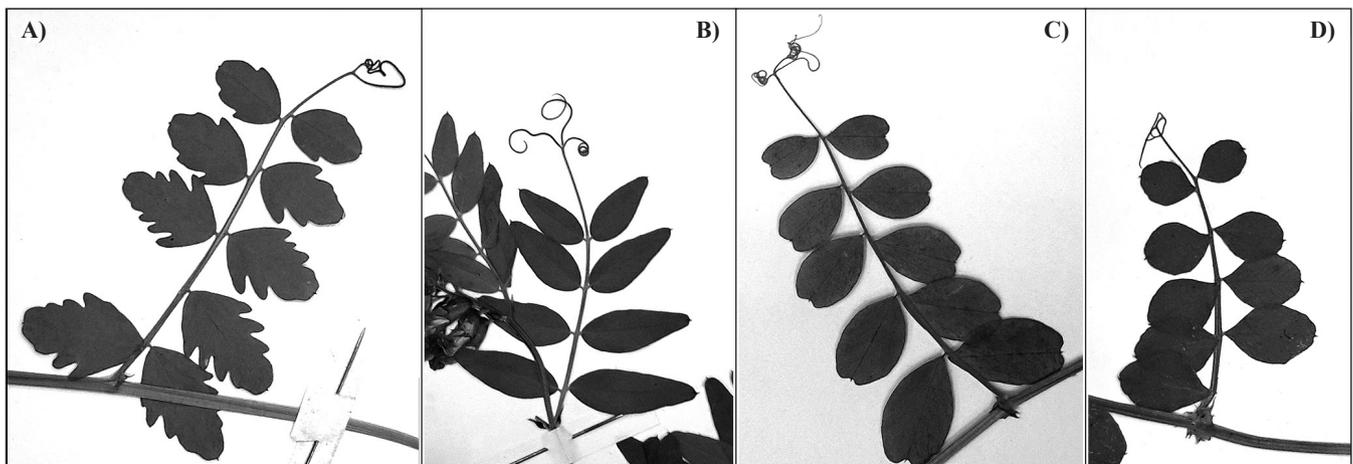


Fig. 4. Margins of the leaf blade in *Vicia incisa* (A), *V. sepium* (B), *V. barbazitae* (C), and *V. grandiflora* (D).

Table 2. Sites in which *Vicia incisa* was recorded (countries, administrative units, and localities are listed in alphabetical order).

Country	Main administrative unit	Locality	Reference
Bulgaria	Balgoevgrad	Paril (Mt. Slavyanka)	Dimitrov (2005)
	Burgas	among Tzarevo, Kiten, Ahtopol, and Sinemorets	Dimitrov (2005)
	Burgas	Balgari (Mts. Strandzha)	Dimitrov (2005)
	Burgas	Fazanovo (Mts. Strandzha)	Dimitrov (2005)
	Burgas	Malko Tarnovo (Mts. Strandzha)	Dimitrov (2005)
	Burgas	<i>not specified</i> (along the Black sea coast)	Assyov & Petrova (2012: 444)
	Haskovo	Kazak (Mts. Rhodopi)	Pavlova et al. (2003: 31), Dimitrov (2005)
	Haskovo	Meden Buk (Mts. Rhodopi)	Dimitrov (2005)
	Haskovo	Ustrem	Vladimirov & Tan (2016: 447)
	Jambol	<i>not specified</i> (central-southern part)	Dimitrov (2005)
	Kardzhali	Goljamo Kamenjane	Vladimirov & Tan (2016: 447)
Crimea	Feodosia	Nanikove	Potokina (1997 : 206)
	Yalta	Yalta	Potokina (1997 : 206)
	Yalta	Vidradne	Potokina (1997 : 206)
Greece	<i>not specified</i>	Mt. Likeo	Baliouisis (2013 : 33)
	Attica	Karavas (Amirali)	Yannitsaros (1998: 77)
	Peloponnese	Messenia	Yannitsaros (1998: 77)
	Thessalia	Karditsa (Nomos, Eparchia)	Vladimirov et al. (2014 : 285–286)
Italy	Lazio	Albano (Miralago), Castalgandolfo	Abbate et al. (2009: 61)
	Sicily	Castiglione di Sicilia	Cristaudo & Margani (2005: 1157)
Turkey	Black sea	Amasya	Başbağ et al. (2013: 64)
	Marmara	Edirne (Güllapoğlu stream, Söğütlük)	Başbağ et al. (2013: 64)
	Marmara	İstanbul (European part)	Başbağ et al. (2013: 64)
	Eastern Anatolia	Van	Başbağ et al. (2013: 64)

of ancient roman armies (named II *Legio Parthica*). The *Legio Parthica*, coming back from SE-Europe, might have introduced this species and cultivated it in the surrounding of Albano, where they had their settlements. During the following centuries the competition with autoctonous species could have determined the rarefaction of *V. sativa* subsp. *incisa*. According to this hypothesis the taxon should be interpreted as an archeophyte. However the occurrence in Sicily in the same habitat would lead us to consider it as native. As for other taxa, the disjunction distribution pattern of *V. incisa* remains an open chorological enigma.

Taxonomic treatment

Vicia incisa M.Bieb., Fl. Taur.-Caucas. 3: 471. 1819 ≡ *Vicia sativa* L. var. *incisa* (M.Bieb.) Boiss., Fl. Orient. 2: 574. 1872 ≡ *Vicia sativa* L. subsp. *incisa* (M.Bieb.) Arcang., Comp. Fl. Ital.: 201. 1882. – Type (lectotype, designated here): CRIMEA. ex *Tauria meridionalis*, 1816, C. Steven von s.n. (LE!, image of the lectotype available at: <http://www.mobot.org/MOBOT/Research/LEguide/collections/1/11.html>). = *Vicia pimpinelloides* Mauri, Roman. Pl. Cent. XIII: 35. 1820. – Type (lectotype, designated here): [Icon] *Vicia pimpinelloides* from Mauri (1820: “Tab. 1”)

(Fig. 1). – Type (epitype, designated here): ITALY. Lazio, Albano (Castelli Romani), Miralago, 29 April 1982, leg. Bassani & Castellaci det. B. Anzalone s.n. (RO!) (Fig. 2). – *Vicia incisiformis* Stef., *Izv. Bot. Inst. (Sofia)* 16: 226. 1966, *nom. inval.* (Art. 40.1).

Description (Fig. 5): herbs annual, 10-100 cm tall. Stem branched, decumbent or climbing, sparsely pubescent, ribbed. Leaves paripinnate 3-8 cm long with a tendril 2-3-branched; stipules hastate, about 3.0 mm long, crenate with apex acuminate, puberulent at margins; leaflets 4-5-paired, elliptic ovate, 12-26 × 7-16 mm, glabrous, apex obtuse truncate (sometimes slightly emarginate) mucronate, base cuneate, with (1)-3-4 lobes per side (each sinus up to 1/3 deep), very shortly petioled. Flowers solitary or in pairs. Actinomorphic tubulate calyx 5-6 mm long, hairy in nerves; linear teeth 7-12 mm long (ratio teeth/tube 1-2), pubescent (hairs up to 0.7 mm long). Blue-purple corolla, 14-16 mm long (ratio corolla/calix 0.89-1.17). Ovary hairy on sutures. Legume brown, linear 40-42 × 7-9 mm, sparsely pubescent with longer hairs on sutures. Seeds 6-7, spheroid.

Chromosome number: $2n = 14$ (Mettin, 1961, 1964; Yamamoto, 1973 from Germany; Roti Michelozzi & Barberis, 1989 from Italy; Meriç & Dane, 1999 from European Turkey)

Habitat in Italy: in Lazio region it occurs at 300-400 m a.s.l. in clearings of deciduous oak/chestnut woodlands and in road edges. In Sicily it occupies the same habitat at 460 m a.s.l.

Distribution area (Fig. 5): *Vicia incisa* is currently recorded in Greece, Bulgaria, Crimea (see e.g., ILDIS World Database of Legumes, 2010), Turkey [Başbağ et al. (2013); 2005; ILDIS World Database of Legumes (2010) did not indicate *Vicia incisa* in Turkey], and Italy [Conti et al., 2005; ILDIS World Database of Legumes (2010) did not indicate *Vicia incisa* in Italy, probably because *Flora Europaea*, which is the main reference in the Euro+Med Plant Base for the *V. sativa* aggregate, reported *V. incisa* as doubt for Italy], and can be considered as a SE-Europe-Pontic chorological element.

Concerning Italy, only few certain sites are known at present. In Lazio region (see Abbate et al., 2009; Anzalone et al., 2010) the species was recorded in Albano and Castel Gandolfo municipalities where few populations were observed [The locality “Casetta Mattei” (Western areas of the city of Rome), which was cited by Mauri (1820: 35) in the protologue and later by other Italian botanists (e.g., Arcangeli, 1882: 201, 1894: 524), was not confirmed by us during the field surveys]. The population at Miralago locality [where it was first collected by P. Sanguinetti in 1829 (see Specimina Visa)] is the most abundant one and this caused the designation of the SCI of Natura 2000 IT-6030039. In Sicily, the species was found in the locality Castiglione di Sicilia, Catania Province, where it was first collected by A. Cristaudo in 1998 (see Specimina Visa) (Cristaudo & Margani, 2005; Raimondo et al. 2010: 237).

Conservation status in Italy: Critically Endangered [CR; criterion B_{sb}(iii)] according to Rossi et al. (2013: 49).

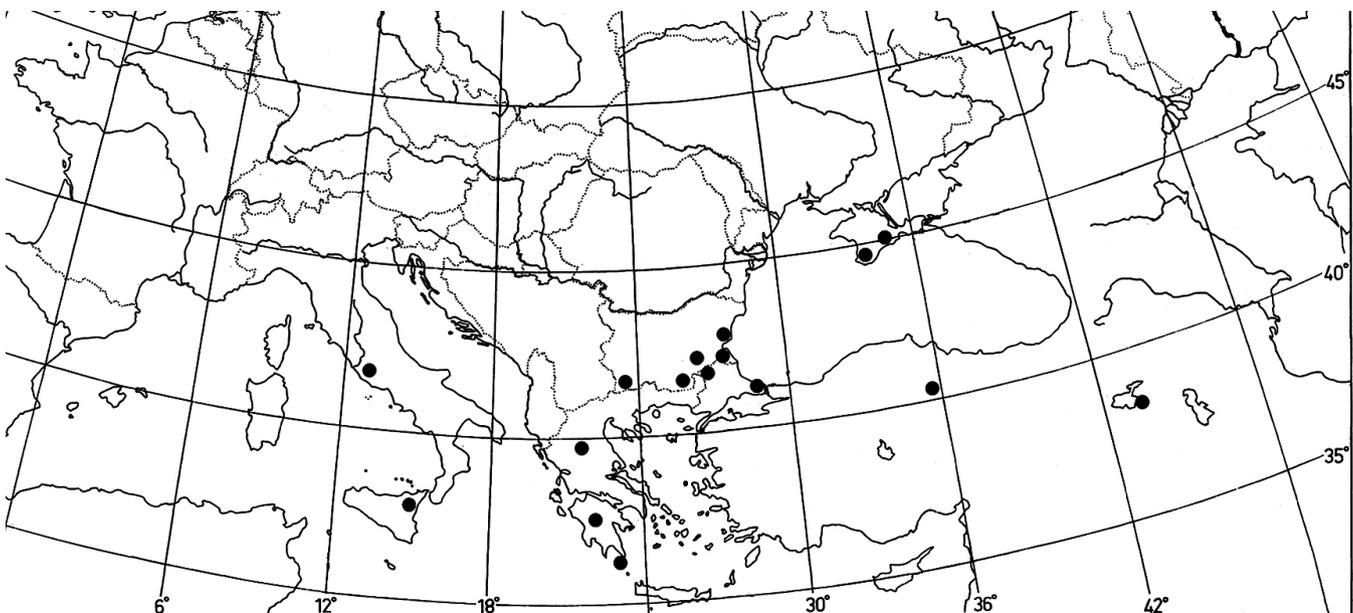


Fig. 5. Distribution area of *Vicia incisa*.

Conservation status in world: *Vicia incisa* is currently not evaluated at world level (see IUCN 2017). However, we here prefer to avoid a proposal about the assessment of a category risk. In fact further taxonomic investigations need to clarify the taxonomic position of some related taxa which were described as varieties of *V. barbazitae* and *V. grandiflora* (an ongoing research work by the authors is in progress). In addition to Italy, we traced the assessment of *V. incisa* in Bulgaria only, where it is evaluated as Endangered using the criteria B1b(i,iii,iv)c(i,ii,iv)+2a(i,ii), and D (Peev 2015).

Specimina Visa Selecta: CRIMEA. ex *Tauria meridionalis*, 1816, *C. Steven von s.n.* (LE!, lectotype of *Vicia incisa*). ITALY. Lazio, Albano, secus li riformati di Castel Gandolfo, s.d. (XIX century), *E. Fiorini-Mazzanti s.n.* (RO-15724!); Lazio, Albano, May 1827, *E. Mauri s.n.* (RO-HR-15720!); Lazio, Albano, May 1829, *P. Sanguinetti s.n.* (RO-HR-15722!); Lazio, Albano, May 1832, *D. Woods s.n.* (RO-HR-15723!); Lazio, Albano nella via che dai Cappuccini conduce a Castel Gandolfo, May 1853, *E. Fiorini-Mazzanti s.n.* (RO-HR-15721!); Lazio, Albano nel bosco di Villa Doria, May 1854, *E. Rolli s.n.* (RO-HR-15719!); Lazio, sopra Albano (Castelli Romani), 25 April 1982, *P. Bassani & Castellacci s.n.* (RO-HR!); Lazio, Albano (Castelli Romani), Miralago, 29 April 1982, leg. *Bassani & Castellacci det. B. Anzalone s.n.* (RO-HA-25348!, epitype of *Vicia pimpinelloides*); *ibidem* (RO-HA-25349!, isoeptypus); *ibidem* (RO-HA-25350!, isoeptypus); Lazio, sopra Albano (Castelli Romani), June 1982, *Castellacci s.n.* (RO-HA-25353!); Lazio, Albano (bosco verso Miralago), 13 June 1982, *B. Anzalone s.n.* (RO-HA-25354!); Lazio, Albano, June 1983, *B. Anzalone s.n.* (RO-HA-25352!); Lazio, Albano (Roma), 13 June 1983, *B. Anzalone s.n.* (RO-HA-25351!). Sicily, Castiglione di Sicilia (Catania), strada Castiglione-Verzella in prossimità del bivio per Solicchiata, in frammento boschivo a querce caducifoglie, 460 m a.s.l., 30 May 1995, *A. Cristaudo s.n.* (CAT!); *ibidem*, 01 May 2001, *A. Cristaudo & I. Margani s.n.* (CAT!). TURKEY. Buyuk... prope Scutari [Üsküdar], 22 May 1864, *R. du Parquet & A. Coumany s.n.* (P-03581753!).

CONCLUSIONS

The results obtained in the present study, together with available molecular data (see e.g., Potokina et al., 2002), allowed to assess that the correct taxonomic rank for the taxon, which was mostly considered as subspecies of *Vicia sativa*, is the species.

Vicia incisa is morphologically distinct from the other members belonging to the *V. sativa* group, while related species are *V. barbazitae*, *V. grandiflora* and *V. sepium*. The

latter taxon is currently accepted as included in the sect. *Atossa*. On the other hand, the placement of *V. barbazitae*, *V. grandiflora*, and *V. incisa* at section level remains still unresolved. The chemical and molecular data showed that these latter three species form a well supported clade which is separated from that including *V. sativa s.lat.* (see e.g., Wouw et al., 2001; Jaaska, 2015). In contrast, the current classification reports all these species under the Sect. *Vicia* (see e.g., Kupicha, 1976; Maxted, 1993; Leht, 2009). Our morphometric analyses pointed out a morphological similarity among *V. incisa*, *V. barbazitae*, *V. grandiflora* and *V. sepium* so supporting the chemical and molecular data. However, further morphometric investigations should be performed to other taxa, such as *V. balansae* Boiss., *V. oroboides* Wulf., *V. truncatula* Fisch. ex M.Bieb. (sometimes placed in the sect. *Atossa*), *V. qatmensis* Gomb. (related to *V. grandiflora* from the molecular point of view; see e.g., Jaaska, 2008). A future study could have the final aim to clarify the number of species which should be included in the sect. *Atossa* and to define the diagnostic characters between this section and the sect. *Vicia*.

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