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„Phenotypic and Biogeographic insights into the evolution of *Vicia* and *Lens* in Southwest Asia"

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And in the end, I dedicate my dissertation work to students who dare to immigrate and study in another country! Education and full-time work for financial support without any other support is not easy! The COVID-19 pandemic was dark, but this darkness provided time for me to finish my work and taught me that in the back of any disappointment, one could find hope too!

ABSTRACT

Plant and animal domestication are the foundational events of human civilization. Domestication, as an evolutionary process makes survival and reproduction of domesticates dependent on humans. Wild plants undergo phenotypic changes during this process. Fabae is a group of plants that were repeatedly domesticated in South-west Asia. One of the most important shared domestication traits in crop species, notably in the Fabaceae, is the increase in seed size and change in seed shape. In this thesis, we aimed at reconstructing the morphospace of phenotypic traits of Fabae seeds; we looked at seeds from wild, wild relatives of domesticates, domesticates, and attempted domesticates from herbaria and seeds from cultivation (from the genera *Vicia* and *Lens*).

X-Ray Computed Tomography (HRXCT) studies offer new possibilities in terms of investigation and improvement of our knowledge of morphological features. Using this method, we did not inflict any damage to the seeds, which makes it the safest way to use the seeds collected from herbaria. We used the software Amira and ImageJ (package MorphoLibJ) to quantify seed size and shape. Seed shape and seed size were analysed in a morphospace approach to test if a wild ancestor and its derived, domesticated descendants cluster together. The study showed that domestication leads to the occupation of novel portions of the morphospace in domesticates.

Another crucial piece of knowledge that helps us understand the domestication process is the ecological and geographical occurrence related to the divergence of wild relatives in this process. We analysed the geographic distribution of the Old World representatives of *Vicia* and *Lens* at an evolutionary scale (time and space). We conducted a phylogenetic analysis based on six chloroplast regions (total 5616 base pairs from 161 accessions) to estimate the diversification times among taxa. The molecular dating analyses suggest that the genus *Vicia* is paraphyletic and *Lens* monophyletic. Fabaeae probably originated at the start of Miocene, 24 Mya, and probably started to diversify around 18 Mya. Diversification appears to have happened in several waves during the middle Miocene. The estimation of ancestral ranges suggests that the most recent common ancestor (MRCA) of Old World *Vicia* and *Lens* likely occurred in the Irano-Turanian region.

Keywords: Domestication, Fabaceae, *Lens* and *Vicia*, X-Ray Computed Tomography, Ancestral area reconstruction, historical biogeography, phylogeny.

ZUSAMENFASSUNG

Die Domestizierung von Pflanzen und Tieren sind die Grundsteine menschlicher Zivilisationen. Domestizierung als evolutionärer Prozess macht das Überleben und die Reproduktion domestizierter Arten vom Menschen abhängig. Wilde Pflanzen erfahren während dieses Prozesses phänotypische Veränderungen. Fabae ist eine Gruppe von Pflanzen, die wiederholt in Südwestasien domestiziert wurden. Einer von die wichtigsten gemeinsamen Domestizierungsmerkmalen bei Kulturpflanzenarten, insbesondere bei den Fabaceae ist die Zunahme der Samengröße und die Veränderung der Samenform. In dieser Arbeit wollten wir den Morphospace von Fabae-Samen rekonstruieren; wir haben uns Samen von wilden Arten angesehen, wilde Verwandte von domestizierten Aren, Domestizierte und Domestikationsversuche aus Herbarien (aus den Gattungen *Vicia* und *Lens*).

Röntgen-Computertomographie (HRXCT) -Studien bieten neue Möglichkeiten in Untersuchungen morphologischer Merkmale. Bei dieser Methode bleiben Samen unversehrt, was die Verwendung der Samen aus Herbarien erleichtert. Wir haben zur Quantifizierung der Samengröße und -form die Software Amira und ImageJ verwendet (Paket MorphoLibJ). Samenform und die Samengröße wurden in einem Morphospace-Ansatz analysiert, um zu testen, ob sich die Nachkommenschaft domestizierter Arten gruppieren. Die Studie zeigte, dass die Domestizierung zur Besetzung neuer Regionen im Morphospace führt.

Ein weiteres wichtiges Element, das uns hilft, den Domestizierungsprozess zu verstehen, ist das ökologische und geografische Vorkommen im Zusammenhang mit der Divergenz wilder Verwandter in diesem Prozess. Wir analysierten die geografische Verteilung der Vertreter der Alten Welt von Vicia und Lens auf einer evolutionären Skala (Zeit und Raum). Wir haben eine phylogenetische Analyse basierend auf sechs Chloroplastenregionen (insgesamt 5616 Zeichen aus 161 Akzessionen) organisiert, um die Diversifikationstermine zwischen Taxa abzuschätzen. Unsere molekularen Datierungsanalysen legen nahe, dass die Gattung *Vicia* paraphyletisch und *Lens* monophyletisch ist. Fabeae entstand wahrscheinlich zu Beginn des Miozäns, 24 Mya, und begann wahrscheinlich um 18 Mya zu diversifizieren. Die Diversifizierung scheint im mittleren Miozän mehrmals vorgekommen zu sein. Die Schätzung der Ahnenbereiche legt nahe, dass der letzte gemeinsame Vorfahre (MRCA) der Alten Welt Vicia und Lens wahrscheinlich in der iranisch-turanischen Region aufgetreten.

Schlüsselwörter: Domestizierung, Fabaceae, Linse und Vicia, Röntgen berechnet Tomographie, Rekonstruktion des Ahnengebiets, historische Biogeographie, Phylogenie.

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CHAPTER 1

1 INTRODUCTION

1.1 The evolutionary importance of morphological traits in plants

Morphological trait-based analyses of form and anatomy in highly diversified species assemblages are crucial for improving our understanding of evolutionary processes (Carroll, 2001). Comparing the morphological characteristics of living organisms has been very important since long ago (Bookstein, 1998). Such comparisons have progressed together with improvements in statistical analysis methods (Fisher, 1935; Hotelling, 1933; Pearson, 1895). The evolution of biological science from a descriptive field to a quantitative science took place at the beginning of the twentieth century; this change, called the "Quantification Revolution" by (Bookstein, 1998), led to the focus of morphological investigation on quantifiable and computable traits the values of which can be compared among groups.

One of the most critical events in human history during the past 13,000 was the transition from foraging and hunting to farming and herding (Diamond, 2002). The domestication of plants and animals provides most of our food today, it was a prerequisite for the rise of civilization, and it transformed global demography (Diamond, 2002). Given the significant consequences of this transition (Diamond, 1997), it is not surprising that the origin and expansion of domesticates and the emergence of agriculture remain the subject of enduring interest for the scientific community (Zeder, 2008). The process of genetic modification of wild plants and animals that led to a change in domestic and cultivated forms is called domestication and is carried out according to people's interests (Fuller et al., 2007). The morphological, behavioural, and later genetic changes due to domestication became an integral part of the concept of plant and animal domestication following Charles Darwin's publication "The Variation of Animals and Plants under Domestication" in 1868. Whereas biologists tend to think of domestication as a dynamic process, historians and archaeologists tend to consider it as an event that happened in the past (Denham et al., 2009). In this thesis, the focus is on plant domestication. Whereas domestication involves a genetic state, cultivation is associated with an activity (Fuller et al., 2007). Cultivation refers to the growing of domesticated crops for food and other targets, but its meaning has been expanded to include, in addition to tillage, different activities that are linked to plant growth, like planting, sowing, harvesting, and irrigation (Denham et al., 2009). "The different sets of characters between domesticated plants and their wild relatives constitute the domestication syndrome" (Harlan,

1973). The domestication syndrome differs among crops. Its characters can be related to various aspects of cultivation and aspects concerning their development (Fuller, 2008); pulses and cereals, for example, were domesticated in a different way compared to fruit trees and other plants. Elimination or reduction of natural seed dispersal, for example, non-dehiscent pods in pulses, is one of the most significant domestication features in pulses; its equivalent in cereals is the non-shattering rachis. This feature allows the plant to retain seeds after maturation so that it can be harvested by farmers (Fuller and Colledge, 2007; Zohary et al., 2000). Plants have different structures that support seed dispersal, like hair, awns, and even the shape of the spikelet in grasses. Therefore, in domesticated forms, these structures tend to be greatly reduced. It can be assumed that this is due to the elimination of the natural selection for effective spread (Fuller and Colledge, 2007). There is also a tendency for domesticates to have increased seed/fruit size**;** investigation of species of the same family have shown that larger seeds germinate faster and are more productive than smaller seeds (Fuller and Colledge, 2007; Kluyver et al., 2013). Wild seeds require some circumstances such as temperature, day-length, or seed coat breaking in order to germinate; these conditions are not present in cultivation. Therefore, in domesticates, germination deterrence is often lost, making plants suitable for cultivation (Ruiz et al., 2013). Loss of germination deterrence is easily selected by planting the crop because the seeds not germinating easily will not be part of the next harvest and thenceforth not be part of the next planting. Similarly, synchronous germination and ripening will also be driven by cultivation, because planting at one time and harvesting at once will favour plants that grow synchronously (Fuller and Allaby, 2009). Finally, more compact growth habits make plants better adapted to grow in stands in tilled fields and easier to harvest; for example, plants with self-standing habits are easier to harvest compared to plants with climbing habits (Fuller and Colledge, 2007).

1.2 The Origins of Agriculture

Publications of molecular and archaeological investigation in the past years indicate that agriculture began over a much larger area of the world than once thought. Vavilov, in 1935 compiled and collected together all previous work about centers of crop origins and diversity (Table 1). He identified eight main centers of origin; see Figure 1 (Hummer and Hancock, 2015; Damania et al., 1997). Currently, 11 regions of the Old and New World are considered centers of origin of agriculture; these regions are distributed across different continents and contain a diverse range of plant and animal taxa (Preece et al., 2015). These centers have been hypothesized to require the presence of large, docile mammals living in herds with a dominance hierarchy, and

annual plants with large, nutritious seeds (Diamond, 2002) Conversely, within a plant genus, it is therefore expected that species with larger seeds are more likely to be domesticated.

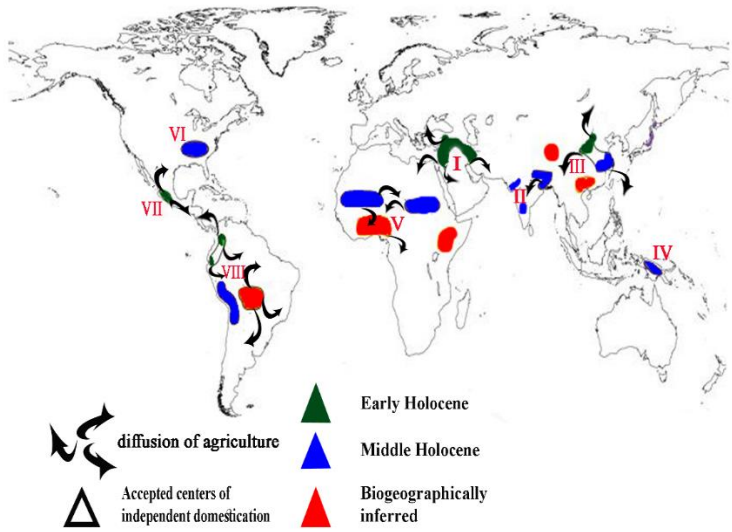


Figure 1 Centers of domestication plants and animals (I-VIII). Black arrows show the migration of domesticated species from the main regions where they originated to other regions. Green and blue areas are, respectively, where the domestication process happened during the end of the Pleistocene to the start of the Holocene (12,000–8,200 B.P.), and during the mid- Holocene (8,200–4,200 B.P.). Red regions represent areas in which current evidence for domestication is inferred involving habitat of domestic forms, indigenous to these regions found outside their native distributions (Fuller et al., 2014).

Table 1 The listing of regions where, and which, key plants and animals were domesticated (Larson et al., 2014)

centers of crop origins	Plant and animals domesticated	Reference
Southwest Asia	*Triticum* spp. (wheats), *Hordeum vulgare* (barley), *Lens culinaris* (lentil), *Pisum sativum* (pea), *Cicer arietinum* (chickpea), *Vicia faba* (broadbean), Linum usitatissimum (flax), *Ovisaries* (sheep), *Capra hircus* (goat), *Bos taurus* (taurine cattle), *Sus scrofa* (pig), *Felis domesticus* (cat)	(Asouti and Fuller, 2013), (Willcox, 2004)
South Asia	*Bubalus bubalis* (water buffalo), *Gallus gallus* (chicken), *Panicum sumatrense* (little millet), *Sesamum indicum* (sesame), *Vigna mungo* (urd bean), *Macrotyloma uniflorum* (horsegram), *Vigna radiata* (mungbean), *Cucumis melo* (melon)	(Fuller, 2011) (Fuller, 2006)
East Asia	*Panicum miliaceum* (broomcorn millet), *Setaria italica* (foxtail millet), *Glycine max* (soybean), *Cannabis sativa* (hemp), *Prunus persica* (peach), *Armeniaca vulgaris* (apricot), *Sus scrofa* (pig)	(Fuller, 2011b)
New Guinea	*Musa acuminata* (banana), *Colocasia esculenta* (taro), *Alocasia macrorrhiza* (giant taro), *Artocarpus altilis* (breadfruit), *Dioscorea* spp. (yams), *Metroxylon sagu* (sago), *Saccharum officinarum* (sugarcane)	(Lebot, 1999)
Africa & S Arabia	*Pennisetum glaucum* (pearl millet), *Digitatia exilis* (fonio), *Sorghum bicolor* (sorghum), *Lablab purpureus* (hyacinth bean) , *Hibiscus sabdariffa* (roselle), *Elaeis guineensis* (oil palm), *Bos taurus taurus* (taurine cattle), *Equus asinus* (Donkey), *Camelus dromedaries* (Dromedary camel), *Numida meleagris* (Guinea fowl)	(Fuller et al., 2013), (Harlan, 1992)

North America	squash *Cucurbita pepo* ssp. *oviferavar. ovifera* (squash), *Helianthus anuus* (sunflower), *Chenopodium berlanderi* (pitseed goosefoot), *Iva annua* (marshelder)	(Smith et al., 2007)
Meso-America	*Zea mays* (maize), *Phaseolus vulgaris* (common bean), *Phaseolus lunatus* (sieva lima bean), *Cucurbita pepo* ssp. *pepo , C. argyrosperma* (squashes), *Persea americana* (avocado), *Capsicum annuum* (chili pepper), *Leucaena esculenta* (Guaje tree bean), *Spondias mombin* (hogplum), *Pachyrhizus erosus* (jicama), *Sechium edule* (chayote)	(Bruce D Smith, 2006)
South America	*Cucurbita moschata* (squash), *Calathea allouia* (leren), *Canna edulis* (achira), *Xanthosoma sagittifolium* (cocoyam), *Ipomoea batatas* (sweet potato), *Bactris gasipaes* (peach palm), *Capsicum baccatum*, *Capsicum chinense* (chilis), *Cavia porcellus* (guinea pig), *Lama glama* (llama), *Vicugna pacos* (alpaca)	(Picanço-Rodrigues et al., 2010)

One of the most important centers of domestication, and the earliest is the 'Fertile Crescent,' an area of south-west Asia consisting of the flatlands of the Tigris, Euphrates and Jordan rivers and their hilly banks (Brown et al., 2009). In this area, crop domestication is estimated to have originated during the Pre-Pottery Neolithic (Table 2), around 11,500–11,000cal Before Present (BP); this area is the focus of this thesis. Eight species are considered as the founder crops of the Fertile Crescent (Weiss and Zohary, 2011), as follows: *Triticum monococcum* (diploid einkorn wheat), *T. dicoccum* (tetraploid emmer wheat), *Hordeum vulgare* (barley), *Lens culinaris* (lentil), *Pisum sativum* (pea), *Linum usitatissimum* (flax), *Vicia ervilia* (bitter vetch) and *Cicer arietinum* (chickpea) (Fuller et al., 2012).

Table 2 Overview of south-west Asian late Epipalaeolithic–early Neolithic chronological framework and associated key developments economies (Asouti and Fuller, 2012; Morris and Cohen, 2011)

Chrono-cultural horizons	Dates BP Cal	subsistence economies
Late Epipalaeolithic	~ 14,900- 11,750	Hunting-gathering
Pre-pottery Neolithic A (PPNA)	~ 12,175–11,000	Hunting-gathering, pre-domestication cultivation
Early Neolithic PPNB	~ 10,950– 10,300	Hunting-gathering,herding, Pre-domestication, mixed with cultivation, the first emergence of domesticated crop
Middle Neolithic PPNB	~ 10,150–9725	Various subsistence patterns
Late Neolithic PPNB	~ 9050–8450	Agro-pastoral economies based on cereals, pulses, and herding, the accomplishment of the plant domestication process

1.3 Legumes Seeds & Their Importance

Legume crops like lentils, beans, peas, and chickpeas have numerous useful properties; they are one of the major sources of plant-based proteins for humans and provide valuable ecosystem services: they can grow as cover crops to fix atmospheric nitrogen in soils through symbiosis with the root bacterium *Rhizobium*. Fabaceae are one of the most economically important plant families (Gwilym, 2006; Yahara et al., 2013). Seeds of legumes have very characteristic features: the seeds contain the mature embryo, which in most legumes consists of two cotyledons and a hypocotyl with plumula and radicula. The endosperm is reduced, and the nutrients are transferred to the cotyledons. Outside the seed coat, the pod (i.e. the typical legume fruit) has a protective role against environmental extremes and often plays a role in seed dispersal (Smýkal et al., 2014). Seed changes during legume domestication include: non-shattering pods (which makes seeds easier to harvest), loss of seed dormancy, large seeds - domesticated bean seeds are 5-8 times larger than their wild relatives, absence or lower levels of toxic substances, increased protein, oil, and sugar concentrations, which means improved nutritional value, flavour, and storage ability (Fuller et al., 2014). Research on legume seeds has led to the improvement of our knowledge of evolution and domestication and provides a reliable food source for the next generations.

1.4 Domesticates of Fabae in the Fertile Crescent

The Fabaceae is the third-largest angiosperm family, after Asteraceae and Orchidaceae, with close to 770 genera and more than 19,500 species (Azani et al., 2017; Gomes et al., 2018). Fabaceae are divided into six subfamilies of which Papilionoideae with 445 genera and 14,000 species is the largest one (Azani et al., 2017).

The *Fabae* tribe of the Papilionoideae contains five genera, *Vicia L*. (c. 216 species); *Lathyrus* L. (c. 150 species) (Kupicha, 1977), *Lens Medik*. (c. 4–8 species) (Schaefer et al., 2012), *Pisum L*. with perhaps two species and several subspecies (Schaefer et al., 2012), and the genus *Vavilovia Al.Fed*. with one or two species (Schaefer et al., 2012). The vetches (*Vicia L.)* are of considerable economic importance, the species *V. faba* (broad bean, horse bean), together with the lentil, the pea, and the chickpea, belong to the earliest domesticates of the Old World, and are important components of the food plant complexes of the late Neolithic in the Near East (Caracuta et al., 2016; Hanelt and Mettin, 1989). At least 7 domestication events occurred within this tribe, which is a very high density of otherwise extremely rare events (Zohary et al., 2012). We focussed

on *Lens* and *Vicia*: three domestication events occurred in *Vicia* (*Vicia faba, Vicia ervilia*, and *Vicia sativa)* and one domestication event in *Lens* (*Lens culinaris).*

1.4.1 *Vicia faba;* Characteristics, Distribution, and Archeological Evidence

The faba bean, *Vicia Faba*, is one of the most widespread grain legumes in the temperate regions of the Old and the New World. It was a valuable animal feed in Asia and Europe. *V. faba* has large seeds with high (between 2-25%) protein value. It grows well in both warm, summer-dry Mediterranean environments (Zohary et al., 2000), and higher north in the more temperate parts of Europe and Asia (Stoddard and Bond, 1987). Under domestication, morphological differentiation and environmental adaptation have occurred in the faba bean, including various morphological traits such as vegetative habit, pod structure, pod shattering, and the shape, colour, and size of the seed.

Differentiating the faba crops in archaeological remains from the other vetches is difficult, for example, because of the similarity of *V. faba* both in shape and size with *Vicia narbonesis*; moreover, charring usually destroyed the seed coats, making the identification unreliable when only a few seeds are found. The wild ancestor of the domesticated faba bean has not yet been found and is possibly extinct. However, charred remains of wild-collected faba beans have been identified in the prehistoric (Natufian, ~15,000–13,500 cal BP) site of el-Wad Terrace (EWT), Mount Carmel, Israel (Caracuta et al., 2016). The other important sites where *V. faba* seeds have been discovered in the south-west Asia are listed in (Table 3).

Table 3 The important archeological sites of *Vicia faba*

Site Name	Date cal BP	Location	Reference
Iraq ed-Dubb	~ 13,150-11,250	Jordan	(Colledge, 2001)
Djade el Mughara	~ 10,700-10,400	Syria	(George Willcox, Fornite, and Herveux 2008)
Tell el-Kerkh	~ 10,600-10,250	Syria	(Tanno and Willcox 2006)

1.4.2 *Vicia ervilia;* Characteristics, Distribution, and Archeological Evidence

The bitter vetch, *Vicia ervilia,* is a fodder crop and cover plant and is one of the Near Eastern founder crops (Minimis, 2015; Zohary et al., 2000). The name refers to the bitter and toxic seeds (Miller, 2002; Van Zeist, 1988). According to Roman literature, this vetch in classical times was not common in the daily diet and was only eaten by poor people during famine. Pliny the Elder (Pliny, 1855) in his Natural History listed the bitter vetch as a plant with medicinal properties that healed Emperor Augustus.*V. ervilia* was grown in West Asia, South Europe, and Northern Africa (Shahal Abbo, 2015); today it is mostly grown as a forage crop in Mediterranean-type climates

(Minimis, 2014). *Vicia ervilia* wild forms, grow in primary habitats, are known from Anatolia, Armenia, northern Iraq, the Anti-Lebanon, and the Jebel Druz (Syria). The seed pods are beaded, and they have roughly tetrahedral seeds. The wild ancestry of the domesticated bitter vetch has been identified (Ladizinsky and Van Oss, 1984). The wild and domesticated plants have significant morphological similarities, but wild forms have dehiscent pods and smaller seeds. Domesticated bitter vetch are defined by rapid germination, loss of seed dormancy and non-shattering pods and their growth habit is compact (Bohrer, 1972). In the domesticate, toxic amino acids and canavanine reach only low concentrations (Minimis, 2014). The seeds are high in protein (20-27 percent) and valued as fodder for animals. According to Zohary, "dehiscent pods and slightly smaller seeds" (Zohary et al., 2012) are the characteristics of wild species. Changes in seed size can be used to identify its domestication. The following *(*Table 4*)* lists some of the archeological sites where *V. ervilia* was discovered. The following *(*Table 4*)* lists some of the archeological sites where *V. ervilia* was discovered in the south-west Asia.

Table 4 Important archeological sites of *Vicia ervilia*

Site Name	Date cal BP	Location	Reference
Kebara Cave	~ 65,000-48,000	Israel	(Lev et al., 2005)
Tell Abu Hureyra	~ 13,400-11,3500	Syria	(Hillman, 1975)
Mureybit	~ 11,800- 11,300	Syria	(Zohary et al., 2012)
Jerf el-ahmar	~11,500-11,000	Syria	(Willcox, 2002)
Djade el Mughara	~10,700-10,400	Syria	(George Willcox, Fornite, and Herveux, 2008)

1.4.3 *Vicia sativa;* Characteristics, Distribution, and Archeological Evidence

The common vetch is a member of the *V. sativa* aggregate; it is an economically important fodder crop. According to Caballero et al. (1995), the common vetch is a crop with many uses, such as: forage meal, dry forage, green forage, or for haylage and silage. The diversity in common vetch is high, and it has wild forms, weeds, and cultivars. The *V. sativa* aggregate seems most likely to have originated in Southwest Asian, southern European or Mediterranean grain agriculture (Potokina et al., 2002). *V.sativa* is characterized by an ascending growth habit and rounded, somewhat compressed, smooth seeds (Zohary et al., 2000). The cultivated forms of *V. sativa* grow together with morphologically closely related wild forms; it is therefore difficult to distinguish from archaeological remains whether these are from a domesticated form or from wild weedy contaminant (Potokina et al., 2002). The wild progenitor of *V. sativa* was established as well

(Zohary et al., 2000). *V. sativa*, charred seeds have been found from several Neolithic and Bronze Age sites in south-west Asia and Europe.

The following *(*Table 5*)* lists some of the archeological sites where *V. ervilia* was discovered in the south-west Asia.

Table 5 The important archeological sites of *Vivia ervilia*

Site Name	Date cal BP	Location	Reference
Tel Abu Hureyra	~ 11,200-10,700 ~ 9500-8500	Syria	(Hillman, 1975)
Can Hasan III	~ 8500	Syria	(French, 1972)

1.4.4 *Lens culinaris;* Characteristics, Distribution, and Archeological Evidence

The lentil was a part of the everyday diet of foragers at the end of the last Ice Age in Europe and the early of Holocene (12,000–9,000 BP) and became associated with the beginning of the 'agricultural revolution' in the Old World (Watkins, 2017). The lentil is one of the very first arable crops with a source of abundant proteins, it is economically important and has been used for various purposes for many years for human consumption, animal fodder, and green manure. It is the most widespread and most cultivated annual legume crop (Ljuština and Mikiae, 2010). Zohary (2000) states that "Geographically, the genus *Lens* is a Mediterranean, south-western, and central Asian element and it can grow from the Atlantic coast of Spain and Morocco in the west to the Indian subcontinent in the east". *Lens* is known as an independent genus, but in the past, it was included in the genus *Ervurm* (Ladizinsky and Hebrew, 1979). They are mainly interfertile with morphological change occurring in their vegetative and reproductive parts. The wild progenitor of the domesticated *Lens culinaris subsp.culinaris* is *Lens culinaris subsp orientalis* (Zohary et al., 2000). Domesticated *Lens* are categorized into two groups of seed sizes: (i) small-seeded (3-6mm) lentils named *subsp. microsperma*, with small pods and (ii) large-seeded (6-9mm) lentils (*subsp. macrosperma*), with larger pods. The other morphological traits which changed during domestication are the seeds pod (pod non-shattering) and a slow increase in seed size (Zohary et al., 2000; Bhartiya et al., 2015).

Together with emmer wheat (*Triticum dicoccum*), einkorn wheat (*Triticum monococcum*), and barley (*Hordeum vulgare*), the lentil is a founder crop of the Old World agriculture. Wild lentil remains were found ca. 50,000-60,000 BP in the Kebara Cave, Mt. Carmel (Lev et al., 2005).

Ohalo II is another site where wild lentils were found and dated to the Upper Palaeolithic, ca. 23,000 cal (Zohary et al., 2000). Important archeological sites are listed in (Table 6).

Table 6 The important archeological sites of *Lens culinaris*

Site Name	Date cal BP	Location	Reference
Tell Abu Hureyra	~ 13,400-11,3500	Syria	(Hillman, 1975)
Mureybit	~ 11,800-11,300	Syria	(Zohary et al., 2012)
Djade el Mughara	~10,700-10,400	Syria	(George et al., 2008)
Netiv Hagdud	~11,300-11,100	Israel	(Zohary et al., 2012)
AtYiftah-el	~8,800	Israel	(George Willcox, Fornite, and Herveux 2008)
Tepe Sabz	~7,500–7,000	Iran	(Zohary et al., 2012)

1.5 Aim and Hypothesis

One of the common domestication traits in dicotyledons, especially in the Fabaceae, is an increase in seed size, together with fast and uniform germination (Zohary, 2016; Fuller and Allaby, 2009). In this thesis, we aim to reconstruct the morphospace of seeds of the two legume genera *Vicia* and *Lens*, including both wild and domesticated forms. Computed Tomography (CT) is very useful for scanning heterogeneous and complex structures and analyse the data via highly efficient imaging techniques (Bertrand et al., 2012; Cnudde and Boone, 2013). We also test the hypothesis that the wild relatives of domesticates have larger seeds than non-domesticated species, and also if domesticates occupy entirely new portions of the seed morphospace.

2 MATERIAL AND METHODS

2.1 Data collection

For our research purposes, we looked at both modern *Vicia* and *Lens* seeds from the Herbarium of Vienna in wild but not domesticated species, wild relatives of domesticated species, and domesticates, together with seeds of modern domesticates from the bazaar. We checked all the names of our species against the plant list (http://www.theplantlist.org/) and the World Flora Online (http://www.plantsoftheworldonline.org/) in order to find the accepted Latin name for all our species and compare them with synonyms.

2.1.1 *Vicia* and *Lens* seeds sampling from Herbarium of the Natural History Museum in Vienna (W)

We sampled *Vicia* seeds from (W), from 66 of the 85 species (128 Herbarium sheets) that grow in the Fertile Crescent and neighbouring regions that were also included in the phylogeny of the Fabeae by Schaeffer et al., (2012). We collected a total of 513 individual seeds for *Vicia*, 494 of which we used for all analyses (Table 7). We sampled from five of the six species of *Lens* (45 Herbarium sheets) a total 172 individual seeds (Table 8). During seed sampling in the herbarium (W), we documented all the sheets' information and took pictures of the sheets (Supplementary.5.1 & 5 2).

2.1.2 *Vicia* and *Lens* seeds sampling from the Market

A total of 162 *Vicia* seeds (90 seeds of *V. faba*, 36 seeds of *V. ervilia*, 36 seeds of *V. sativa*) and 58 individual *Lens* seeds in the domesticated form bought from the bazaar were used as a comparison with herbarium seeds (Table 7,8).

Table 7 Sampling overview for *Vicia*

Taxon	Type of the seeds	seeds obtained from	sum of obtained seeds
Vicia faba *Vicia sativa* *Vicia ervilia*	Domesticate	Market (90) Market (36) Market (36)	162
Vicia narbonesis *Vicia pregerina*	Attempted domesticate	Herbarium (14) Herbarium (12)	26
Vicia faba *Vicia sativa* *Vicia ervilia*	Wild relatives	- Herbarium (15) Herbarium (10)	35
Vicia sp (64 species)	Wild	Herbarium (433)	433
Total of *Vicia* seeds obtained			656

Table 8 Sampling overview for *Lens*

Taxon	Type of the seeds	seeds obtained from	sum of obtained seeds
Lens culinaris ssp. culinaris	Domesticate	Market (58) Herbarium (11)	69
Lenes nigricans	Attempted domesticate	Herbarium (55)	55
Lens culinaris ssp. orientalis	Wild relatives	Herbarium (36)	36
Lens sp (5 species)	Wild	Herbarium (96)	96
Total of Vicia seeds obtained			229

2.2 Sample preparation & Scanning

The seeds were mounted in styrofoam pieces that were cut into small cylinders, which were themselves mounted inside plastic syringes (one such load of seeds constituting a batch). This was done to ensure that samples don't touch each other or move during scanning. A MicroXTC-200 imaging system (Zeiss microscopy, Pleasanton, CA, USA) with a L9421-02 90

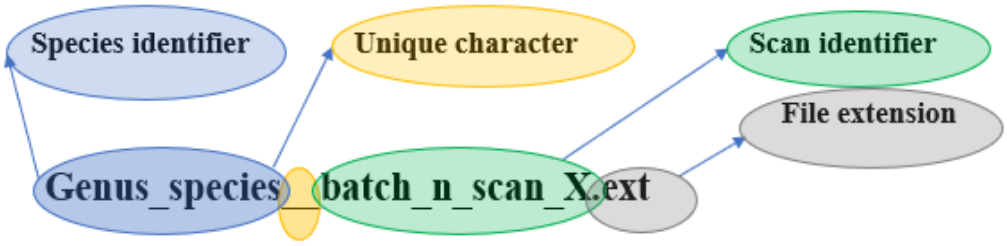


Figure 2 File naming strategy, the arrows show the parts of the file names

kV Microfocus X-ray source (Hamamatsu Photonics, Iwata City, Japan) was used to perform scanning. To stabilize the sample on the mounting table of the CT scanner, the batch was glued on the top of a small aluminium tube using tape. Samples were continuously spun 360 degrees during data acquisition with exposure times of 5-15 s. The scanning conditions depended on the number of seeds and their size and took 20-30 hours for each batch. After scanning, tomographic reconstruction (generation of 3D volumes from 2D images) was computed with the software XMReconstructor (8.1.6599 by XRadia Inc.). The 3D datasets were saved as series of images of sections through the sample. The AMIRA 5.4.1 software package (Visualization Sciences Group) was used to read the DICOM files. Files were named as in Figure 2.

2.3 Image processing

An image processing pipeline, which is an effective method for automated evaluation, was used in order to measure the morphological properties of the seeds of *Vicia* and *Lens*.

2.3.1 Fiji (image J)

Fiji is an image processing package, distributed by ImageJ (ImageJ is open-source software and a very powerful image analysis package); Fiji is a cluster of many plugins that smooth the way for scientific image analysis. The base of ImageJ is a JAVA program which allows the analysis of the 3D object in picture stacks. We used a plugin of Fiji (ImageJ) called

MorphoLibJ (https://imagej.net/MorphoLibJ). MorphoLibJ is a set of mathematical morphology methods, and plugins for ImageJ made at INRA-IJPB Modelling and Digital Imaging lab. The library put into effect various practical tools that were lacking in ImageJ. The output of our analyses is a list of the total number of objects and their individual dimensions in voxels. For processing, a macro in ImageJ script (simplified javascript) was written. By programming an ImageJ Macro, the workload was radically reduced by automating a sequence of commands (less clicking). Each image stack was imported individually in ImageJ. The images below show the process of image analysis (Figure 3). ImageJ script includes the following commands: (i) The imaging process begins with choosing 8-bit grayscale (byte) and (ii) the window was moved through the dataset at coordinates where the seeds would be included. (iii) Run the brightness to have better contrast and (iv) then conversion to a mask provides a dark background for the image, and converts the image into a binary picture with only black or white pixels. (v) Running "Invert"," Erode"," Dilate","Fill Holes", then again "Erode" and "Invert", these series of commands allow to smoothen the seeds and eliminate artefacts and fill holes in the seeds. (vii) Running connected components labelling, allows to give connected components an identity (a label), thereby the seed's images are labelled. (viii) MorphoLibJ can, among other functions, model the best fitting ellipsoid on the seeds.

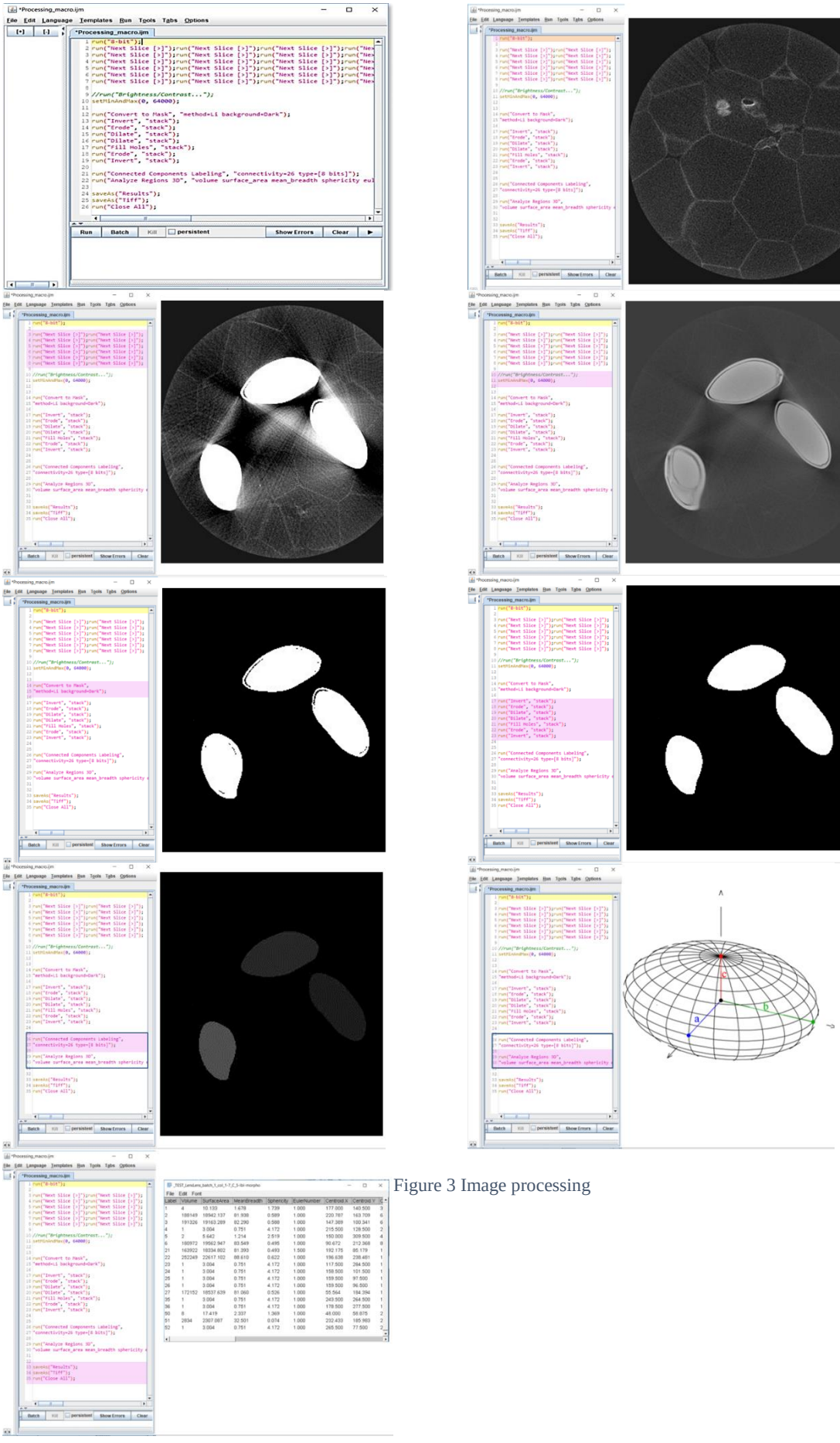


Figure 3 Image processing

In the last step of the image processing, the data were exported as ".CSV" files. After which we performed:

1. manual cleaning of the artefacts (smaller volumes)
2. Manual check of data quality (Euler number)

The Euler number is a measure of 3D object complexity. Filled ellipsoids or spheres display Euler number of 1.

2.3.2 Concatenation in Powershell

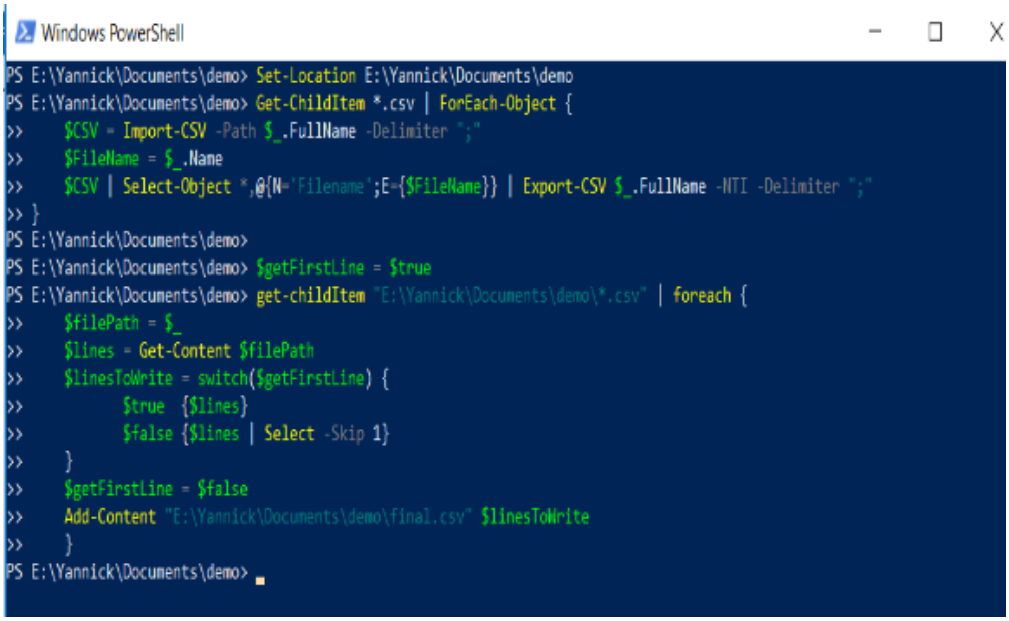


Figure 4 Concatenation in windows PowerShell

Via Powershell, a column with the filename, was appended to each seed datapoint (row) for downstream processing, and all CSV files were then concatenated into a single CSV file (Figure 4).

2.3.3 Scaling to correct voxel size

For scaling data, the correct voxel size is required. At first, adding the voxel size (our tiff format data is devoid of pixel/voxel size) into the concatenated data's CSV file is important. Here the unique character as seen in (Figure 5) was used. In the text editor, the unique character is replaced by a separator, such as a semicolon, then two columns will be obtained, one of them is the species column that is used as an identifier for statistical analyses, and the other contains the sample identifier. The identifier column will be replaced with voxel size to scale the data.

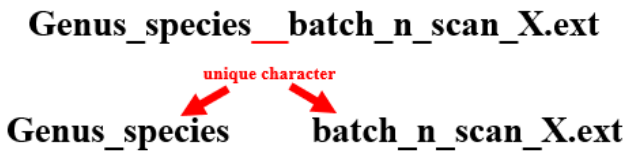


Figure 5 The replacing unique character by a separator to obtains two new columns

After this stage, Kutools (Excel extension) code was used for multiple replacement operations filling the new columns with voxel size to complete scaling (Figure 6).

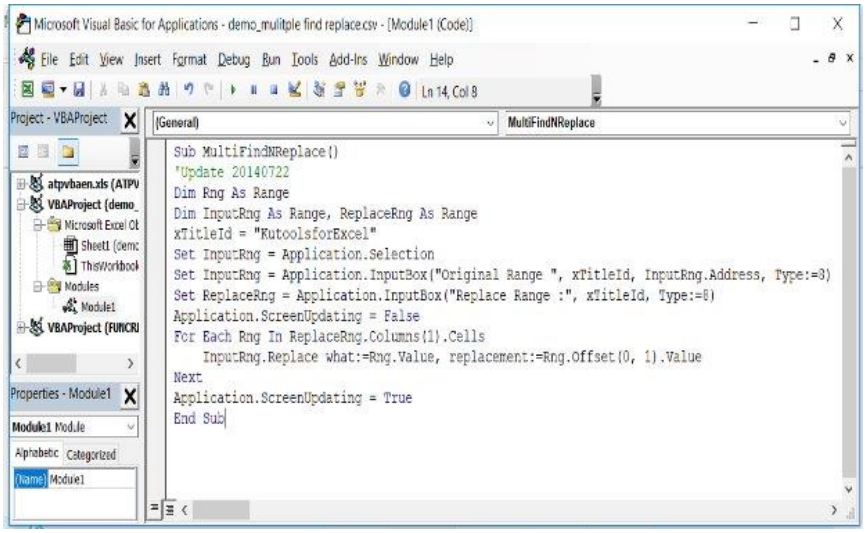


Figure 6 Kutools (Excel extension) script

2.4 Principal Component Analysis (PCA)

To explain the differences between seeds (wild and domesticated) and detect the most important factors of shape and size variability, PCA was used. This multivariate analysis was performed in the software Rstudio (R version 3.4.4 (2018-03-15)). Information on the size and shape features of *Vicia* and *Lens* such as their dimensions (length, width, and thickness), ellipsoid Radius1, Radius2, Radius3, volume, inscribed ball radius, and the surface area is important in the quantification of seed size and shape.

3 RESULTS

The obtained results via PCA after processing a total of 656 *Vicia* seeds and 229 *Lens* seeds, were investigated. Of the 25 obtained variables from ImageJ, 14 (Supplementary.5.3 and 5.4) of them represent the size and shape of seeds and were used in the PCA. The other variables which quantified the position and orientation of the seeds were removed from the data.

3.1 *Lens*

Two PCA graphs with variables extracted from ImageJ were obtained. One of the graphs indicates the variable with the arrows factors (Figure 7).

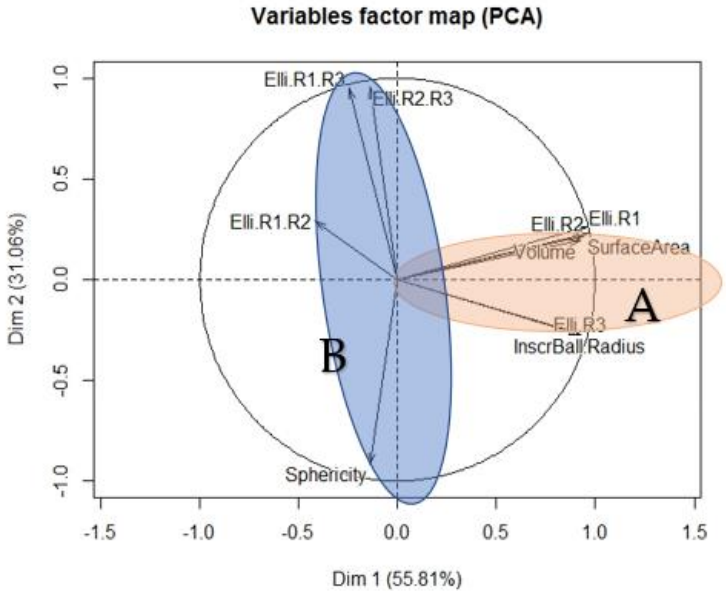


Figure 7 variables factor map, the factor map aids to visualize the cluster of correlated variables. Space, where variables are represented (<87% of variance), is dimension 1 and 2 (Dim1(A), Dim2(B))

The most important variables of the first PCA axis(Figure 7, A) are ellipsoid Radius1, Radius2, Radius3, volume, inscribed ball radius, and surface area, which are all size variables. Elli.R1/R2. Elli.R1/R3. Elli.R2/R3 and sphericity are the most important variables of Dim2(Figure 7, B) and are shape variables. The majority of variables of PC1 are size variables and the majority of variables of PC2 are shape variables. Size is therefore the main signal in our analysis. The PCA revealed those variables of higher importance in the investigation and they explain 87% of the

variance. The PCA is dominated by two main groups of highly correlated variables. First, the variables Dim1 (Figure 7, A) showed a positive correlation and the highest importance. Second, the variables Dim2 (Figure 7, B) also showed a positive correlation; only sphericity has a negative correlation with the other variables.

The other graph of PCA demonstrates the groups of the morphospace of the seeds. The two first axes of the PCA represent 98 % of variations of shape and size of seeds. PC1 (X axis) represents variables linked to size (e.g. seed surface, volume, ellipsoid radii, etc.), whereas PC2 (Y axis) comprises shape variables, such as: sphericity, Ellipsoid R1. R2, Ellipsoid R2. R3, and Ellipsoid R1. R3). The differentiation is clearly seen along the x-axis. Wild species, wild relative and attempted domesticate species overlapped, but the domesticated species is distinguished obviously from these three other groups.

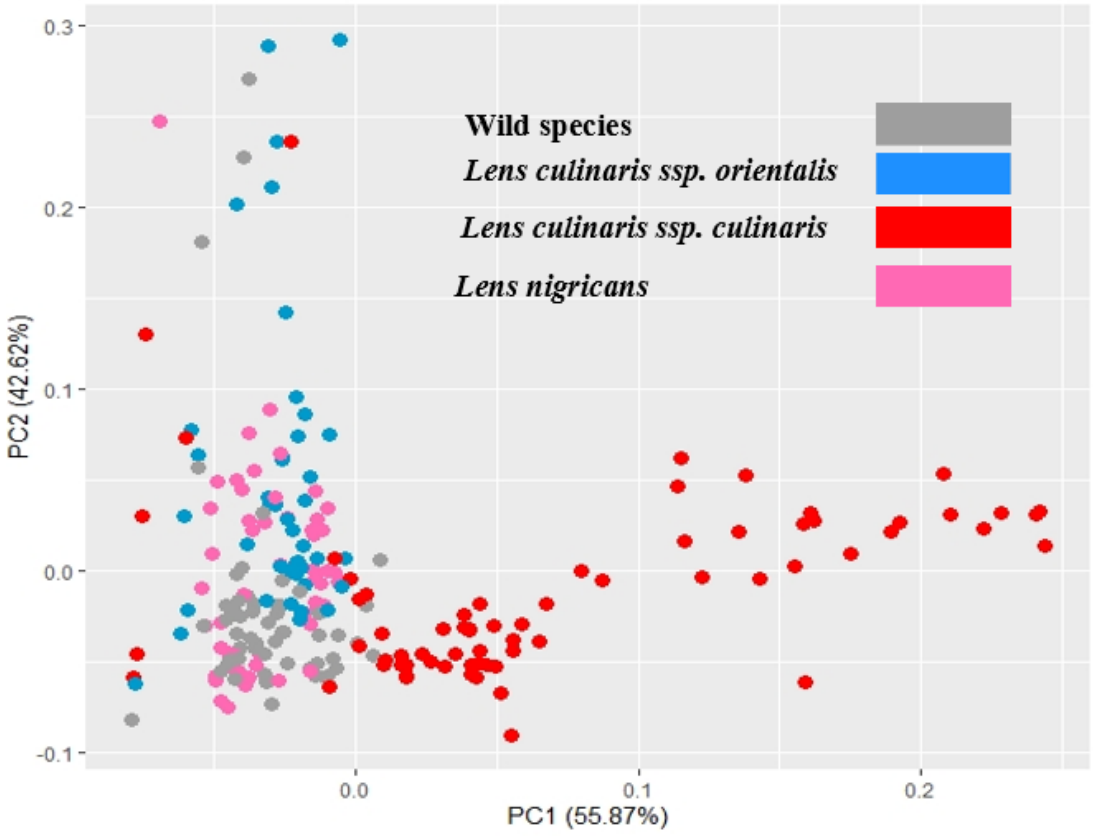


Figure 8 PCA result of *Lens* seeds: wild species (all wild species sampled), wild relative (*Lens culinaris* ssp. *orientalis*), domesticate (*Lens culinaris* ssp. *culinaris*), attemped domesticate (*Lens nigricans*)

Our result illustrates that:

1. The domesticated *Lens* occupies novel portions of the morphospace (*Lens culinaris ssp. culinaris,* see Figure 8)

2. Both the wild relative of the domesticated (*Lens culinaris ssp. orientalis*) and the attempted domesticate (*Lens nigricans)* occupy larger portions of the morphospace than non-domesticated species (wild species) and they occupy similar distributions in the morphospace, which suggests that seed size, shape or both of them together, are relevant for domestication.

3. Little differences in shape were found between the wild relative of *Lens* (*Lens culinaris spp.orientalis*) and the attempted domesticate (*Lens nigricans).*

3.2 *Vicia*

The First graph of the PCA shows the variables loading on the two first PCs with arrows (Figure 9). Dim1 represents is mostly constituted by simple –size- variables (ellipsoid Radius1, Radius2, Radius3, volume, inscribed ball radius, and Surface area) and but also by a compound –shape- variable (Elli.R1/R2). Dim 2 is mostly made up of compounds –shape- variables (sphericity, Elli.R2/R3, and Elli.R1/R3). In PC1, most variables are variables of size and in PC2 most variables are variables of shape.

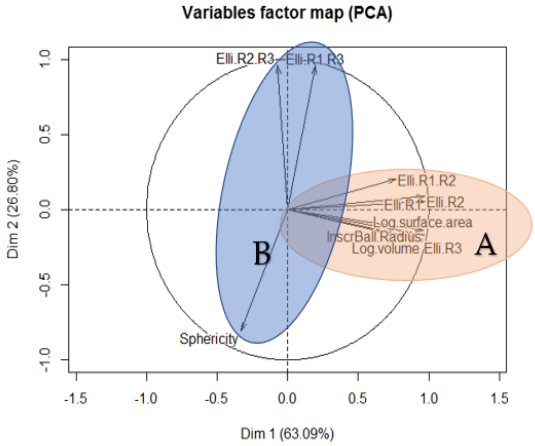


Figure 9 variables factor map. Space, where variables are represented (ca. 90% of variance), is dimension 1 and 2 (Dim1(A), Dim2(B))

The second graph PCA represents the groups of the morphospace of the seeds. Our principal component analyses for *Vicia* demonstrated that *Vicia faba* occupies a distinctive region

of morphospace but also that seed morphospace shows strong constraints. The domesticates

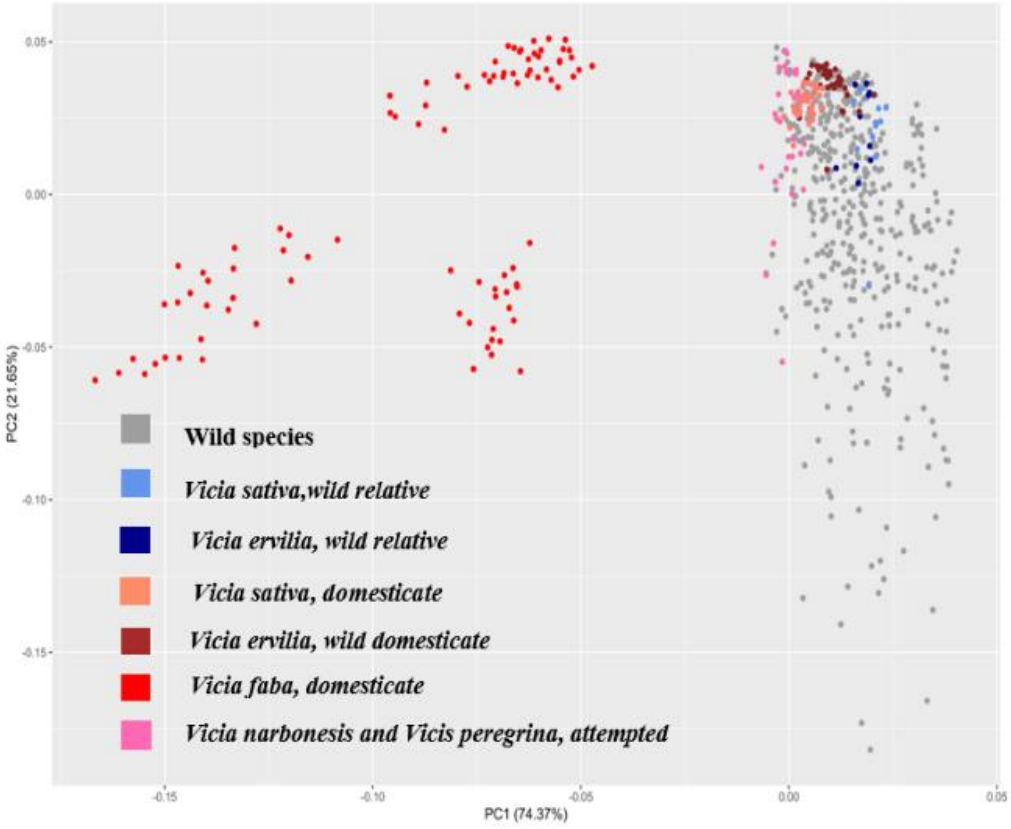


Figure 10 the PCA result of morphospace of the seeds of Vicia.Wild species (all wild species sampled), wild relative(*Visia sativa* and *Vicia ervilia*), domesticate (*Vicia sativa*, *Vicia ervilia* and *Vicia faba*), attemped domesticate(*Vicia narbonesis* and *Vicia peregrina*)

occupy a novel portion of the morphospace, *Vicia faba* occupies the largest proportion of morphospace of shape and size (Figure 10Figure). We can also group *Vicia faba* into three separate morphospecies. *Vicia faba* seed samples in this study are purchased from the market and may have grown in different environments than the rest of the material. *Vicia sativa* and *Vicia ervilia* (Figure 10) diverged from their wild progenitor and tend to occupy different portions of the morphospace along PC1(X-axis) in terms of size but don't occupy an entirely new portion of morphospace: they overlap partly with the other wild species and species that were attempted to domesticate (*Vicia narbonesis* and *Vicia peregrina*) .

Species that are attempted domesticates (cultivated but not domesticated) occupy the same part of the morphospace and demonstrate a little of differentiation along PC2 (Y-axis) which is linked to their shape. The wild species occupy large morphospace along PC2 (y-axis) which illustrates their different shapes.

4 DISCUSSION

The technique we used allows 3-dimensional imaging without damaging the object and more precise morphometric comparison of internal features and/or structures than that had hereto been impossible to visualize and quantify (Friis et al., 2014). These data allowed us to open a successful line of investigation into seed size and shape as a domestication trait of the Fabeae of the Old World. In the present study, we found evidence that domesticates occupy entirely new portions of the morphospace in both *Lens* and *Vicia*. Moreover, in all studied groups (*Lens* and *Vicia*), the domesticates have larger seeds than the wild relatives (further away on the PC1 axis). This increase in seed size of domesticates compared to their wild progenitor is associated with the depth of planting in agricultural systems, larger seeds generating more powerful seedlings (Shahal et al., 2014). Early farmers may have also chosen them for increased amounts of components like starch, oil, and protein.

We observed that the different portions of the morphospace in *Lens culinaris* could be divided into different groups, in agreement with (Zohary et al., 2000). who categorized domesticated *Lens* into two groups of seed sizes: (a) small-seeded lentils (subsp. *microsperma*) with seed size 3-6 mm; (b) large-seeded lentils (subsp. *macrosperma*) with seed size 6-9 mm. Our analysis shows that domesticated *Lens* occupies a large portion of the morphospace. Given that both the wild parents of the domesticated *Lens* (*L. orientalis* subsp. *culinaris*) and the attempted domesticate, *L. nigricans* both occupy relatively large portions of the morphospace. We speculate that phenotypically variable species could have a higher available variation to select from and thus be more suitable for domestication than species with little variation.

Our result of domesticated *Vicia* occupying new portions of the morphospace is largely driven by *V. faba*. The other two domesticates (*V. sativa* and *V. ervillia*), and the attempted domesticates (*V. narbonensis* and *V. peregrina*) do not occupy entirely new portions of the seed morphospace. Among these species, *V. faba* is the only species grown as human food; the other species are grown overwhelmingly as animal fodder (except in times of famine). Species grown for fodder are also grown to feed cattle not only with seeds but also with the rest of the plant (pasture and hay). We hypothesize that the morphospace innovations in *V. faba* are due to the higher selection exerted by humans on cultivars for their own consumption of seeds, whereas the more conservative morphospace of the other species is due to selection exerted on species grown for fodder to produce not only seeds but also pasture and hay. This notwithstanding, environmental conditions can result in changes in size and shape. For example, *V. faba* seed samples in this study

are purchased from the market and may have different environments for planting and growth than seeds of plants collected from escapees inside the Irano-Turanian and Mediterranean floristic regions.

Our morphospace reconstructions of phenotypic traits of *Vicia* and *Lens* (seeds) of wild and wild-relative (with extensive additional sampling from the FC area) can be used in conjunction with previous traditional measurements (Murphy et al., 2019) to identify seeds. Adding subfossils data from different stages of domestication could better test our hypothesis. This can be considered in the next step of the phenotypical study. This study can continue into size and shape as a trait of domestication in other wild and wild relative taxa from the Old World. Our expectation is that the trends will be similar: a decrease upon domestication, and a unsuing gradual step-wise change.

5 SUPPLEMENTARY

5.1 The list of *Lens* seeds sampling from the Herbarium of the Natural History Museum of Vienna

Herbarium - reg year - N	Sample- Nmber	Genus	Species	Seeds- collected	Date- collected	Collector	Locality
2006-04829	1	Lens	orientalis	5	08.06.2004	Ernst Vitek 04-0260	Armenia
2006-14005	2	Lens	orientalis	2	14.04.1998	M. Staudinger J3/23	Jordan
1972-11448	3	Lens	orientalis	4	25.05.1957	K.H. Rechinger 13258	Syria
1912-5598	4	Lens	nigricans	3	5.06.1911	F. Sennen 1181	Spain
no Nber	5	Lens	nigricans	7	probably early 1900s	Fr. Petter 150 (Herb. Pittoni)	Croatia
1982-05328	6	Lens	nigricans	10	15.06.1973	Burri & Krendl	Italy
1982-04976	7	Lens	nigricans	3	24.05.1979	Krendl	Greece
2006-25215	8	Lens	nigricans	21	26.05.1999	A. Di. Martino et al. 21-3-11	Bulgaria
1966-21242	9	Lens	kotschyanum	6	2.05.1966	J. Eiselt	Turkey
2006-08937	10	Lens	ervoides	9	23.06.2004	Ernst Vitek 04-1433	Armenia
1980-07806	11	Lens	ervoides	4	6.07.1979	illegible	Armenia
1982-05334	12	Lens	ervoides	7	3.06.1979	Krendl	Italy
1983-09773	13	Lens	ervoides	7	31.05.1982	Krendl	Greece
1992-13357	14	Lens	ervoides	6	26.06.1965	Friederike Sorger 65-33-71	Turkey
1975-8314	15	Lens	cyanea	2	7.05.1974	B. Sanii 11253	Iran
1972-11470	16	Lens	culinaris	4	18.05.1975	Rechinger 12388	Iraq
1964-5535	17	Lens	culinaris	1	11.07.1950	Gulli 1749	Afghanistan
1981-07288	18	Lens	leuticula	2	1961	K.H. Rechinger 22683	Greac
1978-17697	19	Lens	cyanea	5	1973	K.H. Rechinger	Greece
1979-06659	20	Lens	esculenta	2	15.06.1960	h.pabot	Iran
1936-7344	21	Lens	orientalis Boiss	2	5.6.1934	L.Prilipko	Transcaucasia
2006-08013	22	Lens	orientalis Boiss	2	6.6.1954	-	Armenia
1978-11549	23	Lens	orientalis Boiss	2	8.6.1963	-	Armrnia
1992-13308	24	Lens	orientalis	2	21.6.1965	-	Turkey
1991-04369	25	Lens	orientalis	2	25.5.1963		Turkey
1975-17991	26	Lens	orientalis	8	1.6.1974	Wendelbo,Assadi	Azarbaijan
1962-11067	27	Lens	orientalis	2	30.5.1961	Howard C.Stutz	Iran
1959-22284	28	Lens	orientalis	2	9.10.1956	Voage F.Schmid	Iran
1958-5676	29	Lens	orientalis	2	1948	k.h.Rechinger	Iran
1958-6151	30	Lens	orientalis	10	1948	k.h.Rechinger	Iran
1972-11434	31	Lens	orintalis	one p	24.5.1957	k.h.Rechinger	Damascus
1970-7308	32	Lens	nigricans	2	12.7.1954	N.Vyhodcevski	bulgaria

1982-05331	33	Lens	nigricans	4	3.6.1987	F. Krendle ,w.burri	Italy
1988-9316	34	Lens	nigricans	2	12.6.1987	H.Malicy	Greece
2007-00487	35	Lens	nigricans.gordon	3	21.5.1999	marko tarnovo	Bulgaria
1962-7575	36	Lens	lenticula	7	1959	T.d.Mailand	Lebonan
2006-07463	37	Lens	ervoides	1	2004	Arevshatian	Armenian
1983-09804	38	Lens	ervoides	6	9.6.1982	f. krendle	Greece
1991-04366	39	Lens	ervoides	2	23.6.1971	Friederik Sorger	Turkey
2013-01762	40	Lens	culinaris-subsp-o	1	5.7.2009	Ali Dönmez-Z Ugurlu	Turkey
1991-04365	41	Lens	culinaris Medik	1	30.6.1971	Friederik Sorger	Turkey
2016-04794	42	Lens	culibaris	1	4.9.1997	Albert	Tunesien
1970-11385	43	Lens	culinaris Medik	1	24.8.1969	Noh :Rasul	Afghanistan
1975-7902	44	Lens	culinaris Medik	2	5.5.1972	J.Leonard	Iran
1961-4156	45	Lens	culinarik Medik	1	15.6.1960	Rioux et GOvam	Iran

5.2 The list of *Vicia* seeds sampling from the Herbarium of the Natural History Museum of Vienna

herbarium-	Sample	Genus	Species	Seeds-	Date-	collector	Locality
reg year-	Nber			N	collected		
2004-07680	1	Vicia	abbreviata	3	27.06.2006	Fayvush	Armenia
2009-08798	2	Vicia	abbreviata	3	16.06.2008	K.Kugler, H. Ter-Voskan	Armenia
1991-01009	3	Vicia	alpestris	3	01.08.1982		Turkey
1992-13191	4	Vicia	alpestris	2	01.08.1976	DR.Friederike Sorger	Turkey
2006-05870	5	Vicia	alpestris	1	02.08.1998	Hapoba	Armenia
2003-00329	6	Vicia	alpestris	1	25.08.1997	Ganidze R	Georgia
1965-17478	7	Vicia	akhmaganic	1	19.7.1964	Martin L	Azarbaijan
1958-5878	8	Vicia	amphicarpa	1	20.05.1940	Walter Koelz	Iran
2003-14014	9	Vicia	analolica	3	23.6.2002		Armenia
1992-12245	10	Vicia	anatolica	5	25.05.1963	DR.Friederike Sorger	Turkey
2014-05484	11	Vicia	articulata	5	21/06/1995	Josef Loibl	Austria
2014-05485	12	Vicia	articulata	5	21/06/1995	Josef Loibl	Austria
2003-12453	13	Vicia	balansea	4	13/07/2002	G.M: Schneeweiß	Caucasus
1991-01006	14	Vicia	balansea	4	30/07/1982	Sorger & Buchner	Turkey
2009-00227	15	Vicia	balansea	5	24/04/2007	Manana Khutsishvili77	Georgia
1887-574(old	16	Vicia	bithynica	3	4.07.1886		France
2014-08947	17	Vicia	bithynica	3	06/06/1990	F.M Raimondo	Italy
2014-09139	18	Vicia	bithynica	1	11/06/1995	G.Kamari C.Beutron	Greece
l.h.m 1869	19	Vicia	biennis	10	1869		!!
594 ??	20	Vicia	barbaziatae	2	1857	Theodorus G	
1869	21	Vicia	caesarea	5	1869		Greece
no	22	Vicia	canescens	4	21.08.1854	theodor Kotschy	Turkey
1991-01002	23	Vicia	canescens	2	08/07/1982	Sorger & Buchner	Turkey
2006-03880	24	Vicia	cappadocica	10	19/06/2004	Georg Fayvush	Armenia,
1987-03409	25	Vicia	cassia Boiss	5	07/05/1986	K.H: Rechinger, Iter cyp	Cyprus
17564	26	Vicia	cassubica	2	22/06/1972	K.H: Rechinger, Iter Gra	Macdonia
1977-03436	27	Vicia	cassubica	1	14/07/1973	F.krendel	Hungary
2010-16514	28	Vicia	cassubica	2	26/01/2008	V.Mikolas	Slovakai
1970-12737	29	Vicia	ciceroidea	1	10/08/1957	K.H.Rechinger	Iraq
1979-00987	30	Vicia	ciceroidea	2	09/07/1977	Temeh and Martina	Iran
1964-12779	31	Vicia	ciceroidea	2	11/07/1962	P.furse	Iran
2010-10252	32	Vicia	ciliatula	2	31/05/2006	Oganesian	Armenia
13320	33	Vicia	cracca	5	01/06/1910	Dr Korb	Czech Republic
11430	34	Vicia	cracca	5	26/08/1955	H.j.scoggan	Greece
2011-12014	35	Vicia	cracca	2	06/09/2008	V.Mikolas	Slovakai
1974-17519	36	Vicia	cracca	4	10/05/1973	H und i riedel	Greece
1993-00308	37	Vicia	cracca	5	23/07/1975	V.Vasak	Caucasus
1889-3065	38	Vicia	cretica	3	13.05.1889	Helder	Italy
1993-01684	39	Vicia	crocea	3	10/07/1975	V.Vasak	Caucasus

2013-09297	40	Vicia	cretica	3	25/10/2009	Jiri Danihelka	Greece
1994-01918	41	Vicia	cretica	3	24/04/1990	F.krendel	Greece
1994-01919	42	Vicia	cretica	5	21/05/1990	F.krendel	Greece
1975-21503	43	Vicia	crocea	5	21/06/1974	Wendelbo and Froughi	Iran
1992-13150	44	Vicia	cuspidata	5	01/06/1966	Friedrike Sorger	Turkey
1976-13227	45	Vicia	cuspidata	10	15/06/1972	A.Neumann .	Turkey
1986-03639	46	Vicia	dalmatica	4	03/08/1977	V.Vasak	Ukraine
19993-00537	47	Vicia	dalmatica	3	27/07/1977	V.Vasak	Rassia
1931-07411	48	Vicia	villosa	2	17/05/1964	K.H.Rechinger	Greece
1981-07594	49	Vicia	villosa	1	13/07/1970	K.H.Rechinger	Greece
1965-4880	50	Vicia	villosa	5	11/07/1963	K.Bauer	Macadonia
2004-01726	51	Vicia	ervilia	3	24/06/2002	g.fayvush	Armenia
2006-08688	52	Vicia	ervilia	5	18/06/1957	I.Arveshatian	Armenia
2014-01906	53	Vicia	ervilia	5	23/06/2011	E.vitek ,G,fayvush	Cacasus
1960-15901	54	Vicia	ervilia	3	25/05/1960	K.H.Rechinger	Iran
1972-11622	55	Vicia	ervilla	5	02/06/1971	K.H.Rechinger	Iran
1926-14871	56	Vicia	faba L	6	1892	!!	!!
1926-14870	57	Vicia	faba L	4	1897	!!	!!
2007-06381	58	Vicia	grandiflora	5	03/06/1999	Andrea di Martino	Bulgaria
1982-05052	59	Vicia	grandiflora	5	07/06/1979	F.krendel	Macedinia
1983-09801	60	Vicia	grandiflora	6	23/06/1983	F.krendel	Greece
1981-07473	61	Vicia	hirsuta	4	27/05/1964	K.H.Rechinger	Greece
1981-07178	62	Vicia	hirsuta	2	28/04/1961	K.H.Rechinger	Greece
1978-17462	63	Vicia	hirsuta	2	22/06/1972	K.H.Rechinger	Macedinia
1972-11604	64	Vicia	hirsuta	5	14/05/1971	K.H.Rechinger	Iran
1979-10610	65	Vicia	hololasia W	4	16/05/1971	A.Radzhi	!!
1966-9706	66	Vicia	hybrida	1	05/05/1964	K.H.Rechinger	Greece
1985-10881	67	Vicia	hybrida	2	25/05/1979	F.krendel	Balkans
1992-00743	68	Vicia	hybrida	3	27/04/1990	F.krendel	Greece
2006-04346	69	Vicia	hybrida	2	14/06/2004	I.Arveshatian	Armenia
1964-12504	70	Vicia	hyrianica	5	03/07/1962	p.furse	Iran
1976-06370	71	Vicia	iranica	1	1975		Iran
2015-02387	72	Vicia	lathyroides	10	12/06/2013	Barta	Austria
2013-09299	73	Vicia	lathyroides	2	28/05/2009	M.chytry	Greece
1995-06093	74	Vicia	lilacina	4	26/07/1981	O.nikiforova	Russia
1908-634	75	Vicia	lunata	5	26/05/1906	J.Bornmüler	Turkey
1976-6208	76	Vicia	lutea	5	02/06/1975	K.H.Rechinger,	Iran
1955-6495	77	Vicia	melanops	4	12/06/1926	DR. Korb	!!
1993-01703	78	Vicia	michaxii	5	26/05/1974	V.Vasak	Kazakhstan
1972-11452	79	Vicia	michaxii	3	24/05/1957	K.H.Rechinger	Syira
1958-6206	80	Vicia	monantha	5	!.04.1950	F:stramuelner	Iran
1972-11573	81	Vicia	monantha	3	09/05/1967	K.H.Rechinger	Afghanestan
1995-05985	82	Vicia	multiculis	5	27/06/1957	r.H.Henah	Rassia
1972-11437	83	Vicia	narbonesis	5	24/05/1957	K.H.Rechinger	Syria

1979-09830	84	Vicia	narbonesis	4	31/05/1976	!!!!	Russia
1976-06206	85	Vicia	narbonesis	5	02/06/1975	K.H.Rechinger	Iran
1991-00964	86	Vicia	noeana Reu	4	16/07/1982	Sorger & Buchner	Croatia
1971-7497	87	Vicia	onobrychioi	3	ende juli 1970	A.Polatschek	Italy
1912-3838	88	Vicia	palaestina	5	05/05/1990	J.Bornmüler	!!
1984-09234	89	Vicia	pannonica	5	04/06/1975	K.H.Rechinger	Iran
1991-00696	90	Vicia	pannonica	3	06/08/1982	Sorger & Buchner	Turkey
1959-16402	91	Vicia	paviflora	2	01-Jul-36	H.Zerny	Tanganyika
1972-11500	92	Vicia	peregrina	4	29/06/1962	K.H.Rechinger	Afghanistan
1975-7892	93	Vicia	peregrina	3	27/06/1974	K.H.Rechinger	Iran
1972-11627	94	Vicia	peregrina	5	14/07/1971	K.H.Rechinger	Iran
no -n	95	Vicia	persica	5	23.06.1843	PR,Pagum,ASK	Iran
1954-4325	96	Vicia	picta Fisch	10	25/07/1913	!!!	Russia
1977-04108	97	Vicia	pisiformis	3	30/09/1975	G.H.Leute	Austria
1985-10647	98	Vicia	pisiformis	2	05/08/1977	F.krendel	Austria
2016-03329	99	Vicia	pesudocassu	3	15/06/2014	!!!	Spain
1959-2953	100	Vicia	pubescens	5	27/05/1955	K.H.Rechinger	Greece
1962-9521	101	Vicia	pubescens	5	05/06/1955	K.H.Rechinger	Macadonia
1976-07383	102	Vicia	sativa L	5	30/06/1959	!!	Cauocasus
1959-2952	103	Vicia	sativa L	5	27/05/1955	K.H.Rechinger	Greece
1972-11535	104	Vicia	sativa L	5	02/06/1965	K.H.Rechinger	Pakistan
1996-05159	105	Vicia	sepium	5	05/07/1959	K.H.Rechinger	Spain
2015-02644	106	Vicia	sepium	5	08/07/2010	V.Mikolas	Germany
1964-12510	107	Vicia	sericocarpa	4	19/05/1962	P.furse	Iran
1972-11435	108	Vicia	sericocarpa	5	25/05/1957	K.H.Rechinger	Syria
2000-04732	109	Vicia	serratifolia	4	02/07/1996	J.Barta	Austria
2012-06832	110	Vicia	serratifolia	5	17/09/2008	J.Barta	Austria
1899-5396	111	Vicia	sibthorpii	4	15.07.1899	DR.A.Baldacci	
…..	112	Vicia	sicula	2	13.04.1855	E.et A. Heut du	Italy
1975-3327	113	Vicia	sylvatica	5	21/08/1974	A.Polatschek	-
2007-16730	114	Vicia	tenuifolia	4	14/08/2006	L.Martins & J.Müller	Greece
1983-0965	115	Vicia	tenuifolia	4	20/07/1978	F.krendel	Greece
1966-1160	116	Vicia	tenuissima	8	14/05/1965	D.Phitos	Greece
1992-00746	117	Vicia	tenuissima	10	27/04/1990	F;KRENDEL; W.Burri	Greece
1959-24436	118	Vicia	tetrasperma	5	29/05/1956	VOYAGE F. SCHMID	Iran
1970-12046	119	Vicia	tetrasperma	5	07/08/1934	Suoma Valle	Finnland
1972-11602	120	Vicia	truncatula	6	20,07,1971	J.LAMOND; f;terme	Iran
1975-7895	121	Vicia	truncatula	5	25/06/1974	K.H.Rechinger	Iran
2000-11221	122	Vicia	varia	5	01/07/1970	F.krendel	Bulgarien
1972-11603	123	Vicia	variabilis	5	18/07/1971	J,Lamond	Iran
1974-04405	124	Vicia	variabilis	4	01/06/1973		Iran
1975-7886	125	Vicia	variabilis	5	11/07/1974	K.H.Rechinger	Iran
1958-5792	126	Vicia	variegata	2	07/06/1948	K.H.Rechinger	Iran
1976-06205	127	Vicia	villosa	3	03/06/1975	K.H.Rechinger	Iran

1972-11534	128	Vicia	villosa	4	22/06/1965	K.H.Rechinger	Afghanestan

5.3 Scaled data with 10 variables that quantify the shape and size of *Lens* seeds

Genus	Species	Classification	color	Volume	Surface-Area	Sphericity	Elli.R1	Elli.R2	Elli.R3	Elli-.R1/R2	Elli-.R1/R3	Elli-.R2/R3	InscrBall-.Radius
Lens	nigricans	att_domest	hotpink	0.08	1.17	0.44	0.39	0.37	0.14	1.04	2.78	2.67	0.15
Lens	nigricans	att_domest	hotpink	0.06	0.94	0.52	0.34	0.33	0.14	1.02	2.44	2.39	0.15
Lens	nigricans	att_domest	hotpink	0.09	1.25	0.46	0.41	0.37	0.14	1.10	2.94	2.67	0.15
Lens	nigricans	att_domest	hotpink	0.11	1.27	0.61	0.41	0.38	0.16	1.07	2.46	2.30	0.17
Lens	nigricans	att_domest	hotpink	0.12	1.36	0.61	0.42	0.38	0.17	1.09	2.40	2.20	0.19
Lens	nigricans	att_domest	hotpink	0.11	1.27	0.63	0.39	0.37	0.18	1.05	2.18	2.08	0.18
Lens	nigricans	att_domest	hotpink	0.10	1.20	0.65	0.38	0.37	0.18	1.03	2.14	2.08	0.18
Lens	nigricans	att_domest	hotpink	0.09	1.14	0.65	0.36	0.36	0.18	1.01	2.05	2.02	0.19
Lens	nigricans	att_domest	hotpink	0.06	0.97	0.50	0.36	0.33	0.13	1.10	2.85	2.60	0.15
Lens	nigricans	att_domest	hotpink	0.11	1.32	0.60	0.40	0.40	0.17	1.00	2.38	2.37	0.17
Lens	nigricans	att_domest	hotpink	0.10	1.23	0.61	0.39	0.37	0.17	1.07	2.37	2.21	0.18
Lens	nigricans	att_domest	hotpink	0.10	1.18	0.66	0.37	0.35	0.18	1.06	2.06	1.94	0.19
Lens	nigricans	att_domest	hotpink	0.10	1.21	0.65	0.40	0.35	0.17	1.12	2.28	2.03	0.18
Lens	nigricans	att_domest	hotpink	0.04	0.70	0.54	0.30	0.29	0.11	1.04	2.77	2.66	0.12
Lens	nigricans	att_domest	hotpink	0.03	0.63	0.49	0.30	0.28	0.10	1.06	3.01	2.85	0.10
Lens	nigricans	att_domest	hotpink	0.03	0.59	0.49	0.29	0.27	0.09	1.07	3.08	2.89	0.10
Lens	nigricans	att_domest	hotpink	0.09	1.19	0.59	0.41	0.35	0.16	1.16	2.54	2.19	0.15
Lens	nigricans	att_domest	hotpink	0.10	1.20	0.59	0.40	0.35	0.16	1.14	2.46	2.16	0.17
Lens	nigricans	att_domest	hotpink	0.09	1.23	0.50	0.40	0.38	0.15	1.03	2.71	2.62	0.15
Lens	nigricans	att_domest	hotpink	0.08	1.14	0.50	0.38	0.37	0.14	1.04	2.71	2.61	0.16
Lens	nigricans	att_domest	hotpink	0.12	1.41	0.63	0.42	0.41	0.18	1.03	2.35	2.29	0.18
Lens	nigricans	att_domest	hotpink	0.08	1.16	0.53	0.39	0.37	0.14	1.03	2.67	2.59	0.16
Lens	orientalis	wild_proge	deepskyblue3	0.11	1.40	0.51	0.43	0.39	0.17	1.08	2.55	2.36	0.18
Lens	orientalis	wild_proge	deepskyblue3	0.06	1.05	0.35	0.38	0.36	0.11	1.06	3.57	3.36	0.11
Lens	orientalis	wild_proge	deepskyblue3	0.05	0.98	0.35	0.38	0.35	0.10	1.09	3.73	3.42	0.10
Lens	orientalis	wild_proge	deepskyblue3	0.06	1.03	0.32	0.39	0.33	0.11	1.21	3.58	2.97	0.12
Lens	orientalis	wild_proge	deepskyblue3	0.06	0.97	0.45	0.35	0.34	0.13	1.05	2.78	2.66	0.13
Lens	orientalis	wild_proge	deepskyblue3	0.06	1.02	0.45	0.36	0.34	0.13	1.08	2.74	2.54	0.15
Lens	orientalis	wild_proge	deepskyblue3	0.08	1.10	0.52	0.38	0.34	0.14	1.11	2.66	2.40	0.16
Lens	orientalis	wild_proge	deepskyblue3	0.05	0.89	0.38	0.36	0.31	0.12	1.16	3.01	2.60	0.12
Lens	orientalis	wild_proge	deepskyblue3	0.07	1.07	0.52	0.37	0.35	0.15	1.07	2.51	2.35	0.16
Lens	orientalis	wild_proge	deepskyblue3	0.08	1.06	0.55	0.37	0.34	0.15	1.07	2.42	2.28	0.16
Lens	orientalis	wild_proge	deepskyblue3	0.08	1.12	0.58	0.37	0.35	0.16	1.06	2.33	2.21	0.17
Lens	ervoides	wild_sp	gray62	0.07	1.24	0.31	0.35	0.32	0.16	1.11	2.15	1.94	0.17
Lens	ervoides	wild_sp	gray62	0.05	0.77	0.61	0.31	0.28	0.14	1.12	2.24	2.00	0.15
Lens	ervoides	wild_sp	gray62	0.06	0.96	0.60	0.36	0.32	0.15	1.12	2.42	2.16	0.16
Lens	ervoides	wild_sp	gray62	0.06	0.93	0.64	0.34	0.31	0.15	1.10	2.22	2.02	0.16
Lens	ervoides	wild_sp	gray62	0.07	1.00	0.71	0.35	0.32	0.17	1.11	2.04	1.85	0.18
Lens	ervoides	wild_sp	gray62	0.08	1.10	0.60	0.38	0.34	0.16	1.12	2.34	2.09	0.16
Lens	ervoides	wild_sp	gray62	0.11	1.25	0.76	0.38	0.37	0.19	1.04	1.98	1.90	0.20

Lens	ervoides	wild_sp	gray62	0.10	1.20	0.80	0.37	0.34	0.21	1.07	1.76	1.64	0.22
Lens	ervoides	wild_sp	gray62	0.13	1.38	0.81	0.39	0.38	0.23	1.05	1.75	1.67	0.23
Lens	ervoides	wild_sp	gray62	0.14	1.65	0.62	0.47	0.43	0.18	1.08	2.56	2.37	0.19
Lens	ervoides	wild_sp	gray62	0.15	1.64	0.70	0.43	0.42	0.23	1.03	1.82	1.77	0.24
Lens	ervoides	wild_sp	gray62	0.14	1.57	0.71	0.45	0.42	0.20	1.08	2.23	2.07	0.20
Lens	ervoides	wild_sp	gray62	0.12	1.33	0.81	0.38	0.37	0.23	1.03	1.68	1.62	0.24
Lens	ervoides	wild_sp	gray62	0.10	1.24	0.73	0.38	0.35	0.21	1.08	1.80	1.66	0.22
Lens	ervoides	wild_sp	gray62	0.11	1.38	0.65	0.40	0.38	0.20	1.06	1.98	1.87	0.22
Lens	ervoides	wild_sp	gray62	0.12	1.35	0.76	0.38	0.38	0.21	1.02	1.80	1.77	0.24
Lens	kotschyanum	wild_sp	gray62	0.11	1.24	0.81	0.37	0.35	0.22	1.05	1.69	1.61	0.23
Lens	kotschyanum	wild_sp	gray62	0.07	0.95	0.66	0.34	0.33	0.16	1.04	2.17	2.08	0.16
Lens	kotschyanum	wild_sp	gray62	0.14	1.52	0.75	0.42	0.40	0.22	1.05	1.93	1.84	0.23
Lens	kotschyanum	wild_sp	gray62	0.12	1.31	0.82	0.37	0.37	0.23	1.02	1.66	1.63	0.24
Lens	kotschyanum	wild_sp	gray62	0.08	1.05	0.68	0.39	0.27	0.20	1.44	1.99	1.39	0.20
Lens	kotschyanum	wild_sp	gray62	0.03	0.64	0.62	0.29	0.27	0.12	1.07	2.42	2.26	0.12
Lens	kotschyanum	wild_sp	gray62	0.07	0.94	0.86	0.32	0.29	0.21	1.11	1.52	1.37	0.22
Lens	kotschyanum	wild_sp	gray62	0.07	0.89	0.84	0.32	0.29	0.19	1.11	1.74	1.56	0.18
Lens	kotschyanum	wild_sp	gray62	0.04	0.67	0.74	0.29	0.26	0.14	1.11	2.02	1.82	0.15
Lens	kotschyanum	wild_sp	gray62	0.04	0.65	0.70	0.28	0.27	0.13	1.03	2.11	2.04	0.13
Lens	kotschyanum	wild_sp	gray62	0.04	0.70	0.74	0.28	0.27	0.15	1.04	1.86	1.79	0.15
Lens	nigricans	att_domest	hotpink	0.04	0.63	0.79	0.27	0.25	0.15	1.08	1.77	1.65	0.15
Lens	nigricans	att_domest	hotpink	0.06	0.83	0.76	0.31	0.29	0.17	1.08	1.86	1.72	0.17
Lens	nigricans	att_domest	hotpink	0.05	0.75	0.84	0.29	0.26	0.18	1.10	1.64	1.48	0.18
Lens	nigricans	att_domest	hotpink	0.04	0.68	0.81	0.28	0.25	0.16	1.11	1.75	1.57	0.17
Lens	nigricans	att_domest	hotpink	0.05	0.78	0.81	0.29	0.27	0.17	1.08	1.68	1.56	0.17
Lens	nigricans	att_domest	hotpink	0.06	0.81	0.78	0.31	0.28	0.17	1.10	1.78	1.62	0.18
Lens	nigricans	att_domest	hotpink	0.05	0.74	0.84	0.29	0.27	0.17	1.09	1.70	1.57	0.16
Lens	nigricans	att_domest	hotpink	0.03	0.55	0.70	0.26	0.24	0.13	1.09	2.08	1.91	0.14
Lens	nigricans	att_domest	hotpink	0.04	0.61	0.80	0.27	0.25	0.14	1.08	1.86	1.73	0.14
Lens	nigricans	att_domest	hotpink	0.03	0.58	0.85	0.24	0.23	0.16	1.04	1.49	1.43	0.16
Lens	nigricans	att_domest	hotpink	0.04	0.66	0.80	0.28	0.26	0.15	1.05	1.82	1.74	0.16
Lens	nigricans	att_domest	hotpink	0.04	0.69	0.76	0.28	0.25	0.16	1.10	1.74	1.58	0.15
Lens	nigricans	att_domest	hotpink	0.02	0.44	0.72	0.24	0.21	0.11	1.15	2.10	1.82	0.12
Lens	nigricans	att_domest	hotpink	0.04	0.64	0.88	0.25	0.24	0.18	1.05	1.45	1.38	0.17
Lens	nigricans	att_domest	hotpink	0.03	0.54	0.83	0.24	0.23	0.15	1.07	1.64	1.54	0.15
Lens	nigricans	att_domest	hotpink	0.02	0.46	0.48	0.26	0.23	0.08	1.10	3.11	2.82	0.08
Lens	nigricans	att_domest	hotpink	0.02	0.40	0.62	0.23	0.21	0.10	1.10	2.33	2.12	0.10
Lens	nigricans	att_domest	hotpink	0.03	0.56	0.78	0.26	0.24	0.14	1.10	1.90	1.73	0.13

Lens	nigricans	att_domest	hotpink	0.02	0.45	0.58	0.23	0.23	0.09	1.00	2.48	2.48	0.10
Lens	nigricans	att_domest	hotpink	0.02	0.41	0.52	0.23	0.23	0.08	1.01	2.81	2.78	0.08
Lens	nigricans	att_domest	hotpink	0.03	0.53	0.80	0.24	0.23	0.14	1.05	1.67	1.59	0.14
Lens	culinaris	domesticate	red1	0.14	1.56	0.62	0.44	0.42	0.19	1.05	2.27	2.17	0.19
Lens	culinaris	domesticate	red1	0.12	1.44	0.58	0.42	0.41	0.18	1.03	2.35	2.30	0.17
Lens	culinaris	domesticate	red1	0.13	1.51	0.59	0.43	0.41	0.19	1.05	2.24	2.13	0.20
Lens	culinaris	domesticate	red1	0.13	1.51	0.59	0.43	0.41	0.19	1.05	2.24	2.13	0.20
Lens	culinaris	domesticate	red1	0.00	0.00	0.77	0.03	0.02	0.01	1.39	3.14	2.25	0.01
Lens	culinaris	domesticate	red1	0.00	0.00	1.23	0.02	0.02	0.01	1.00	1.63	1.63	0.01
Lens	culinaris	domesticate	red1	0.00	0.00	0.57	0.04	0.02	0.01	2.01	5.18	2.58	0.01
Lens	culinaris	domesticate	red1	0.00	0.01	0.79	0.03	0.02	0.01	1.28	1.96	1.53	0.02
Lens	culinaris	domesticate	red1	0.00	0.00	1.23	0.02	0.02	0.01	1.00	1.63	1.63	0.01
Lens	cyanea	wild_sp	gray62	0.06	0.94	0.54	0.34	0.32	0.14	1.06	2.47	2.32	0.14
Lens	cyanea	wild_sp	gray62	0.00	0.01	0.90	0.03	0.02	0.02	1.27	1.72	1.36	0.02
Lens	cyanea	wild_sp	gray62	0.05	0.88	0.43	0.34	0.32	0.12	1.06	2.90	2.73	0.11
Lens	culinaris	domesticate	red1	0.13	1.34	0.80	0.38	0.36	0.23	1.04	1.61	1.55	0.24
Lens	culinaris	domesticate	red1	0.11	1.33	0.55	0.43	0.38	0.16	1.13	2.60	2.30	0.16
Lens	ervoides	wild_sp	gray62	0.00	0.00	1.07	0.02	0.02	0.02	1.18	1.42	1.20	0.02
Lens	ervoides	wild_sp	gray62	0.04	0.61	0.78	0.26	0.25	0.15	1.01	1.73	1.71	0.16
Lens	ervoides	wild_sp	gray62	0.04	0.64	0.79	0.27	0.26	0.15	1.04	1.77	1.71	0.16
Lens	ervoides	wild_sp	gray62	0.04	0.62	0.78	0.27	0.25	0.15	1.09	1.81	1.66	0.16
Lens	ervoides	wild_sp	gray62	0.05	0.68	0.82	0.28	0.27	0.16	1.05	1.80	1.71	0.16
Lens	ervoides	wild_sp	gray62	0.04	0.72	0.59	0.30	0.28	0.13	1.09	2.27	2.09	0.13
Lens	ervoides	wild_sp	gray62	0.04	0.68	0.63	0.28	0.27	0.14	1.04	2.08	2.00	0.14
Lens	ervoides	wild_sp	gray62	0.06	0.88	0.65	0.32	0.31	0.16	1.03	2.04	1.97	0.17
Lens	ervoides	wild_sp	gray62	0.06	0.81	0.74	0.30	0.29	0.16	1.05	1.89	1.80	0.16
Lens	ervoides	wild_sp	gray62	0.05	0.76	0.67	0.30	0.29	0.14	1.02	2.11	2.06	0.14
Lens	ervoides	wild_sp	gray62	0.07	0.93	0.67	0.33	0.32	0.16	1.02	2.09	2.05	0.17
Lens	ervoides	wild_sp	gray62	0.06	0.86	0.73	0.31	0.30	0.17	1.05	1.83	1.75	0.19
Lens	ervoides	wild_sp	gray62	0.08	0.98	0.68	0.33	0.33	0.17	1.01	1.95	1.94	0.18
Lens	ervoides	wild_sp	gray62	0.07	0.93	0.70	0.33	0.31	0.17	1.04	1.92	1.84	0.18
Lens	orientalis	wild_proge	deepskyblue3	0.04	0.91	0.23	0.35	0.33	0.11	1.07	3.25	3.03	0.08
Lens	orientalis	wild_proge	deepskyblue3	0.03	0.86	0.21	0.35	0.34	0.08	1.00	4.19	4.18	0.08
Lens	orientalis	wild_proge	deepskyblue3	0.06	1.04	0.41	0.35	0.34	0.14	1.04	2.45	2.36	0.15
Lens	orientalis	wild_proge	deepskyblue3	0.07	1.08	0.40	0.36	0.34	0.15	1.06	2.45	2.31	0.16
Lens	orientalis	wild_proge	deepskyblue3	0.07	1.09	0.42	0.38	0.36	0.13	1.05	2.93	2.79	0.13
Lens	orientalis	wild_proge	deepskyblue3	0.07	1.12	0.39	0.39	0.37	0.13	1.06	3.11	2.94	0.13
Lens	orientalis	wild_proge	deepskyblue3	0.08	1.02	0.61	0.35	0.35	0.15	1.02	2.40	2.35	0.15
Lens	orientalis	wild_proge	deepskyblue3	0.08	1.24	0.36	0.42	0.38	0.12	1.11	3.50	3.14	0.12
Lens	orientalis	wild_proge	deepskyblue3	0.08	1.03	0.60	0.35	0.33	0.16	1.05	2.19	2.09	0.15
Lens	orientalis	wild_proge	deepskyblue3	0.12	1.38	0.62	0.42	0.40	0.18	1.05	2.33	2.22	0.18
Lens	orientalis	wild_proge	deepskyblue3	0.11	1.29	0.67	0.40	0.38	0.18	1.04	2.16	2.07	0.19
Lens	orientalis	wild_proge	deepskyblue3	0.05	1.15	0.16	0.43	0.40	0.07	1.08	6.34	5.88	0.07
Lens	orientalis	wild_proge	deepskyblue3	0.06	0.86	0.64	0.33	0.30	0.15	1.10	2.26	2.05	0.14
Lens	orientalis	wild_proge	deepskyblue3	0.09	1.11	0.66	0.37	0.34	0.17	1.08	2.11	1.94	0.18

Lens	orientalis	wild_proge	deepskyblue3	0.09	1.11	0.64	0.37	0.34	0.17	1.09	2.17	1.99	0.18
Lens	orientalis	wild_proge	deepskyblue3	0.02	0.73	0.13	0.33	0.32	0.06	1.04	5.49	5.26	0.05
Lens	orientalis	wild_proge	deepskyblue3	0.02	0.72	0.11	0.33	0.29	0.06	1.13	5.35	4.72	0.06
Lens	esculenta	wild_sp	gray62	0.39	3.25	0.50	0.62	0.60	0.26	1.04	2.41	2.32	0.29
Lens	orientalis	wild_proger	deepskyblue3	0.01	0.50	0.18	0.30	0.23	0.05	1.30	5.50	4.24	0.06
Lens	orientalis	wild_proge	deepskyblue3	0.02	0.66	0.11	0.35	0.29	0.05	1.21	6.58	5.43	0.05
Lens	esculenta	wild_sp	gray62	0.64	4.36	0.56	0.72	0.72	0.30	1.01	2.43	2.40	0.31
Lens	orientalis	wild_proge	deepskyblue3	0.07	1.06	0.53	0.36	0.34	0.15	1.05	2.40	2.28	0.15
Lens	orientalis	wild_proge	deepskyblue3	0.04	0.69	0.53	0.30	0.29	0.11	1.03	2.58	2.50	0.12
Lens	orientalis	wild_proge	deepskyblue3	0.09	1.19	0.56	0.39	0.37	0.15	1.04	2.51	2.42	0.16
Lens	orientalis	wild_proge	deepskyblue3	0.05	0.83	0.48	0.33	0.32	0.11	1.06	2.96	2.80	0.11
Lens	orientalis	wild_proge	deepskyblue3	0.05	0.84	0.48	0.34	0.31	0.12	1.11	2.97	2.68	0.12
Lens	orientalis	wild_proge	deepskyblue3	0.05	0.91	0.39	0.36	0.33	0.11	1.08	3.26	3.00	0.10
Lens	cyanea	wild_sp	gray62	0.01	0.27	0.71	0.17	0.17	0.09	1.02	1.93	1.89	0.10
Lens	cyanea	wild_sp	gray62	0.01	0.30	0.58	0.19	0.18	0.09	1.06	2.13	2.01	0.10
Lens	cyanea	wild_sp	gray62	0.01	0.32	0.17	0.22	0.19	0.06	1.14	3.32	2.91	0.05
Lens	cyanea	wild_sp	gray62	0.01	0.25	0.32	0.19	0.16	0.06	1.24	2.97	2.40	0.06
Lens	cyanea	wild_sp	gray62	0.01	0.26	0.40	0.19	0.18	0.06	1.06	3.42	3.23	0.06
Lens	leuticula	wild_sp	gray62	0.01	0.52	0.14	0.29	0.27	0.05	1.09	6.04	5.57	0.04
Lens	leuticula	wild_sp	gray62	0.01	0.52	0.74	0.31	0.26	0.05	1.16	5.61	4.84	0.03
Lens	leuticula	wild_sp	gray62	0.07	0.90	0.84	0.32	0.29	0.19	1.08	1.65	1.53	0.20
Lens	leuticula	wild_sp	gray62	0.06	0.80	0.77	0.33	0.27	0.16	1.24	2.01	1.62	0.17
Lens	leuticula	wild_sp	gray62	0.05	0.67	0.80	0.27	0.26	0.16	1.02	1.63	1.60	0.17
Lens	leuticula	wild_sp	gray62	0.06	0.79	0.73	0.30	0.29	0.16	1.02	1.89	1.85	0.16
Lens	leuticula	wild_sp	gray62	0.04	0.57	0.77	0.25	0.24	0.15	1.07	1.71	1.61	0.15
Lens	leuticula	wild_sp	gray62	0.04	0.64	0.66	0.29	0.25	0.13	1.13	2.21	1.96	0.14
Lens	leuticula	wild_sp	gray62	0.02	0.43	0.63	0.22	0.21	0.11	1.05	2.01	1.91	0.12
Lens	nigricans	att_domest	hotpink	0.11	1.20	0.82	0.36	0.35	0.21	1.03	1.71	1.66	0.22
Lens	nigricans	att_domest	hotpink	0.04	0.69	0.65	0.29	0.28	0.13	1.04	2.25	2.16	0.14
Lens	nigricans	att_domest	hotpink	0.08	0.98	0.81	0.33	0.31	0.20	1.08	1.66	1.55	0.21
Lens	nigricans	att_domest	hotpink	0.05	0.88	0.38	0.34	0.31	0.11	1.10	3.00	2.72	0.12
Lens	nigricans	att_domest	hotpink	0.04	0.73	0.42	0.31	0.28	0.11	1.11	2.75	2.49	0.12
Lens	nigricans	att_domest	hotpink	0.08	1.16	0.44	0.41	0.36	0.13	1.14	3.11	2.72	0.14
Lens	nigricans	att_domest	hotpink	0.04	0.81	0.32	0.36	0.29	0.09	1.22	3.79	3.12	0.11
Lens	nigricans	att_domest	hotpink	0.03	0.68	0.37	0.33	0.26	0.09	1.26	3.66	2.91	0.10
Lens	nigricans	att_domest	hotpink	0.05	0.89	0.36	0.36	0.32	0.11	1.12	3.35	3.00	0.12
Lens	nigricans	att_domest	hotpink	0.04	0.72	0.40	0.32	0.29	0.10	1.12	3.22	2.87	0.10
Lens	nigricans	att_domest	hotpink	0.05	0.81	0.45	0.33	0.31	0.12	1.07	2.78	2.60	0.12
Lens	nigricans	att_domest	hotpink	0.00	0.00	0.35	0.03	0.02	0.00	1.71	6.78	3.97	0.01
Lens	culinaris	domesticate	red1	0.54	3.95	0.54	0.70	0.67	0.28	1.05	2.47	2.35	0.31
Lens	culinaris	domesticate	red1	0.17	1.69	0.64	0.47	0.39	0.22	1.20	2.11	1.76	0.24
Lens	culinaris	domesticate	red1	0.15	1.55	0.66	0.43	0.38	0.22	1.14	1.97	1.73	0.22
Lens	culinaris	domesticate	red1	0.19	1.73	0.77	0.45	0.42	0.24	1.08	1.84	1.71	0.24
Lens	culinaris	domesticate	red1	0.19	1.71	0.79	0.44	0.42	0.25	1.05	1.78	1.70	0.25
Lens	culinaris	domesticate	red1	0.03	0.85	0.12	0.40	0.34	0.07	1.19	5.81	4.87	0.07

Lens	culinaris	domesticate	red1	0.39	3.77	0.32	0.71	0.65	0.21	1.09	3.36	3.10	0.24
Lens	culinaris	domesticate	red1	0.01	0.23	0.42	0.19	0.17	0.05	1.11	3.43	3.10	0.05
Lens	ervoides	wild_sp	gray62	0.04	0.58	0.71	0.26	0.25	0.13	1.05	2.07	1.97	0.13
Lens	ervoides	wild_sp	gray62	0.04	0.67	0.63	0.29	0.28	0.12	1.03	2.42	2.34	0.12
Lens	ervoides	wild_sp	gray62	0.03	0.58	0.68	0.27	0.25	0.12	1.06	2.18	2.06	0.13
Lens	ervoides	wild_sp	gray62	0.05	0.80	0.56	0.33	0.31	0.12	1.06	2.85	2.70	0.12
Lens	ervoides	wild_sp	gray62	0.04	0.66	0.70	0.29	0.27	0.13	1.05	2.21	2.10	0.14
Lens	ervoides	wild_sp	gray62	0.04	0.63	0.69	0.28	0.27	0.13	1.03	2.14	2.08	0.13
Lens	ervoides	wild_sp	gray62	0.05	0.76	0.68	0.29	0.28	0.15	1.04	1.93	1.85	0.14
Lens	ervoides	wild_sp	gray62	0.01	0.33	0.44	0.21	0.20	0.07	1.09	3.19	2.93	0.07
Lens	ervoides	wild_sp	gray62	0.01	0.27	0.23	0.22	0.18	0.04	1.24	5.11	4.11	0.05
Lens	culinaris	domesticate	red1	0.19	1.89	0.58	0.46	0.39	0.26	1.17	1.77	1.51	0.26
Lens	culinaris	domesticate	red1	0.20	1.84	0.71	0.45	0.42	0.25	1.08	1.80	1.67	0.25
Lens	culinaris	domesticate	red1	0.20	1.83	0.72	0.45	0.43	0.24	1.06	1.85	1.76	0.26
Lens	culinaris	domesticate	red1	0.21	1.88	0.73	0.46	0.43	0.25	1.07	1.79	1.68	0.26
Lens	culinaris	domesticate	red1	0.21	2.13	0.51	0.48	0.45	0.23	1.06	2.05	1.93	0.24
Lens	culinaris	domesticate	red1	0.21	1.99	0.64	0.47	0.44	0.25	1.07	1.88	1.75	0.26
Lens	culinaris	domesticate	red1	0.21	1.89	0.75	0.46	0.42	0.26	1.09	1.73	1.59	0.27
Lens	culinaris	domesticate	red1	0.21	2.38	0.38	0.50	0.46	0.22	1.09	2.25	2.07	0.24
Lens	culinaris	domesticate	red1	0.22	2.05	0.63	0.47	0.44	0.26	1.08	1.82	1.69	0.26
Lens	culinaris	domesticate	red1	0.22	2.32	0.44	0.48	0.47	0.24	1.03	2.00	1.94	0.24
Lens	culinaris	domesticate	red1	0.23	2.17	0.58	0.49	0.43	0.27	1.14	1.83	1.60	0.28
Lens	culinaris	domesticate	red1	0.23	2.28	0.53	0.50	0.47	0.24	1.05	2.06	1.96	0.24
Lens	culinaris	domesticate	red1	0.24	2.32	0.52	0.51	0.47	0.25	1.09	2.07	1.90	0.26
Lens	culinaris	domesticate	red1	0.24	2.23	0.59	0.49	0.46	0.26	1.05	1.86	1.77	0.26
Lens	culinaris	domesticate	red1	0.24	2.27	0.58	0.52	0.48	0.24	1.07	2.17	2.02	0.24
Lens	culinaris	domesticate	red1	0.26	2.34	0.58	0.48	0.47	0.27	1.02	1.77	1.73	0.29
Lens	culinaris	domesticate	red1	0.26	2.40	0.54	0.50	0.47	0.26	1.06	1.90	1.78	0.27
Lens	culinaris	domesticate	red1	0.26	2.46	0.53	0.51	0.46	0.28	1.11	1.82	1.65	0.29
Lens	culinaris	domesticate	red1	0.27	2.48	0.55	0.53	0.50	0.25	1.05	2.07	1.97	0.27
Lens	culinaris	domesticate	red1	0.28	2.39	0.66	0.50	0.48	0.28	1.05	1.80	1.72	0.29
Lens	culinaris	domesticate	red1	0.28	2.34	0.71	0.49	0.48	0.29	1.03	1.71	1.67	0.29
Lens	culinaris	domesticate	red1	0.29	2.53	0.57	0.51	0.48	0.29	1.07	1.79	1.68	0.28
Lens	culinaris	domesticate	red1	0.29	2.64	0.52	0.52	0.51	0.27	1.02	1.94	1.91	0.29
Lens	culinaris	domesticate	red1	0.30	2.39	0.73	0.51	0.48	0.30	1.07	1.72	1.61	0.30
Lens	culinaris	domesticate	red1	0.30	2.57	0.60	0.50	0.47	0.31	1.05	1.59	1.51	0.32
Lens	culinaris	domesticate	red1	0.31	2.64	0.58	0.52	0.52	0.28	1.01	1.86	1.85	0.28
Lens	culinaris	domesticate	red1	0.31	2.86	0.46	0.56	0.54	0.25	1.03	2.22	2.15	0.25
Lens	culinaris	domesticate	red1	0.33	2.69	0.62	0.55	0.54	0.27	1.03	2.08	2.02	0.27
Lens	culinaris	domesticate	red1	0.33	2.82	0.54	0.54	0.52	0.28	1.04	1.96	1.88	0.28
Lens	culinaris	domesticate	red1	0.34	3.10	0.43	0.60	0.56	0.24	1.06	2.49	2.36	0.26
Lens	culinaris	domesticate	red1	0.38	2.66	0.87	0.51	0.47	0.38	1.07	1.32	1.24	0.38
Lens	culinaris	domesticate	red1	0.40	3.76	0.34	0.67	0.66	0.22	1.01	3.05	3.03	0.23
Lens	culinaris	domesticate	red1	0.46	4.78	0.21	0.73	0.69	0.25	1.07	2.89	2.72	0.24
Lens	culinaris	domesticate	red1	0.48	4.24	0.34	0.72	0.71	0.23	1.02	3.16	3.11	0.24

Lens	culinaris	domesticate	red1	0.48	3.82	0.48	0.69	0.66	0.25	1.05	2.72	2.59	0.26
Lens	culinaris	domesticate	red1	0.51	4.21	0.39	0.71	0.68	0.25	1.03	2.78	2.69	0.27
Lens	culinaris	domesticate	red1	0.60	4.68	0.40	0.78	0.72	0.27	1.08	2.91	2.69	0.26
Lens	culinaris	domesticate	red1	0.62	4.71	0.42	0.76	0.75	0.26	1.01	2.89	2.87	0.27
Lens	culinaris	domesticate	red1	0.63	4.63	0.45	0.74	0.72	0.29	1.02	2.53	2.48	0.32
Lens	culinaris	domesticate	red1	0.70	5.02	0.43	0.77	0.75	0.29	1.03	2.65	2.56	0.30
Lens	culinaris	domesticate	red1	0.71	5.31	0.38	0.81	0.75	0.28	1.08	2.86	2.65	0.31
Lens	culinaris	domesticate	red1	0.72	5.37	0.38	0.81	0.77	0.28	1.06	2.91	2.74	0.29
Lens	culinaris	domesticate	red1	0.74	5.67	0.34	0.84	0.81	0.26	1.04	3.24	3.11	0.26
Lens	culinaris	domesticate	red1	0.74	4.74	0.58	0.68	0.66	0.40	1.03	1.73	1.67	0.38
Lens	culinaris	domesticate	red1	0.82	6.10	0.34	0.86	0.81	0.29	1.06	3.00	2.83	0.31
Lens	culinaris	domesticate	red1	0.85	5.97	0.38	0.84	0.83	0.30	1.01	2.83	2.79	0.31
Lens	culinaris	domesticate	red1	0.85	5.72	0.43	0.87	0.81	0.29	1.07	2.99	2.81	0.29
Lens	culinaris	domesticate	red1	0.94	6.36	0.39	0.89	0.86	0.30	1.03	2.98	2.90	0.32
Lens	culinaris	domesticate	red1	0.95	6.34	0.40	0.89	0.86	0.30	1.04	2.97	2.86	0.30
Lens	culinaris	domesticate	red1	0.97	6.42	0.40	0.88	0.83	0.32	1.06	2.77	2.62	0.32

5.4 Scaled data with 10 variables that quantify the shape and size of *Vica* seeds

genus	species	classification	color	Log -	Log -	Spheric	Elli.R1	Elli.R2	Elli.R3	Elli	Elli-	Elli-	Inscr-
				surface are	volume					.R1/R2	.R1/R3	.R2/R3	Ball.Radius
Vicia	hybrida	wild_sp	grey62	0.50	-0.37	0.684	0.63	0.56	0.30	1.123	2.077	1.85	0.28
Vicia	hybrida	wild_sp	grey62	0.53	-0.33	0.624	0.67	0.61	0.28	1.087	2.363	2.17	0.28
Vicia	hybrida	wild_sp	grey62	0.51	-0.32	0.736	0.64	0.57	0.32	1.124	2.018	1.80	0.28
Vicia	hybrida	wild_sp	grey62	0.61	-0.17	0.771	0.68	0.67	0.36	1.025	1.925	1.88	0.35
Vicia	hybrida	wild_sp	grey62	0.61	-0.17	0.762	0.70	0.66	0.36	1.056	1.951	1.85	0.34
Vicia	hybrida	wild_sp	grey62	0.66	-0.16	0.581	0.83	0.70	0.30	1.189	2.798	2.35	0.27
Vicia	hololasia	wild_sp	grey62	0.40	-0.45	0.91	0.51	0.47	0.36	1.094	1.402	1.28	0.33
Vicia	hololasia	wild_sp	grey62	0.41	-0.43	0.947	0.52	0.45	0.38	1.147	1.377	1.20	0.36
Vicia	hololasia	wild_sp	grey62	0.43	-0.43	0.817	0.54	0.51	0.33	1.052	1.652	1.57	0.30
Vicia	hololasia	wild_sp	grey62	0.41	-0.43	0.921	0.51	0.46	0.38	1.119	1.348	1.21	0.36
Vicia	hirsota	wild_sp	grey62	-0.19	-1.44	0.552	0.29	0.26	0.11	1.139	2.558	2.25	0.12
Vicia	hirsota	wild_sp	grey62	-0.37	-1.80	0.368	0.25	0.23	0.07	1.068	3.457	3.24	0.07
Vicia	hirsota	wild_sp	grey62	-0.10	-1.26	0.693	0.29	0.28	0.16	1.036	1.8	1.74	0.16
Vicia	hirsota	wild_sp	grey62	-0.16	-1.30	0.839	0.27	0.26	0.17	1.018	1.541	1.51	0.17
Vicia	hirsota	wild_sp	grey62	-0.21	-1.43	0.686	0.26	0.25	0.14	1.052	1.874	1.78	0.14
Vicia	hirsota	wild_sp	grey62	-0.26	-1.50	0.701	0.25	0.24	0.13	1.054	1.963	1.86	0.13
Vicia	hirsota	wild_sp	grey62	-0.24	-1.45	0.733	0.26	0.24	0.13	1.071	1.953	1.82	0.13
Vicia	cospidata	wild_sp	grey62	-0.07	-1.39	0.299	0.33	0.28	0.12	1.17	2.667	2.28	0.10
Vicia	cospidata	wild_sp	grey62	-0.08	-1.50	0.196	0.32	0.28	0.09	1.146	3.464	3.02	0.08
Vicia	cospidata	wild_sp	grey62	0.15	-1.08	0.275	0.39	0.35	0.16	1.106	2.477	2.24	0.15
Vicia	cospidata	wild_sp	grey62	-0.08	-1.45	0.256	0.33	0.29	0.11	1.148	2.945	2.57	0.10
Vicia	cospidata	wild_sp	grey62	0.06	-1.20	0.295	0.36	0.33	0.15	1.096	2.404	2.19	0.13
Vicia	lathyroides	wild_sp	grey62	-0.23	-1.45	0.692	0.23	0.22	0.18	1.039	1.308	1.26	0.15
Vicia	lathyroides	wild_sp	grey62	-0.22	-1.46	0.609	0.24	0.21	0.18	1.171	1.325	1.13	0.14
Vicia	lathyroides	wild_sp	grey62	-0.21	-1.41	0.691	0.23	0.21	0.20	1.078	1.152	1.07	0.16
Vicia	lathyroides	wild_sp	grey62	-0.17	-1.40	0.594	0.26	0.21	0.19	1.252	1.342	1.07	0.14
Vicia	lathyroides	wild_sp	grey62	-0.18	-1.41	0.595	0.24	0.23	0.18	1.082	1.344	1.24	0.14
Vicia	lathyroides	wild_sp	grey62	-0.16	-1.38	0.595	0.24	0.23	0.20	1.056	1.234	1.17	0.14
Vicia	lathyroides	wild_sp	grey62	-0.23	-1.51	0.54	0.24	0.22	0.16	1.107	1.498	1.35	0.12
Vicia	hyranica	wild_sp	grey62	0.62	-0.13	0.843	0.68	0.63	0.42	1.074	1.605	1.49	0.42
Vicia	hyrianica	wild_sp	grey62	0.66	-0.07	0.852	0.72	0.62	0.47	1.158	1.537	1.33	0.46
Vicia	hybrida	wild_sp	grey62	0.51	-0.30	0.818	0.62	0.52	0.38	1.197	1.635	1.37	0.35
Vicia	hyrianica	wild_sp	grey62	0.50	-0.33	0.779	0.60	0.56	0.33	1.074	1.823	1.70	0.32

Vicia	hyrianica	wild_sp	grey62	0.50	-0.37	0.658	0.64	0.55	0.30	1.172	2.156	1.84	0.28
Vicia	hybrida	wild_sp	grey62	0.54	-0.27	0.817	0.62	0.58	0.37	1.06	1.667	1.57	0.34
Vicia	hyrianica	wild_sp	grey62	0.64	-0.09	0.88	0.69	0.63	0.45	1.092	1.529	1.40	0.45
Vicia	iranica	wild_sp	grey62	0.48	-0.50	0.395	0.64	0.57	0.23	1.123	2.788	2.48	0.21
Vicia	lutea	wild_sp	grey62	0.47	-0.48	0.49	0.65	0.60	0.21	1.079	3.08	2.86	0.19
Vicia	melanops	wild_sp	grey62	0.50	-0.45	0.463	0.70	0.52	0.26	1.341	2.706	2.02	0.22
Vicia	melanops	wild_sp	grey62	0.51	-0.45	0.417	0.71	0.55	0.25	1.29	2.78	2.16	0.23
Vicia	lunata	wild_sp	grey62	0.22	-0.93	0.347	0.51	0.42	0.14	1.225	3.55	2.90	0.13
Vicia	lunata	wild_sp	grey62	0.21	-0.97	0.301	0.53	0.43	0.12	1.232	4.643	3.77	0.11
Vicia	lunata	wild_sp	grey62	0.16	-1.05	0.298	0.48	0.41	0.12	1.172	4.009	3.42	0.13
Vicia	lunata	wild_sp	grey62	0.19	-0.97	0.352	0.50	0.38	0.15	1.316	3.324	2.53	0.14
Vicia	lunata	wild_sp	grey62	0.21	-0.95	0.328	0.50	0.43	0.14	1.175	3.57	3.04	0.13
Vicia	lilacina	wild_sp	grey62	-0.11	-1.29	0.628	0.32	0.29	0.14	1.104	2.362	2.14	0.13
Vicia	lilacina	wild_sp	grey62	0.03	-1.03	0.808	0.35	0.32	0.21	1.105	1.675	1.52	0.20
Vicia	lilacina	wild_sp	grey62	-0.22	-1.51	0.485	0.26	0.25	0.11	1.042	2.305	2.21	0.11
Vicia	lilacina	wild_sp	grey62	-0.11	-1.28	0.684	0.33	0.28	0.14	1.167	2.383	2.04	0.13
Vicia	lathyroides	wild_sp	grey62	-0.18	-1.48	0.423	0.27	0.21	0.16	1.243	1.639	1.32	0.13
Vicia	lathyroides	wild_sp	grey62	-0.19	-1.51	0.394	0.22	0.21	0.18	1.043	1.224	1.17	0.12
Vicia	monathae	wild_sp	grey62	0.36	-0.52	0.881	0.46	0.42	0.38	1.097	1.2	1.09	0.32
Vicia	monathae	wild_sp	grey62	0.35	-0.51	0.932	0.45	0.42	0.40	1.068	1.12	1.05	0.38
Vicia	monathae	wild_sp	grey62	0.31	-0.59	0.859	0.44	0.41	0.35	1.066	1.259	1.18	0.31
Vicia	michaxii	wild_sp	grey62	0.56	-0.23	0.838	0.61	0.53	0.46	1.151	1.322	1.15	0.41
Vicia	monathae	wild_sp	grey62	0.31	-0.58	0.937	0.43	0.41	0.36	1.055	1.222	1.16	0.34
Vicia	monathae	wild_sp	grey62	0.32	-0.60	0.796	0.44	0.40	0.36	1.117	1.237	1.11	0.29
Vicia	michaxii	wild_sp	grey62	0.58	-0.20	0.85	0.61	0.56	0.46	1.092	1.333	1.22	0.41
Vicia	michaxii	wild_sp	grey62	0.47	-0.36	0.868	0.55	0.52	0.38	1.04	1.451	1.40	0.36
Vicia	michaxii	wild_sp	grey62	0.53	-0.24	0.939	0.58	0.56	0.42	1.039	1.384	1.33	0.42
Vicia	michaxii	wild_sp	grey62	0.60	-0.15	0.903	0.66	0.57	0.45	1.151	1.443	1.25	0.44
Vicia	michaxii	wild_sp	grey62	0.56	-0.21	0.928	0.59	0.56	0.45	1.057	1.307	1.24	0.43
Vicia	michaxii	wild_sp	grey62	0.60	-0.16	0.888	0.62	0.61	0.44	1.012	1.397	1.38	0.43
Vicia	michaxii	wild_sp	grey62	0.59	-0.16	0.914	0.64	0.58	0.45	1.107	1.409	1.27	0.46
Vicia	multiculis	wild_sp	grey62	0.10	-0.96	0.697	0.41	0.35	0.19	1.149	2.196	1.91	0.17
Vicia	multiculis	wild_sp	grey62	0.15	-0.85	0.811	0.41	0.36	0.23	1.14	1.746	1.53	0.22
Vicia	multiculis	wild_sp	grey62	0.15	-0.92	0.574	0.46	0.39	0.17	1.188	2.761	2.32	0.17
Vicia	multiculis	wild_sp	grey62	0.17	-0.93	0.505	0.44	0.37	0.18	1.183	2.409	2.04	0.18
Vicia	multiculis	wild_sp	grey62	0.13	-0.94	0.634	0.45	0.37	0.17	1.22	2.583	2.12	0.18
Vicia	monathae	wild_sp	grey62	0.38	-0.49	0.841	0.50	0.47	0.33	1.068	1.526	1.43	0.31
Vicia	monathae	wild_sp	grey62	0.38	-0.49	0.87	0.50	0.48	0.33	1.036	1.506	1.45	0.33
Vicia	monathae	wild_sp	grey62	0.34	-0.55	0.845	0.47	0.45	0.32	1.037	1.486	1.43	0.30
Vicia	noeana	wild_sp	grey62	0.45	-0.49	0.527	0.59	0.52	0.29	1.117	2.012	1.80	0.28
Vicia	noeana	wild_sp	grey62	0.47	-0.50	0.447	0.66	0.53	0.24	1.261	2.805	2.23	0.22
Vicia	onobrychioide	wild_sp	grey62	0.37	-0.56	0.681	0.61	0.45	0.25	1.355	2.499	1.84	0.23

Vicia	onobrychiode wild_sp	wild_sp	grey62	0.38	-0.60	0.518	0.65	0.47	0.20	1.386	3.19	2.30	0.21
Vicia	onobrychiode	wild_sp	grey62	0.33	-0.64	0.614	0.61	0.41	0.23	1.494	2.665	1.78	0.21
Vicia	palaestina	wild_sp	grey62	0.42	-0.46	0.77	0.54	0.52	0.31	1.038	1.749	1.69	0.28
Vicia	palaestina	wild_sp	grey62	0.38	-0.54	0.665	0.55	0.52	0.25	1.067	2.256	2.12	0.24
Vicia	palaestina	wild_sp	grey62	0.38	-0.55	0.634	0.53	0.50	0.27	1.045	1.981	1.90	0.24
Vicia	palaestina	wild_sp	grey62	0.46	-0.42	0.712	0.57	0.53	0.32	1.066	1.799	1.69	0.29
Vicia	palaestina	wild_sp	grey62	0.43	-0.44	0.738	0.56	0.54	0.29	1.052	1.933	1.84	0.28
Vicia	noeana	wild_sp	grey62	0.54	-0.46	0.317	0.71	0.66	0.19	1.074	3.655	3.40	0.19
Vicia	noeana	wild_sp	grey62	0.53	-0.41	0.452	0.69	0.56	0.26	1.237	2.602	2.10	0.25
Vicia	panonica	wild_sp	grey62	0.53	-0.35	0.607	0.65	0.56	0.31	1.147	2.06	1.80	0.29
Vicia	panonica	wild_sp	grey62	0.48	-0.43	0.544	0.62	0.57	0.27	1.091	2.3	2.11	0.25
Vicia	panonica	wild_sp	grey62	0.43	-0.55	0.439	0.59	0.50	0.26	1.189	2.289	1.93	0.21
Vicia	panonica	wild_sp	grey62	0.51	-0.30	0.834	0.61	0.54	0.36	1.132	1.695	1.50	0.34
Vicia	panonica	wild_sp	grey62	0.46	-0.37	0.859	0.56	0.49	0.38	1.143	1.472	1.29	0.34
Vicia	panonica	wild_sp	grey62	0.43	-0.42	0.836	0.55	0.51	0.33	1.091	1.672	1.53	0.33
Vicia	panonica	wild_sp	grey62	0.48	-0.34	0.834	0.58	0.53	0.35	1.098	1.651	1.50	0.34
Vicia	panonica	wild_sp	grey62	0.47	-0.36	0.865	0.55	0.50	0.40	1.097	1.38	1.26	0.35
Vicia	pesudocassubi	wild_sp	grey62	0.27	-0.70	0.703	0.45	0.40	0.28	1.13	1.617	1.43	0.26
Vicia	pesudocassubi	wild_sp	grey62	0.28	-0.66	0.802	0.43	0.38	0.34	1.118	1.274	1.14	0.29
Vicia	pesudocassubi	wild_sp	grey62	0.26	0.692	0.692	0.43	0.36	0.32	1.209	1.339	1.11	0.26
Vicia	pisiformis	wild_sp	grey62	0.50	-0.30	0.913	0.55	0.49	0.45	1.117	1.225	1.10	0.43
Vicia	pisiformis	wild_sp	grey62	0.49	-0.31	0.926	0.53	0.49	0.45	1.087	1.193	1.10	0.40
Vicia	pisiformis	wild_sp	grey62	0.63	-0.15	0.76	0.71	0.66	0.37	1.081	1.919	1.78	0.35
Vicia	pisiformis	wild_sp	grey62	0.62	-0.15	0.769	0.68	0.66	0.38	1.036	1.772	1.71	0.35
Vicia	pisiformis	wild_sp	grey62	0.61	-0.17	0.743	0.71	0.66	0.35	1.078	2.015	1.87	0.31
Vicia	picta	wild_sp	grey62	0.03	-1.08	0.636	0.37	0.33	0.17	1.128	2.202	1.95	0.15
Vicia	picta	wild_sp	grey62	0.03	-1.11	0.561	0.36	0.33	0.16	1.098	2.29	2.09	0.15
Vicia	picta	wild_sp	grey62	0.08	-1.00	0.659	0.35	0.33	0.21	1.049	1.639	1.56	0.20
Vicia	picta	wild_sp	grey62	-0.01	-1.22	0.442	0.33	0.30	0.16	1.122	2.026	1.81	0.13
Vicia	picta	wild_sp	grey62	0.11	-0.97	0.608	0.35	0.32	0.24	1.092	1.504	1.38	0.21
Vicia	picta	wild_sp	grey62	0.09	-0.97	0.708	0.35	0.33	0.23	1.073	1.56	1.45	0.20
Vicia	picta	wild_sp	grey62	0.12	-0.95	0.639	0.38	0.34	0.21	1.119	1.78	1.59	0.19
Vicia	persica	wild_sp	grey62	-0.05	-1.28	0.442	0.36	0.31	0.11	1.162	3.151	2.71	0.12
Vicia	persica	wild_sp	grey62	-0.16	-1.46	0.417	0.33	0.28	0.10	1.189	3.482	2.93	0.10
Vicia	persica	wild_sp	grey62	-0.02	-1.21	0.497	0.34	0.33	0.13	1.015	2.498	2.46	0.14
Vicia	persica	wild_sp	grey62	0.02	-1.26	0.288	0.39	0.38	0.09	1.012	4.068	4.02	0.09
Vicia	persica	wild_sp	grey62	-0.01	-1.23	0.428	0.38	0.33	0.12	1.125	3.098	2.76	0.11
vicia	pubscens	wild_sp	grey62	-0.42	-1.73	0.695	0.23	0.19	0.10	1.219	2.295	1.88	0.10
vicia	pubscens	wild_sp	grey62	-0.39	-1.67	0.768	0.23	0.20	0.11	1.122	1.983	1.77	0.11
vicia	pubscens	wild_sp	grey62	-0.42	-1.73	0.703	0.22	0.20	0.10	1.097	2.187	1.99	0.10

vicia	pubscens	wild_sp	grey62	-0.46	-1.81	0.635	0.22	0.19	0.09	1.134	2.449	2.16	0.08
vicia	pubscens	wild_sp	grey62	-0.43	-1.75	0.685	0.22	0.20	0.10	1.09	2.304	2.11	0.10
Vicia	pubscens	wild_sp	grey62	-0.63	-2.03	0.742	0.18	0.15	0.08	1.163	2.082	1.79	0.08
Vicia	pubscens	wild_sp	grey62	-0.56	-1.92	0.8	0.18	0.17	0.10	1.06	1.777	1.68	0.10
Vicia	pubscens	wild_sp	grey62	-0.60	-1.99	0.727	0.18	0.16	0.08	1.117	2.129	1.91	0.08
Vicia	pubscens	wild_sp	grey62	-0.57	-1.96	0.709	0.18	0.17	0.08	1.041	2.138	2.05	0.09
Vicia	pubscens	wild_sp	grey62	-0.56	-1.92	0.779	0.19	0.16	0.10	1.181	1.925	1.63	0.10
Vicia	alpestris	wild_sp	grey62	0.34	-0.59	0.743	0.55	0.43	0.27	1.272	2.052	1.61	0.25
Vicia	alpestris	wild_sp	grey62	0.42	-0.42	0.922	0.52	0.48	0.36	1.081	1.458	1.35	0.35
Vicia	alpestris	wild_sp	grey62	0.41	-0.42	0.94	0.48	0.46	0.41	1.049	1.165	1.11	0.40
Vicia	alpestris	wild_sp	grey62	0.44	-0.38	0.918	0.57	0.46	0.39	1.239	1.468	1.19	0.37
Vicia	alpestris	wild_sp	grey62	0.52	-0.33	0.683	0.67	0.47	0.36	1.421	1.838	1.29	0.36
Vicia	alpestris	wild_sp	grey62	0.42	-0.44	0.814	0.62	0.43	0.33	1.45	1.888	1.30	0.33
Vicia	alpestris	wild_sp	grey62	0.40	-0.46	0.839	0.60	0.41	0.34	1.47	1.79	1.22	0.33
Vicia	abbreviata	wild_sp	grey62	0.30	-0.59	0.931	0.46	0.38	0.36	1.19	1.276	1.07	0.34
Vicia	abbreviata	wild_sp	grey62	0.41	-0.48	0.712	0.65	0.43	0.29	1.509	2.202	1.46	0.28
Vicia	abbreviata	wild_sp	grey62	0.38	-0.50	0.836	0.58	0.40	0.33	1.46	1.753	1.20	0.32
Vicia	abbreviata	wild_sp	grey62	0.22	-0.90	0.386	0.50	0.42	0.18	1.181	2.84	2.41	0.17
Vicia	abbreviata	wild_sp	grey62	0.10	-0.95	0.719	0.39	0.30	0.24	1.306	1.622	1.24	0.22
Vicia	abbreviata	wild_sp	grey62	0.25	-0.74	0.646	0.44	0.43	0.25	1.011	1.763	1.74	0.21
Vicia	sericocarpa	wild_sp	grey62	0.55	-0.33	0.542	0.80	0.53	0.28	1.502	2.853	1.90	0.26
Vicia	sericocarpa	wild_sp	grey62	0.51	-0.41	0.484	0.73	0.54	0.26	1.354	2.849	2.10	0.24
Vicia	sericocarpa	wild_sp	grey62	0.55	-0.34	0.513	0.68	0.64	0.27	1.053	2.527	2.40	0.25
Vicia	sericocarpa	wild_sp	grey62	0.69	-0.05	0.77	0.77	0.68	0.41	1.139	1.891	1.66	0.37
Vicia	sericocarpa	wild_sp	grey62	0.66	-0.10	0.783	0.72	0.63	0.43	1.143	1.655	1.45	0.42
Vicia	sericocarpa	wild_sp	grey62	0.36	-0.60	0.585	0.60	0.48	0.22	1.246	2.738	2.20	0.21
Vicia	sericocarpa	wild_sp	grey62	0.30	-0.66	0.682	0.50	0.47	0.23	1.055	2.177	2.06	0.22
Vicia	sericocarpa	wild_sp	grey62	0.32	-0.65	0.648	0.54	0.46	0.22	1.177	2.418	2.05	0.22
Vicia	sericocarpa	wild_sp	grey62	0.41	-0.52	0.627	0.62	0.50	0.24	1.238	2.567	2.07	0.21
Vicia	sepium	wild_sp	grey62	0.23	-0.71	0.898	0.43	0.36	0.31	1.17	1.394	1.19	0.29
Vicia	sepium	wild_sp	grey62	0.41	-0.44	0.873	0.56	0.45	0.35	1.268	1.593	1.26	0.34
Vicia	sepium	wild_sp	grey62	0.53	-0.44	0.366	0.52	0.46	0.37	1.134	1.389	1.23	0.32
Vicia	sepium	wild_sp	grey62	0.25	-0.70	0.826	0.46	0.38	0.28	1.195	1.635	1.37	0.26
Vicia	sepium	wild_sp	grey62	0.20	-0.75	0.882	0.41	0.36	0.29	1.139	1.382	1.21	0.29
Vicia	sepium	wild_sp	grey62	0.27	-0.70	0.67	0.52	0.44	0.21	1.202	2.491	2.07	0.21
Vicia	sepium	wild_sp	grey62	0.29	-0.64	0.816	0.49	0.42	0.27	1.151	1.833	1.59	0.26
Vicia	sepium	wild_sp	grey62	0.32	-0.56	0.9	0.47	0.43	0.32	1.101	1.474	1.34	0.31
Vicia	sepium	wild_sp	grey62	0.36	-0.57	0.701	0.56	0.47	0.25	1.193	2.299	1.93	0.23
Vicia	sepium	wild_sp	grey62	0.21	-0.80	0.651	0.47	0.42	0.20	1.14	2.413	2.12	0.20
Vicia	serratifolia	wild_sp	grey62	0.67	-0.02	0.972	0.63	0.63	0.57	1.004	1.113	1.11	0.54
Vicia	serratifolia	wild_sp	grey62	0.70	0.01	0.981	0.65	0.62	0.61	1.05	1.07	1.02	0.55
Vicia	serratifolia	wild_sp	grey62	0.66	-0.05	0.956	0.64	0.61	0.55	1.055	1.178	1.12	0.49
Vicia	serratifolia	wild_sp	grey62	0.66	-0.05	0.941	0.65	0.62	0.54	1.038	1.196	1.15	0.52

Vicia	serratifolia	wild_sp	grey62	0.72	0.04	0.957	0.69	0.65	0.58	1.055	1.178	1.12	0.53
Vicia	serratifolia	wild_sp	grey62	0.72	0.04	0.946	0.69	0.66	0.58	1.038	1.196	1.15	0.56
Vicia	serratifolia	wild_sp	grey62	0.76	0.08	0.859	0.67	0.67	0.65	1.003	1.024	1.02	0.54
Vicia	serratifolia	wild_sp	grey62	0.74	0.06	0.917	0.71	0.64	0.62	1.109	1.142	1.03	0.56
Vicia	serratifolia	wild_sp	grey62	0.70	-0.01	0.855	0.73	0.66	0.50	1.095	1.444	1.32	0.47
Vicia	tenuissima	wild_sp	grey62	-0.34	-1.64	0.647	0.24	0.22	0.10	1.094	2.362	2.16	0.11
Vicia	tenuissima	wild_sp	grey62	-0.41	-1.77	0.556	0.23	0.22	0.08	1.033	2.658	2.57	0.08
Vicia	tenuissima	wild_sp	grey62	-0.35	-1.63	0.683	0.23	0.22	0.11	1.042	2.164	2.08	0.11
Vicia	tenuissima	wild_sp	grey62	-0.57	-2.06	0.424	0.20	0.19	0.06	1.03	3.479	3.38	0.06
Vicia	tenuissima	wild_sp	grey62	-0.54	-1.96	0.562	0.20	0.19	0.07	1.054	2.763	2.62	0.07
Vicia	tenuissima	wild_sp	grey62	-0.52	-1.97	0.452	0.21	0.20	0.06	1.046	3.283	3.14	0.06
Vicia	tenuissima	wild_sp	grey62	-0.50	-1.90	0.563	0.21	0.20	0.07	1.05	2.764	2.63	0.07
Vicia	tenuissima	wild_sp	grey62	-0.53	-1.96	0.538	0.20	0.19	0.07	1.053	2.836	2.69	0.07
Vicia	tenuissima	wild_sp	grey62	-0.55	-2.05	0.42	0.20	0.19	0.06	1.059	3.364	3.18	0.06
Vicia	tenuissima	wild_sp	grey62	-0.41	-1.66	0.969	0.19	0.19	0.15	1.026	1.27	1.24	0.15
Vicia	tenuissima	wild_sp	grey62	-0.53	-1.91	0.647	0.20	0.18	0.08	1.088	2.372	2.18	0.08
Vicia	tenuissima	wild_sp	grey62	-0.43	-1.74	0.75	0.20	0.19	0.11	1.048	1.844	1.76	0.11
Vicia	tenuissima	wild_sp	grey62	-0.54	-1.95	0.594	0.20	0.18	0.08	1.119	2.599	2.32	0.07
Vicia	tenuissima	wild_sp	grey62	-0.43	-1.72	0.794	0.21	0.19	0.12	1.109	1.771	1.60	0.12
Vicia	tenuissima	wild_sp	grey62	-0.41	-1.68	0.841	0.20	0.20	0.12	1.024	1.67	1.63	0.13
Vicia	tenuissima	wild_sp	grey62	-0.56	-2.04	0.447	0.21	0.18	0.06	1.147	3.48	3.03	0.06
Vicia	tenuissima	wild_sp	grey62	-0.52	-1.93	0.563	0.20	0.19	0.08	1.095	2.717	2.48	0.08
Vicia	tenuifolia	wild_sp	grey62	0.21	-0.77	0.773	0.48	0.37	0.23	1.318	2.099	1.59	0.23
Vicia	tenuifolia	wild_sp	grey62	0.22	-0.75	0.782	0.52	0.34	0.24	1.503	2.17	1.44	0.24
Vicia	tenuifolia4	wild_sp	grey62	0.25	-0.76	0.618	0.49	0.43	0.20	1.125	2.388	2.12	0.21
Vicia	tenuifolia	wild_sp	grey62	0.18	-0.79	0.896	0.43	0.34	0.27	1.249	1.593	1.28	0.26
Vicia	tenuifolia	wild_sp	grey62	0.37	-0.56	0.684	0.58	0.48	0.24	1.213	2.393	1.97	0.23
Vicia	tenuifolia	wild_sp	grey62	0.34	-0.59	0.723	0.51	0.50	0.25	1.023	2.052	2.01	0.23
Vicia	tenuifolia	wild_sp	grey62	0.26	-0.72	0.668	0.48	0.45	0.21	1.053	2.229	2.12	0.20
Vicia	tenuifolia	wild_sp	grey62	0.30	-0.63	0.808	0.48	0.45	0.26	1.061	1.856	1.75	0.24
Vicia	sylvatica	wild_sp	grey62	0.41	-0.48	0.705	0.57	0.51	0.28	1.132	2.078	1.84	0.26
Vicia	sylvatica	wild_sp	grey62	0.38	-0.51	0.81	0.55	0.46	0.30	1.189	1.823	1.53	0.29
Vicia	sylvatica	wild_sp	grey62	0.41	-0.46	0.798	0.56	0.49	0.31	1.152	1.798	1.56	0.28
Vicia	sylvatica	wild_sp	grey62	0.39	-0.47	0.865	0.51	0.48	0.34	1.074	1.52	1.42	0.32
Vicia	sylvatica	wild_sp	grey62	0.41	-0.55	0.552	0.59	0.53	0.22	1.111	2.667	2.40	0.20
Vicia	sibthorpii	wild_sp	grey62	0.24	-0.83	0.47	0.53	0.42	0.17	1.266	3.181	2.51	0.17
Vicia	sibthorpii	wild_sp	grey62	0.22	-0.81	0.574	0.51	0.42	0.18	1.216	2.847	2.34	0.16
Vicia	sibthorpii	wild_sp	grey62	0.20	-0.84	0.589	0.48	0.41	0.18	1.179	2.63	2.23	0.19
Vicia	sibthorpii	wild_sp	grey62	0.07	-1.03	0.605	0.39	0.33	0.19	1.193	2.046	1.72	0.16
Vicia	sicula	wild_sp	grey62	0.15	-0.95	0.511	0.45	0.42	0.15	1.073	3.058	2.85	0.14
Vicia	sicula	wild_sp	grey62	0.06	-1.24	0.248	0.45	0.38	0.10	1.194	4.391	3.68	0.09
Vicia	varia	wild_sp	grey62	0.43	-0.40	0.908	0.49	0.48	0.41	1.019	1.217	1.19	0.39
Vicia	varia	wild_sp	grey62	0.33	-0.55	0.901	0.44	0.41	0.38	1.08	1.178	1.09	0.35

Vicia	varia	wild_sp	grey62	0.40	-0.45	0.889	0.50	0.46	0.37	1.069	1.348	1.26	0.34
Vicia	varia	wild_sp	grey62	0.42	-0.41	0.914	0.51	0.47	0.39	1.085	1.291	1.19	0.38
Vicia	varia	wild_sp	grey62	0.36	-0.51	0.913	0.45	0.44	0.37	1.032	1.208	1.17	0.33
Vicia	truncatula	wild_sp	grey62	0.37	-0.71	0.327	0.60	0.55	0.17	1.095	3.616	3.30	0.14
Vicia	truncatula	wild_sp	grey62	0.36	-0.75	0.292	0.63	0.51	0.16	1.236	4.008	3.24	0.14
Vicia	truncatula	wild_sp	grey62	0.35	-0.75	0.309	0.61	0.50	0.15	1.209	4.013	3.32	0.14
Vicia	truncatula	wild_sp	grey62	0.39	-0.77	0.211	0.60	0.58	0.15	1.033	3.872	3.75	0.12
Vicia	truncatula	wild_sp	grey62	0.23	-0.88	0.397	0.52	0.44	0.15	1.165	3.337	2.86	0.15
Vicia	truncatula	wild_sp	grey62	0.16	-0.85	0.759	0.43	0.39	0.21	1.105	2.032	1.84	0.20
Vicia	truncatula	wild_sp	grey62	0.22	-0.74	0.814	0.42	0.40	0.26	1.061	1.603	1.51	0.24
Vicia	truncatula	wild_sp	grey62	0.14	-0.86	0.832	0.41	0.34	0.24	1.192	1.68	1.41	0.22
Vicia	truncatula	wild_sp	grey62	0.25	-0.73	0.702	0.47	0.44	0.22	1.068	2.198	2.06	0.21
Vicia	truncatula	wild_sp	grey62	0.27	-0.72	0.636	0.51	0.45	0.20	1.131	2.51	2.22	0.20
Vicia	truncatula	wild_sp	grey62	0.24	-0.72	0.818	0.46	0.41	0.25	1.112	1.861	1.67	0.24
Vicia	tetrasperma	wild_sp	grey62	-0.37	-1.69	0.616	0.24	0.22	0.09	1.095	2.577	2.35	0.09
Vicia	tetrasperma	wild_sp	grey62	-0.27	-1.51	0.701	0.27	0.24	0.12	1.152	2.35	2.04	0.11
Vicia	tetrasperma	wild_sp	grey62	-0.10	-1.23	0.794	0.31	0.29	0.16	1.074	1.903	1.77	0.15
Vicia	tetrasperma	wild_sp	grey62	-0.16	-1.31	0.78	0.32	0.24	0.16	1.325	2.005	1.51	0.15
Vicia	tetrasperma	wild_sp	grey62	-0.22	-1.39	0.859	0.26	0.25	0.15	1.035	1.679	1.62	0.14
Vicia	tetrasperma	wild_sp	grey62	-0.29	-1.48	0.941	0.23	0.21	0.17	1.105	1.378	1.25	0.16
Vicia	tetrasperma	wild_sp	grey62	-0.29	-1.48	0.927	0.23	0.21	0.16	1.097	1.461	1.33	0.15
Vicia	tetrasperma	wild_sp	grey62	-0.30	-1.51	0.879	0.23	0.23	0.14	1.016	1.583	1.56	0.14
Vicia	tetrasperma	wild_sp	grey62	-0.36	-1.62	0.783	0.23	0.21	0.12	1.056	1.898	1.80	0.12
Vicia	tetrasperma	wild_sp	grey62	-0.30	-1.50	0.894	0.23	0.22	0.15	1.058	1.55	1.47	0.15
Vicia	villosa	wild_sp	grey62	0.11	-0.96	0.625	0.41	0.38	0.17	1.07	2.405	2.25	0.18
Vicia	villosa	wild_sp	grey62	0.14	-0.88	0.712	0.44	0.36	0.20	1.211	2.126	1.76	0.19
Vicia	villosa	wild_sp	grey62	0.13	-0.90	0.719	0.44	0.35	0.20	1.257	2.232	1.78	0.18
Vicia	villosa	wild_sp	grey62	0.15	-0.88	0.699	0.42	0.38	0.20	1.083	2.04	1.88	0.19
Vicia	villosa	wild_sp	grey62	0.33	-0.70	0.454	0.55	0.49	0.20	1.119	2.816	2.52	0.17
Vicia	villosa	wild_sp	grey62	0.22	-0.79	0.676	0.46	0.43	0.20	1.072	2.273	2.12	0.20
Vicia	villosa	wild_sp	grey62	0.41	-0.65	0.341	0.60	0.54	0.18	1.114	3.294	2.96	0.17
Vicia	variabilis	wild_sp	grey62	0.57	-0.20	0.88	0.69	0.55	0.40	1.254	1.711	1.37	0.39
Vicia	variegata	wild_sp	grey62	0.63	-0.19	0.597	0.80	0.69	0.28	1.172	2.83	2.42	0.27
Vicia	variegata	wild_sp	grey62	0.57	-0.28	0.601	0.69	0.67	0.28	1.018	2.449	2.41	0.26
Vicia	variabilis	wild_sp	grey62	0.59	-0.16	0.894	0.73	0.52	0.44	1.421	1.68	1.18	0.42
Vicia	variabilis	wild_sp	grey62	0.58	-0.17	0.92	0.69	0.51	0.46	1.35	1.501	1.11	0.44
Vicia	variabilis	wild_sp	grey62	0.56	-0.23	0.814	0.70	0.51	0.40	1.357	1.749	1.29	0.40
Vicia	variabilis	wild_sp	grey62	0.60	-0.19	0.758	0.72	0.52	0.42	1.368	1.722	1.26	0.42
Vicia	variabilis	wild_sp	grey62	0.50	-0.55	0.277	0.75	0.60	0.16	1.265	4.831	3.82	0.17
Vicia	variabilis	wild_sp	grey62	0.32	-0.95	0.156	0.57	0.54	0.12	1.044	4.573	4.38	0.11
Vicia	variabilis	wild_sp	grey62	0.50	-0.38	0.606	0.63	0.56	0.29	1.127	2.211	1.96	0.25
Vicia	variabilis	wild_sp	grey62	0.43	-0.49	0.611	0.61	0.50	0.26	1.215	2.379	1.96	0.26
Vicia	variabilis	wild_sp	grey62	0.19	-0.84	0.634	0.43	0.37	0.23	1.148	1.895	1.65	0.21

Vicia	variabilis	wild_sp	grey62	0.24	-0.78	0.588	0.50	0.37	0.22	1.368	2.264	1.66	0.21
Vicia	variabilis	wild_sp	grey62	0.29	-0.68	0.67	0.52	0.40	0.25	1.312	2.113	1.61	0.24
Vicia	variabilis	wild_sp	grey62	0.36	-0.52	0.876	0.52	0.45	0.31	1.149	1.673	1.46	0.29
Vicia	variabilis	wild_sp	grey62	0.23	-0.85	0.476	0.52	0.33	0.21	1.553	2.49	1.60	0.20
Vicia	anatolica	wild_sp	grey62	0.51	-0.30	0.852	0.60	0.52	0.38	1.142	1.556	1.36	0.36
Vicia	anatolica	wild_sp	grey62	0.43	-0.40	0.888	0.51	0.49	0.40	1.043	1.271	1.22	0.39
Vicia	anatolica	wild_sp	grey62	0.52	-0.30	0.821	0.61	0.55	0.37	1.099	1.643	1.49	0.33
Vicia	anatolica	wild_sp	grey62	0.52	-0.28	0.865	0.59	0.54	0.41	1.091	1.453	1.33	0.40
Vicia	anatolica	wild_sp	grey62	0.49	-0.34	0.786	0.58	0.57	0.34	1.029	1.72	1.67	0.34
Vicia	anatolica	wild_sp	grey62	0.41	-0.44	0.888	0.53	0.46	0.36	1.168	1.484	1.27	0.35
Vicia	anatolica	wild_sp	grey62	0.37	-0.53	0.746	0.54	0.47	0.29	1.14	1.889	1.66	0.28
Vicia	amphicarpa	wild_sp	grey62	0.50	-0.28	0.964	0.56	0.52	0.43	1.078	1.297	1.20	0.42
Vicia	anatolia	wild_sp	grey62	0.41	-0.43	0.933	0.52	0.48	0.36	1.079	1.434	1.33	0.34
Vicia	akhmaganica l	wild_sp	grey62	0.48	-0.63	0.229	0.66	0.58	0.19	1.152	3.557	3.09	0.17
Vicia	akhmaganica l	wild_sp	grey62	0.12	-1.03	0.436	0.42	0.38	0.14	1.129	2.965	2.63	0.16
Vicia	bithynica	wild_sp	grey62	0.29	-0.64	0.807	0.49	0.41	0.28	1.192	1.772	1.49	0.26
Vicia	bithynica	wild_sp	grey62	0.27	-0.69	0.711	0.48	0.44	0.23	1.102	2.069	1.88	0.23
Vicia	bithynica	wild_sp	grey62	0.29	-0.63	0.845	0.48	0.41	0.28	1.166	1.697	1.46	0.27
Vicia	bithynica	wild_sp	grey62	0.51	-0.28	0.914	0.55	0.54	0.43	1.029	1.274	1.24	0.42
Vicia	bithynica	wild_sp	grey62	0.49	-0.32	0.851	0.54	0.47	0.45	1.139	1.195	1.05	0.43
Vicia	bithynica	wild_sp	grey62	0.51	-0.26	0.966	0.54	0.49	0.49	1.096	1.115	1.02	0.46
Vicia	balansae	wild_sp	grey62	0.53	-0.27	0.834	0.64	0.49	0.41	1.302	1.562	1.20	0.40
Vicia	balansae	wild_sp	grey62	0.46	-0.40	0.762	0.61	0.47	0.34	1.29	1.761	1.37	0.32
Vicia	balansae	wild_sp	grey62	0.56	-0.24	0.769	0.65	0.54	0.39	1.205	1.655	1.37	0.39
Vicia	balansae	wild_sp	grey62	0.43	-0.49	0.628	0.61	0.49	0.28	1.248	2.187	1.75	0.27
Vicia	balansae	wild_sp	grey62	0.48	-0.53	0.36	0.59	0.52	0.29	1.119	2.048	1.83	0.22
Vicia	balansae	wild_sp	grey62	0.47	-0.54	0.365	0.57	0.44	0.32	1.275	1.746	1.37	0.23
Vicia	balansae	wild_sp	grey62	0.49	-0.56	0.302	0.63	0.51	0.25	1.233	2.517	2.04	0.20
Vicia	balansae	wild_sp	grey62	0.45	-0.56	0.388	0.61	0.52	0.23	1.158	2.635	2.28	0.21
Vicia	balansae	wild_sp	grey62	0.34	-0.61	0.643	0.51	0.48	0.25	1.049	2.036	1.94	0.24
Vicia	balansae	wild_sp	grey62	0.36	-0.65	0.463	0.53	0.45	0.25	1.161	2.12	1.83	0.21
Vicia	balansae	wild_sp	grey62	0.26	-0.73	0.632	0.50	0.43	0.21	1.162	2.442	2.10	0.19
Vicia	balansae	wild_sp	grey62	0.22	-0.75	0.776	0.44	0.39	0.25	1.139	1.743	1.53	0.25
Vicia	articulata	wild_sp	grey62	-0.21	-1.37	0.856	0.26	0.24	0.17	1.124	1.596	1.42	0.16
Vicia	articulata	wild_sp	grey62	-0.20	-1.42	0.633	0.29	0.27	0.12	1.059	2.332	2.20	0.11
Vicia	articulata	wild_sp	grey62	-0.36	-1.63	0.765	0.23	0.20	0.12	1.164	1.882	1.62	0.12
Vicia	articulata	wild_sp	grey62	-0.23	-1.43	0.749	0.28	0.24	0.14	1.154	1.981	1.72	0.13
Vicia	articulata	wild_sp	grey62	-0.16	-1.31	0.818	0.27	0.25	0.17	1.084	1.597	1.47	0.16
Vicia	articulata	wild_sp	grey62	-0.50	-1.88	0.604	0.21	0.17	0.09	1.217	2.292	1.88	0.09
Vicia	articulata	wild_sp	grey62	-0.34	-1.60	0.76	0.24	0.21	0.12	1.185	2.007	1.69	0.12
Vicia	articulata	wild_sp	grey62	-0.25	-1.46	0.756	0.26	0.25	0.13	1.057	1.979	1.87	0.13

Vicia	articulata	wild_sp	grey62	-0.20	-1.43	0.617	0.28	0.26	0.13	1.104	2.187	1.98	0.13
Vicia	articulata	wild_sp	grey62	-0.38	-1.66	0.767	0.23	0.20	0.12	1.139	1.995	1.75	0.11
Vicia	canscens	wild_sp	grey62	0.44	-0.50	0.549	0.61	0.52	0.26	1.165	2.337	2.01	0.24
Vicia	canscens	wild_sp	grey62	0.52	-0.27	0.939	0.56	0.54	0.44	1.034	1.276	1.23	0.43
Vicia	cappadocia	wild_sp	grey62	0.28	-0.62	0.919	0.45	0.41	0.30	1.092	1.49	1.37	0.29
Vicia	cappadocia	wild_sp	grey62	0.27	-0.63	0.948	0.43	0.39	0.34	1.084	1.269	1.17	0.32
Vicia	cappadocia	wild_sp	grey62	0.19	-0.77	0.87	0.39	0.38	0.27	1.033	1.464	1.42	0.26
Vicia	cappadocia	wild_sp	grey62	0.17	-0.79	0.901	0.40	0.37	0.26	1.077	1.522	1.41	0.25
Vicia	cappadocia	wild_sp	grey62	0.16	-0.84	0.783	0.40	0.39	0.23	1.032	1.758	1.70	0.22
Vicia	cappadocia	wild_sp	grey62	0.23	-0.71	0.883	0.43	0.39	0.28	1.095	1.519	1.39	0.26
Vicia	cappadocia	wild_sp	grey62	0.26	-0.69	0.768	0.45	0.41	0.27	1.09	1.677	1.54	0.26
Vicia	cappadocia	wild_sp	grey62	0.13	-0.88	0.82	0.40	0.35	0.23	1.155	1.76	1.52	0.22
Vicia	cappadocia	wild_sp	grey62	0.20	-0.75	0.872	0.40	0.37	0.29	1.083	1.362	1.26	0.26
Vicia	canscens	wild_sp	grey62	0.69	-0.13	0.55	0.86	0.72	0.29	1.188	2.954	2.49	0.27
Vicia	canscens	wild_sp	grey62	0.75	-0.01	0.63	0.90	0.75	0.35	1.201	2.589	2.16	0.35
Vicia	canscens	wild_sp	grey62	0.70	-0.03	0.77	0.82	0.68	0.40	1.203	2.029	1.69	0.37
Vicia	canscens	wild_sp	grey62	0.71	-0.04	0.662	0.87	0.71	0.35	1.219	2.472	2.03	0.33
Vicia	caesarea	wild_sp	grey62	0.38	-0.49	0.813	0.55	0.45	0.31	1.224	1.759	1.44	0.32
Vicia	caesarea	wild_sp	grey62	0.44	-0.42	0.755	0.65	0.44	0.32	1.478	2.055	1.39	0.33
Vicia	caesarea	wild_sp	grey62	0.38	-0.49	0.835	0.53	0.46	0.32	1.164	1.682	1.45	0.33
Vicia	caesarea	wild_sp	grey62	0.39	-0.48	0.829	0.54	0.46	0.32	1.16	1.668	1.44	0.33
Vicia	caesarea	wild_sp	grey62	0.38	-0.51	0.767	0.57	0.44	0.30	1.276	1.921	1.51	0.31
Vicia	biennis	wild_sp	grey62	0.23	-0.70	0.94	0.39	0.35	0.35	1.12	1.141	1.02	0.32
Vicia	biennis	wild_sp	grey62	0.23	-0.71	0.919	0.40	0.37	0.32	1.077	1.225	1.14	0.32
Vicia	biennis	wild_sp	grey62	0.17	-0.79	0.949	0.37	0.34	0.31	1.091	1.184	1.09	0.30
Vicia	biennis	wild_sp	grey62	0.16	-0.79	0.971	0.35	0.34	0.33	1.038	1.086	1.05	0.31
Vicia	biennis	wild_sp	grey62	0.22	-0.70	0.97	0.38	0.36	0.35	1.044	1.087	1.04	0.33
Vicia	bithynica	wild_sp	grey62	0.36	-0.53	0.818	0.51	0.41	0.35	1.254	1.478	1.18	0.32
Vicia	barbazitae	wild_sp	grey62	0.53	-0.24	0.944	0.53	0.52	0.50	1.026	1.076	1.05	0.47
Vicia	barbazitae	wild_sp	grey62	0.52	-0.25	0.935	0.53	0.51	0.49	1.025	1.074	1.05	0.47
Vicia	biennis	wild_sp	grey62	0.17	-0.78	0.951	0.38	0.35	0.30	1.083	1.258	1.16	0.29
Vicia	biennis	wild_sp	grey62	0.25	-0.66	0.939	0.39	0.38	0.35	1.038	1.106	1.07	0.33
Vicia	biennis	wild_sp	grey62	0.28	-0.64	0.902	0.42	0.40	0.33	1.05	1.273	1.21	0.32
Vicia	biennis	wild_sp	grey62	0.29	-0.61	0.943	0.41	0.39	0.36	1.048	1.142	1.09	0.34
Vicia	biennis	wild_sp	grey62	0.23	-0.69	0.967	0.38	0.37	0.35	1.016	1.095	1.08	0.33
Vicia	ciliatula	wild_sp	grey62	0.16	-1.21	0.141	0.47	0.43	0.09	1.087	5.279	4.86	0.09
Vicia	ciliatula	wild_sp	grey62	0.06	-1.35	0.148	0.44	0.36	0.08	1.216	5.694	4.68	0.07
Vicia	circeroidea	wild_sp	grey62	0.20	-0.77	0.855	0.42	0.39	0.26	1.092	1.642	1.50	0.26
Vicia	circeroidea	wild_sp	grey62	0.21	-0.82	0.632	0.48	0.41	0.19	1.146	2.479	2.16	0.20
Vicia	ciceroidea	wild_sp	grey62	0.21	-0.81	0.65	0.49	0.40	0.19	1.22	2.58	2.12	0.19
Vicia	ciceroidea	wild_sp	grey62	0.10	-1.01	0.545	0.44	0.37	0.15	1.195	2.986	2.50	0.15
Vicia	ciceroidea	wild_sp	grey62	0.04	-1.47	0.097	0.46	0.37	0.10	1.252	4.611	3.68	0.08
Vicia	cassubica	wild_sp	grey62	0.27	-0.64	0.925	0.46	0.38	0.31	1.204	1.473	1.22	0.31

Vicia	cassubica	wild_sp	grey62	0.23	-0.71	0.876	0.46	0.34	0.29	1.358	1.586	1.17	0.28
Vicia	cassubica	wild_sp	grey62	0.32	-0.69	0.525	0.56	0.48	0.18	1.151	3.023	2.63	0.18
Vicia	cassia	wild_sp	grey62	-0.04	-1.34	0.31	0.39	0.34	0.09	1.12	4.361	3.90	0.08
Vicia	cassia	wild_sp	grey62	-0.04	-1.24	0.485	0.36	0.33	0.12	1.108	3.025	2.73	0.12
Vicia	cassia	wild_sp	grey62	-0.05	-1.25	0.517	0.35	0.33	0.12	1.063	2.869	2.70	0.12
Vicia	cassia	wild_sp	grey62	-0.04	-1.24	0.496	0.36	0.34	0.12	1.053	3.058	2.91	0.11
Vicia	cassia	wild_sp	grey62	-0.03	-1.37	0.245	0.39	0.35	0.10	1.101	3.97	3.61	0.08
Vicia	cassubica	wild_sp	grey62	-0.49	-2.00	0.329	0.24	0.14	0.08	1.672	2.95	1.76	0.08
Vicia	crocea	wild_sp	grey62	0.31	-0.57	0.939	0.47	0.42	0.33	1.112	1.41	1.27	0.29
Vicia	crocea	wild_sp	grey62	0.32	-0.57	0.915	0.48	0.40	0.34	1.212	1.432	1.18	0.31
Vicia	crocea	wild_sp	grey62	0.32	-0.57	0.888	0.48	0.44	0.31	1.086	1.525	1.41	0.32
Vicia	crocea	wild_sp	grey62	0.34	-0.54	0.915	0.50	0.41	0.34	1.205	1.455	1.21	0.34
Vicia	crocea	wild_sp	grey62	0.30	-0.60	0.922	0.47	0.37	0.34	1.265	1.375	1.09	0.34
Vicia	cretica	wild_sp	grey62	0.13	-0.86	0.927	0.37	0.35	0.26	1.04	1.424	1.37	0.24
Vicia	cretica	wild_sp	grey62	0.01	-1.06	0.817	0.35	0.31	0.19	1.102	1.797	1.63	0.19
Vicia	cretica	wild_sp	grey62	0.15	-0.83	0.857	0.40	0.38	0.24	1.042	1.673	1.61	0.24
Vicia	cretica	wild_sp	grey62	0.00	-1.04	0.906	0.33	0.31	0.21	1.05	1.541	1.47	0.22
Vicia	cretica	wild_sp	grey62	-0.03	-1.11	0.854	0.33	0.31	0.19	1.061	1.741	1.64	0.18
Vicia	cretica	wild_sp	grey62	-0.04	-1.17	0.667	0.35	0.32	0.14	1.077	2.402	2.23	0.14
Vicia	cretica	wild_sp	grey62	-0.13	-1.29	0.716	0.31	0.28	0.14	1.077	2.164	2.01	0.14
Vicia	cretica	wild_sp	grey62	-0.12	-1.27	0.762	0.30	0.29	0.15	1.035	2.005	1.94	0.15
Vicia	cretica	wild_sp	grey62	-0.04	-1.22	0.561	0.35	0.33	0.13	1.056	2.62	2.48	0.14
Vicia	cretica	wild_sp	grey62	-0.03	-1.20	0.543	0.35	0.33	0.14	1.061	2.553	2.41	0.12
Vicia	crocea	wild_sp	grey62	0.30	-0.75	0.456	0.48	0.45	0.24	1.069	1.959	1.83	0.18
Vicia	crocea	wild_sp	grey62	0.27	-0.77	0.516	0.47	0.35	0.29	1.364	1.645	1.21	0.21
Vicia	crocea	wild_sp	grey62	-0.03	-1.16	0.654	0.35	0.32	0.15	1.088	2.345	2.16	0.15
Vicia	crocea	wild_sp	grey62	0.03	-1.04	0.759	0.36	0.33	0.18	1.092	1.99	1.82	0.18
Vicia	crocea	wild_sp	grey62	0.01	-1.14	0.564	0.37	0.34	0.14	1.106	2.69	2.43	0.14
Vicia	cracca	wild_sp	grey62	0.31	-0.65	0.644	0.59	0.41	0.23	1.438	2.59	1.80	0.24
Vicia	cracca	wild_sp	grey62	0.29	-0.64	0.826	0.53	0.39	0.27	1.351	1.971	1.46	0.26
Vicia	cracca	wild_sp	grey62	0.25	-0.74	0.695	0.51	0.40	0.23	1.286	2.266	1.76	0.23
Vicia	cracca	wild_sp	grey62	0.19	-0.82	0.697	0.49	0.38	0.20	1.3	2.434	1.87	0.20
Vicia	cracca	wild_sp	grey62	0.23	-0.80	0.57	0.50	0.43	0.19	1.165	2.618	2.25	0.19
Vicia	cracca	wild_sp	grey62	0.45	-0.37	0.937	0.56	0.46	0.39	1.223	1.423	1.16	0.40
Vicia	cracca	wild_sp	grey62	0.45	-0.37	0.904	0.53	0.46	0.41	1.138	1.276	1.12	0.40
Vicia	cracca	wild_sp	grey62	0.48	-0.31	0.955	0.57	0.50	0.41	1.147	1.374	1.20	0.39
Vicia	cracca	wild_sp	grey62	0.51	-0.26	0.967	0.56	0.51	0.45	1.103	1.255	1.14	0.44
Vicia	cracca	wild_sp	grey62	0.18	-0.78	0.903	0.37	0.34	0.32	1.068	1.154	1.08	0.31
Vicia	cracca	wild_sp	grey62	0.13	-0.86	0.917	0.35	0.32	0.30	1.084	1.137	1.05	0.29
Vicia	cracca	wild_sp	grey62	0.19	-0.76	0.944	0.42	0.34	0.30	1.226	1.409	1.15	0.30
Vicia	cracca	wild_sp	grey62	0.18	-0.76	0.99	0.37	0.35	0.33	1.073	1.138	1.06	0.31
Vicia	cracca	wild_sp	grey62	0.19	-0.75	0.961	0.40	0.35	0.30	1.17	1.338	1.14	0.30
Vicia	cracca	wild_sp	grey62	0.16	-0.78	0.989	0.36	0.35	0.32	1.042	1.14	1.10	0.31

Vicia	cracca	wild_sp	grey62	0.03	-1.00	0.935	0.33	0.31	0.23	1.058	1.427	1.35	0.22
Vicia	cracca	wild_sp	grey62	0.15	-0.85	0.798	0.44	0.36	0.22	1.23	2.011	1.64	0.22
Vicia	cracca	wild_sp	grey62	0.16	-0.86	0.736	0.44	0.38	0.20	1.141	2.174	1.91	0.20
Vicia	cracca	wild_sp	grey62	0.14	-0.86	0.792	0.41	0.38	0.21	1.105	1.944	1.76	0.19
Vicia	cracca	wild_sp	grey62	0.10	-0.92	0.82	0.40	0.35	0.21	1.131	1.874	1.66	0.21
Vicia	cracca	wild_sp	grey62	0.08	-0.95	0.846	0.36	0.33	0.23	1.102	1.608	1.46	0.22
Vicia	cuspidata	wild_sp	grey62	0.29	-0.61	0.931	0.43	0.39	0.36	1.105	1.176	1.07	0.33
Vicia	cuspidata	wild_sp	grey62	0.25	-0.67	0.913	0.41	0.37	0.35	1.091	1.161	1.07	0.32
Vicia	cuspidata	wild_sp	grey62	0.18	-0.82	0.734	0.38	0.36	0.29	1.045	1.322	1.26	0.24
Vicia	cuspidata	wild_sp	grey62	0.28	-0.63	0.908	0.42	0.39	0.36	1.07	1.169	1.09	0.33
Vicia	cuspidata	wild_sp	grey62	0.14	-0.87	0.742	0.37	0.35	0.26	1.043	1.41	1.35	0.22
Vicia	cuspidata	wild_sp	grey62	0.22	-0.73	0.873	0.39	0.36	0.33	1.09	1.178	1.08	0.29
Vicia	cuspidata	wild_sp	grey62	0.29	-0.61	0.922	0.45	0.40	0.34	1.119	1.331	1.19	0.33
Vicia	cuspidata	wild_sp	grey62	0.23	-0.72	0.816	0.42	0.38	0.31	1.113	1.358	1.22	0.29
Vicia	dasycarpa	wild_sp	grey62	0.50	-0.34	0.734	0.66	0.53	0.31	1.241	2.114	1.70	0.32
Vicia	dasycarpa	wild_sp	grey62	0.61	-0.15	0.857	0.65	0.55	0.48	1.181	1.349	1.14	0.43
Vicia	dasycarpa	wild_sp	grey62	0.52	-0.28	0.878	0.64	0.51	0.38	1.26	1.675	1.33	0.38
Vicia	dasycarpa	wild_sp	grey62	0.57	-0.19	0.886	0.69	0.54	0.41	1.264	1.655	1.31	0.40
Vicia	dasycarpa	wild_sp	grey62	0.61	-0.15	0.847	0.66	0.61	0.43	1.088	1.532	1.41	0.38
Vicia	dasycarpa	wild_sp	grey62	0.41	-0.43	0.952	0.49	0.46	0.40	1.071	1.243	1.16	0.39
Vicia	dasycarpa	wild_sp	grey62	0.05	-0.98	0.905	0.34	0.32	0.23	1.063	1.475	1.39	0.23
Vicia	dasycarpa	wild_sp	grey62	0.10	-0.91	0.886	0.37	0.33	0.24	1.128	1.569	1.39	0.24
Vicia	dalmatica	wild_sp	grey62	0.59	-0.17	0.888	0.69	0.52	0.45	1.316	1.532	1.17	0.43
Vicia	dalmatica	wild_sp	grey62	0.35	-0.54	0.858	0.48	0.42	0.35	1.133	1.37	1.21	0.35
Vicia	dalmatica	wild_sp	grey62	0.39	-0.46	0.922	0.48	0.43	0.41	1.105	1.169	1.06	0.40
Vicia	dalmatica	wild_sp	grey62	0.14	-1.11	0.256	0.45	0.42	0.13	1.076	3.407	3.17	0.13
Vicia	dalmatica	wild_sp	grey62	-0.16	-1.68	0.155	0.35	0.28	0.08	1.256	4.29	3.42	0.08
Vicia	dalmatica	wild_sp	grey62	-0.03	-1.32	0.33	0.34	0.28	0.16	1.194	2.088	1.75	0.11
Vicia	dalmatica	wild_sp	grey62	-0.12	-1.65	0.134	0.34	0.28	0.10	1.207	3.297	2.73	0.06
Vicia	cuspidata	wild_sp	grey62	0.28	-0.78	0.448	0.39	0.35	0.33	1.125	1.183	1.05	0.24
Vicia	cuspidata	wild_sp	grey62	0.30	-0.74	0.475	0.40	0.35	0.35	1.14	1.151	1.01	0.24
Vicia	cuspidata	wild_sp	grey62	0.23	-0.89	0.385	0.37	0.34	0.28	1.073	1.29	1.20	0.20
Vicia	hirsuta	wild_sp	grey62	-0.36	-1.97	0.158	0.26	0.24	0.05	1.061	4.958	4.67	0.04
Vicia	hirsuta	wild_sp	grey62	-0.42	-1.84	0.419	0.23	0.22	0.07	1.013	3.168	3.13	0.07
Vicia	hirsuta	wild_sp	grey62	-0.43	-1.95	0.281	0.23	0.21	0.06	1.095	3.798	3.47	0.06
Vicia	hirsuta	wild_sp	grey62	-0.32	-1.69	0.435	0.25	0.24	0.08	1.043	3.06	2.93	0.08
Vicia	hirsuta	wild_sp	grey62	-0.41	-1.97	0.212	0.24	0.23	0.06	1.048	4.335	4.14	0.05
Vicia	hirsuta	wild_sp	grey62	-0.39	-1.84	0.348	0.23	0.21	0.07	1.113	3.198	2.87	0.08
Vicia	grandiflora	wild_sp	grey62	0.15	-0.85	0.798	0.40	0.37	0.23	1.098	1.749	1.59	0.23
Vicia	grandiflora	wild_sp	grey62	0.15	-0.87	0.758	0.42	0.35	0.22	1.19	1.896	1.59	0.22
Vicia	grandiflora	wild_sp	grey62	0.19	-0.80	0.785	0.43	0.37	0.24	1.169	1.817	1.55	0.24
Vicia	grandiflora	wild_sp	grey62	0.19	-0.80	0.798	0.44	0.37	0.24	1.174	1.831	1.56	0.25
Vicia	grandiflora	wild_sp	grey62	0.18	-0.83	0.697	0.43	0.39	0.21	1.101	1.994	1.81	0.22

Vicia	grandiflora	wild_sp	grey62	0.15	-0.91	0.628	0.43	0.37	0.19	1.16	2.343	2.02	0.18
Vicia	grandiflora	wild_sp	grey62	0.02	-1.07	0.713	0.37	0.30	0.19	1.245	1.975	1.59	0.20
Vicia	grandiflora	wild_sp	grey62	0.01	-1.09	0.678	0.37	0.31	0.17	1.182	2.125	1.80	0.16
Vicia	grandiflora	wild_sp	grey62	0.03	-1.07	0.682	0.37	0.32	0.18	1.162	2.109	1.81	0.18
Vicia	grandiflora	wild_sp	grey62	0.07	-1.03	0.586	0.39	0.35	0.17	1.093	2.281	2.09	0.17
Vicia	grandiflora	wild_sp	grey62	0.08	-0.96	0.793	0.37	0.32	0.22	1.155	1.71	1.48	0.22
Vicia	grandiflora	wild_sp	grey62	0.12	-0.92	0.722	0.36	0.35	0.24	1.016	1.458	1.44	0.21
Vicia	grandiflora	wild_sp	grey62	0.03	-1.08	0.62	0.39	0.32	0.16	1.205	2.407	2.00	0.16
Vicia	grandiflora	wild_sp	grey62	0.14	-0.89	0.717	0.38	0.35	0.25	1.082	1.52	1.41	0.21
Vicia	grandiflora	wild_sp	grey62	0.09	-0.96	0.718	0.38	0.35	0.21	1.078	1.806	1.67	0.19
Vicia	grandiflora	wild_sp	grey62	0.13	-0.91	0.706	0.38	0.35	0.24	1.072	1.604	1.50	0.20
Vicia	hybrida	wild_sp	grey62	0.50	-0.37	0.684	0.63	0.56	0.30	1.123	2.077	1.85	0.28
Vicia	hybrida	wild_sp	grey62	0.53	-0.33	0.624	0.67	0.61	0.28	1.087	2.363	2.17	0.28
Vicia	hybrida	wild_sp	grey62	0.51	-0.32	0.736	0.64	0.57	0.32	1.124	2.018	1.80	0.28
Vicia	hybrida	wild_sp	grey62	0.61	-0.17	0.771	0.68	0.67	0.36	1.025	1.925	1.88	0.35
Vicia	hybrida	wild_sp	grey62	0.61	-0.17	0.762	0.70	0.66	0.36	1.056	1.951	1.85	0.34
Vicia	hybrida	wild_sp	grey62	0.66	-0.16	0.581	0.83	0.70	0.30	1.189	2.798	2.35	0.27
Vicia	hololasia	wild_sp	grey62	0.40	-0.45	0.91	0.51	0.47	0.36	1.094	1.402	1.28	0.33
Vicia	hololasia	wild_sp	grey62	0.41	-0.43	0.947	0.52	0.45	0.38	1.147	1.377	1.20	0.36
Vicia	hololasia	wild_sp	grey62	0.43	-0.43	0.817	0.54	0.51	0.33	1.052	1.652	1.57	0.30
Vicia	hololasia	wild_sp	grey62	0.41	-0.43	0.921	0.51	0.46	0.38	1.119	1.348	1.21	0.36
Vicia	hirsota	wild_sp	grey62	-0.19	-1.44	0.552	0.29	0.26	0.11	1.139	2.558	2.25	0.12
Vicia	hirsota	wild_sp	grey62	-0.37	-1.80	0.368	0.25	0.23	0.07	1.068	3.457	3.24	0.07
Vicia	hirsota	wild_sp	grey62	-0.10	-1.26	0.693	0.29	0.28	0.16	1.036	1.8	1.74	0.16
Vicia	hirsota	wild_sp	grey62	-0.16	-1.30	0.839	0.27	0.26	0.17	1.018	1.541	1.51	0.17
Vicia	hirsota	wild_sp	grey62	-0.21	-1.43	0.686	0.26	0.25	0.14	1.052	1.874	1.78	0.14
Vicia	hirsota	wild_sp	grey62	-0.26	-1.50	0.701	0.25	0.24	0.13	1.054	1.963	1.86	0.13
Vicia	hirsota	wild_sp	grey62	-0.24	-1.45	0.733	0.26	0.24	0.13	1.071	1.953	1.82	0.13
Vicia	cospidata	wild_sp	grey62	-0.07	-1.39	0.299	0.33	0.28	0.12	1.17	2.667	2.28	0.10
Vicia	faba	domesticate	red1	1.54	1.17	0.596	1.82	1.47	1.33	1.241	1.365	1.10	1.24
Vicia	faba	domesticate	red1	1.60	1.21	0.462	1.98	1.44	1.39	1.375	1.425	1.04	1.22
Vicia	faba	domesticate	red1	1.62	1.23	0.471	2.04	1.49	1.38	1.369	1.471	1.07	1.22
Vicia	faba	domesticate	red1	1.68	1.25	0.338	2.86	1.96	0.81	1.458	3.534	2.42	0.77
Vicia	faba	domesticate	red1	1.65	1.27	0.439	1.92	1.57	1.52	1.224	1.26	1.03	1.42
Vicia	faba	domesticate	red1	1.61	1.28	0.626	2.29	1.46	1.41	1.568	1.619	1.03	1.17
Vicia	faba	domesticate	red1	1.75	1.28	0.239	2.84	1.90	0.97	1.496	2.944	1.97	0.92
Vicia	faba	domesticate	red1	1.59	1.29	0.749	1.85	1.75	1.46	1.054	1.261	1.20	1.40
Vicia	faba	domesticate	red1	1.74	1.29	0.269	2.97	1.93	0.95	1.539	3.12	2.03	0.87
Vicia	faba	domesticate	red1	1.73	1.30	0.298	2.82	2.03	0.90	1.391	3.124	2.25	0.97
Vicia	faba	domesticate	red1	1.65	1.31	0.518	2.61	1.97	1.02	1.322	2.559	1.94	0.99
Vicia	faba	domesticate	red1	1.62	1.31	0.654	2.09	1.55	1.51	1.351	1.392	1.03	1.42
Vicia	faba	domesticate	red1	1.60	1.31	0.761	1.94	1.61	1.59	1.211	1.223	1.01	1.47
Vicia	faba	domesticate	red1	1.66	1.32	0.513	2.03	1.64	1.51	1.236	1.348	1.09	1.40

Vicia	faba	domesticate	red1	1.64	1.32	0.579	1.95	1.65	1.56	1.187	1.255	1.06	1.43
Vicia	faba	domesticate	red1	1.72	1.32	0.339	2.78	2.01	0.97	1.385	2.868	2.07	0.95
Vicia	faba	domesticate	red1	1.70	1.32	0.394	3.10	1.93	0.91	1.611	3.431	2.13	0.94
Vicia	faba	domesticate	red1	1.59	1.32	0.846	2.29	1.52	1.45	1.51	1.586	1.05	1.36
Vicia	faba	domesticate	red1	1.69	1.33	0.448	2.98	1.92	0.98	1.552	3.043	1.96	1.01
Vicia	faba	domesticate	red1	1.72	1.33	0.358	3.01	1.83	1.01	1.64	2.963	1.81	1.07
Vicia	faba	domesticate	red1	1.69	1.33	0.455	2.85	1.94	1.01	1.47	2.824	1.92	1.04
Vicia	faba	domesticate	red1	1.75	1.34	0.316	3.11	2.07	0.93	1.503	3.338	2.22	1.00
Vicia	faba	domesticate	red1	1.76	1.35	0.293	3.23	1.94	0.92	1.666	3.501	2.10	0.99
Vicia	faba	domesticate	red1	1.76	1.35	0.284	3.12	1.99	0.95	1.569	3.301	2.10	0.98
Vicia	faba	domesticate	red1	1.78	1.35	0.255	3.14	1.92	1.02	1.634	3.087	1.89	0.85
Vicia	faba	domesticate	red1	1.73	1.36	0.38	3.13	2.05	0.90	1.527	3.474	2.28	0.99
Vicia	faba	domesticate	red1	1.67	1.36	0.588	2.21	1.63	1.53	1.353	1.445	1.07	1.43
Vicia	faba	domesticate	red1	1.74	1.36	0.369	3.08	1.99	1.03	1.55	3.005	1.94	1.01
Vicia	faba	domesticate	red1	1.65	1.39	0.795	2.03	1.75	1.68	1.155	1.207	1.05	1.54
Vicia	faba	domesticate	red1	1.71	1.40	0.507	2.15	1.69	1.66	1.268	1.293	1.02	1.53
Vicia	faba	domesticate	red1	1.79	1.40	0.294	3.34	2.13	0.93	1.566	3.588	2.29	0.97
Vicia	faba	domesticate	red1	1.66	1.40	0.76	2.28	1.75	1.52	1.306	1.498	1.15	1.43
Vicia	faba	domesticate	red1	1.64	1.41	0.895	2.22	1.74	1.62	1.278	1.372	1.07	1.53
Vicia	faba	domesticate	red1	1.72	1.42	0.518	2.36	1.67	1.61	1.42	1.471	1.04	1.47
Vicia	faba	domesticate	red1	1.65	1.42	0.857	2.27	1.70	1.66	1.339	1.372	1.02	1.56
Vicia	faba	domesticate	red1	1.78	1.44	0.388	3.35	2.08	1.02	1.613	3.296	2.04	1.12
Vicia	faba	domesticate	red1	1.66	1.44	0.871	2.20	1.75	1.73	1.254	1.269	1.01	1.63
Vicia	faba	domesticate	red1	1.79	1.44	0.374	3.14	2.17	1.09	1.446	2.892	2.00	1.12
Vicia	faba	domesticate	red1	1.69	1.44	0.727	2.37	1.78	1.59	1.331	1.489	1.12	1.44
Vicia	faba	domesticate	red1	1.73	1.45	0.593	2.56	1.67	1.60	1.534	1.6	1.04	1.47
Vicia	faba	domesticate	red1	1.68	1.45	0.809	2.31	1.79	1.67	1.289	1.384	1.07	1.51
Vicia	faba	domesticate	red1	1.71	1.48	0.761	2.34	1.79	1.76	1.313	1.335	1.02	1.61
Vicia	faba	domesticate	red1	1.73	1.49	0.693	2.29	1.88	1.75	1.218	1.309	1.08	1.65
Vicia	faba	domesticate	red1	1.73	1.49	0.704	2.48	1.82	1.66	1.358	1.495	1.10	1.56
Vicia	faba	domesticate	red1	1.84	1.50	0.339	3.29	2.36	1.07	1.395	3.079	2.21	1.20
Vicia	faba	domesticate	red1	1.71	1.51	0.863	2.40	1.82	1.79	1.318	1.337	1.02	1.66
Vicia	faba	domesticate	red1	1.74	1.51	0.733	2.67	1.74	1.69	1.537	1.576	1.03	1.55
Vicia	faba	domesticate	red1	1.90	1.52	0.242	3.42	2.25	1.21	1.52	2.835	1.87	1.19
Vicia	faba	domesticate	red1	1.79	1.53	0.554	2.50	1.93	1.72	1.29	1.454	1.13	1.59
Vicia	faba	domesticate	red1	1.73	1.55	0.922	2.38	1.95	1.83	1.218	1.299	1.07	1.70
Vicia	faba	domesticate	red1	1.83	1.55	0.467	2.66	1.86	1.75	1.432	1.516	1.06	1.60
Vicia	faba	domesticate	red1	1.83	1.55	0.466	2.75	1.82	1.75	1.509	1.572	1.04	1.56
Vicia	faba	domesticate	red1	1.83	1.57	0.489	2.57	1.92	1.84	1.335	1.392	1.04	1.58
Vicia	faba	domesticate	red1	1.84	1.61	0.552	2.67	2.06	1.82	1.295	1.467	1.13	1.56
Vicia	faba	domesticate	red1	1.85	1.65	0.644	2.89	2.06	1.81	1.402	1.599	1.14	1.74
Vicia	faba	domesticate	red1	1.85	1.68	0.709	3.00	2.01	1.92	1.491	1.564	1.05	1.77
Vicia	faba	domesticate	red1	1.89	1.68	0.57	3.30	2.10	1.72	1.568	1.922	1.23	1.52

Vicia	faba	domesticate	red1	1.92	1.77	0.703	3.29	2.31	1.90	1.426	1.734	1.22	1.83
Vicia	faba	domesticate	red1	1.95	1.78	0.588	3.48	2.31	1.87	1.507	1.862	1.24	1.62
Vicia	faba	domesticate	red1	1.91	1.78	0.759	3.29	2.18	2.03	1.51	1.621	1.07	1.88
Vicia	faba	domesticate	red1	1.99	1.84	0.58	3.67	2.36	2.00	1.556	1.834	1.18	1.83
Vicia	faba	domesticate	red1	2.00	1.87	0.593	3.74	2.36	2.06	1.586	1.817	1.15	1.78
Vicia	faba	domesticate	red1	1.98	1.89	0.794	3.60	2.48	2.13	1.453	1.689	1.16	1.97
Vicia	faba	domesticate	red1	2.13	1.96	0.373	4.13	3.37	1.70	1.225	2.43	1.98	1.62
Vicia	faba	domesticate	red1	2.09	1.98	0.566	4.85	2.91	1.72	1.668	2.817	1.69	1.77
Vicia	faba	domesticate	red1	2.12	2.01	0.51	5.05	2.99	1.69	1.691	2.988	1.77	1.81
Vicia	faba	domesticate	red1	2.11	2.01	0.547	5.19	2.85	1.84	1.818	2.824	1.55	1.92
Vicia	faba	domesticate	red1	2.13	2.05	0.591	4.90	3.13	1.88	1.568	2.615	1.67	1.94
Vicia	faba	domesticate	red1	2.16	2.06	0.5	5.05	3.03	1.94	1.663	2.601	1.56	1.99
Vicia	faba	domesticate	red1	2.21	2.09	0.42	5.24	3.59	1.68	1.459	3.127	2.14	1.78
Vicia	faba	domesticate	red1	2.23	2.16	0.485	5.50	3.72	1.81	1.478	3.043	2.06	2.03
Vicia	faba	domesticate	red1	2.28	2.18	0.379	5.38	3.64	1.96	1.478	2.751	1.86	1.99
Vicia	faba	domesticate	red1	2.26	2.19	0.44	5.41	3.52	2.04	1.536	2.648	1.72	2.03
Vicia	faba	domesticate	red1	2.44	2.19	0.132	5.34	4.02	1.91	1.329	2.793	2.10	1.32
Vicia	faba	domesticate	red1	2.25	2.19	0.488	5.86	3.50	1.99	1.674	2.938	1.76	2.13
Vicia	faba	domesticate	red1	2.33	2.19	0.288	5.89	3.79	1.81	1.556	3.256	2.09	1.91
Vicia	faba	domesticate	red1	2.31	2.20	0.336	5.75	4.03	1.73	1.428	3.321	2.33	1.96
Vicia	faba	domesticate	red1	2.28	2.21	0.445	5.74	3.85	1.91	1.491	2.997	2.01	1.96
Vicia	faba	domesticate	red1	2.29	2.23	0.435	5.65	3.90	2.05	1.45	2.755	1.90	2.18
Vicia	faba	domesticate	red1	2.32	2.24	0.371	6.08	4.03	1.81	1.51	3.356	2.22	2.01
Vicia	faba	domesticate	red1	2.30	2.26	0.456	6.04	3.91	2.01	1.543	3.006	1.95	2.28
Vicia	faba	domesticate	red1	2.36	2.26	0.319	6.45	4.00	1.87	1.613	3.444	2.14	2.10
Vicia	faba	domesticate	red1	2.43	2.26	0.197	5.66	4.20	2.03	1.348	2.795	2.07	2.04
Vicia	faba	domesticate	red1	2.34	2.26	0.355	6.51	3.56	2.08	1.827	3.126	1.71	2.03
Vicia	faba	domesticate	red1	2.37	2.27	0.301	6.50	4.25	1.89	1.528	3.437	2.25	2.01
Vicia	faba	domesticate	red1	2.33	2.30	0.467	6.08	4.51	1.89	1.349	3.214	2.38	1.81
Vicia	faba	domesticate	red1	2.30	2.32	0.632	6.01	3.91	2.17	1.538	2.763	1.80	2.16
Vicia	faba	domesticate	red1	2.51	2.32	0.147	6.96	4.62	2.04	1.505	3.415	2.27	2.21
Vicia	faba	domesticate	red1	2.41	2.32	0.294	6.57	4.37	1.99	1.503	3.304	2.20	1.98
Vicia	faba	domesticate	red1	2.41	2.33	0.304	6.82	4.29	1.97	1.59	3.459	2.18	2.10
Vicia	peregrina	att_domest	hotpink	0.65	-0.09	0.837	0.71	0.67	0.41	1.058	1.715	1.62	0.38
Vicia	peregrina	att_domest	hotpink	0.63	-0.15	0.741	0.71	0.67	0.37	1.058	1.936	1.83	0.36
Vicia	peregrina	att_domest	hotpink	0.58	-0.20	0.791	0.64	0.61	0.39	1.049	1.669	1.59	0.39
Vicia	peregrina	att_domest	hotpink	0.67	-0.09	0.733	0.73	0.67	0.40	1.078	1.796	1.67	0.38
Vicia	peregrina	att_domest	hotpink	0.64	-0.14	0.697	0.69	0.60	0.42	1.15	1.63	1.42	0.40
Vicia	sativa	wild_relative	cornflower	0.20	-0.75	0.889	0.44	0.37	0.27	1.183	1.64	1.39	0.26
Vicia	sativa	wild_relative	cornflower	0.11	-0.96	0.63	0.41	0.38	0.17	1.092	2.438	2.23	0.16
Vicia	sativa	wild_relative	cornflower	0.21	-0.73	0.963	0.38	0.37	0.32	1.032	1.181	1.15	0.30

Vicia	sativa	wild_relative	cornflower	0.15	-0.81	0.962	0.38	0.34	0.30	1.119	1.263	1.13	0.29
Vicia	sativa	wild_relative	cornflower	0.24	-0.68	0.957	0.42	0.37	0.32	1.126	1.308	1.16	0.31
Vicia	sativa	wild_relative	cornflower	0.05	-0.99	0.883	0.34	0.30	0.25	1.126	1.382	1.23	0.22
Vicia	sativa	wild_relative	cornflower	0.00	-1.03	0.957	0.32	0.28	0.25	1.125	1.288	1.15	0.23
Vicia	sativa	wild_relative	cornflower	0.06	-0.97	0.85	0.35	0.29	0.26	1.22	1.334	1.09	0.22
Vicia	sativa	wild_relative	cornflower	0.08	-0.94	0.876	0.36	0.30	0.25	1.21	1.436	1.19	0.22
Vicia	sativa	wild_relative	cornflower	0.09	-0.91	0.909	0.35	0.31	0.28	1.142	1.227	1.07	0.25
Vicia	sativa	wild_relative cornflower	cornflower	0.17	-0.82	0.802	0.35	0.35	0.30	1.025	1.192	1.16	0.28
Vicia	sativa	wild_relative cornflower	cornflower	0.08	-0.94	0.857	0.36	0.34	0.23	1.054	1.58	1.50	0.21
Vicia	sativa	wild_relative cornflower	cornflower	0.11	-0.89	0.88	0.36	0.34	0.25	1.067	1.467	1.38	0.23
Vicia	sativa	wild_relative	cornflower	0.01	-1.03	0.945	0.31	0.29	0.25	1.08	1.262	1.17	0.23
Vicia	sativa	wild_relative	cornflower	0.08	-0.92	0.909	0.35	0.33	0.25	1.066	1.393	1.31	0.24
Vicia	ervilia	wild_relative	darkblue	0.14	-0.88	0.715	0.38	0.35	0.25	1.079	1.52	1.41	0.21
Vicia	ervilia	wild_relative	darkblue	0.14	-0.90	0.694	0.38	0.35	0.24	1.07	1.603	1.50	0.20
Vicia	ervilia	wild_relative	darkblue	0.19	-0.76	0.892	0.41	0.35	0.29	1.163	1.406	1.21	0.28
Vicia	ervilia	wild_relative	darkblue	0.36	-0.56	0.71	0.51	0.46	0.30	1.113	1.741	1.57	0.28
Vicia	ervilia	wild_relative	darkblue	0.23	-0.76	0.685	0.43	0.40	0.26	1.08	1.669	1.55	0.23
Vicia	ervilia	wild_relative	darkblue	0.20	-0.79	0.739	0.44	0.39	0.24	1.122	1.812	1.62	0.22
Vicia	ervilia	wild_relative	darkblue	0.15	-0.83	0.924	0.36	0.35	0.30	1.03	1.194	1.16	0.29
Vicia	ervilia	wild_relative	darkblue	0.24	-0.68	0.931	0.40	0.37	0.34	1.074	1.174	1.09	0.32
Vicia	ervilia	wild_relative	darkblue	0.14	-0.84	0.903	0.35	0.34	0.30	1.051	1.187	1.13	0.28
Vicia	ervilia	wild_relative	darkblue	0.17	-0.80	0.904	0.36	0.34	0.32	1.059	1.136	1.07	0.29
Vicia	ervilia	domesticate	brown4	0.41	-0.55	0.525	0.43	0.42	0.38	1.04	1.134	1.09	0.36
Vicia	ervilia	domesticate	brown4	0.57	-0.26	0.689	0.54	0.51	0.49	1.051	1.086	1.03	0.44
Vicia	ervilia	domesticate	brown4	0.54	-0.33	0.613	0.51	0.48	0.47	1.078	1.099	1.02	0.43
Vicia	ervilia	domesticate	brown4	0.47	-0.44	0.581	0.47	0.45	0.43	1.053	1.106	1.05	0.35
Vicia	ervilia	domesticate	brown4	0.48	-0.42	0.575	0.48	0.45	0.44	1.062	1.094	1.03	0.37
Vicia	ervilia	domesticate	brown4	0.50	-0.38	0.632	0.49	0.46	0.45	1.051	1.08	1.03	0.41

Vicia	ervilia	domesticate	brown4	0.41	-0.54	0.556	0.44	0.41	0.39	1.076	1.117	1.04	0.36
Vicia	ervilia	domesticate	brown4	0.46	-0.58	0.313	0.41	0.41	0.38	1.003	1.074	1.07	0.35
Vicia	ervilia	domesticate	brown4	0.25	-0.75	0.603	0.39	0.37	0.30	1.035	1.285	1.24	0.26
Vicia	ervilia	domesticate	brown4	0.48	-0.39	0.698	0.49	0.46	0.46	1.049	1.057	1.01	0.35
Vicia	ervilia	domesticate	brown4	0.43	-0.63	0.321	0.45	0.44	0.35	1.033	1.276	1.24	0.21
Vicia	ervilia	domesticate	brown4	0.48	-0.42	0.582	0.48	0.45	0.43	1.08	1.115	1.03	0.39
Vicia	ervilia	domesticate	brown4	0.43	-0.62	0.333	0.45	0.44	0.36	1.03	1.273	1.24	0.22
Vicia	ervilia	domesticate	brown4	0.36	-0.64	0.5	0.42	0.39	0.35	1.079	1.209	1.12	0.30
Vicia	ervilia	domesticate	brown4	0.43	-0.48	0.636	0.45	0.43	0.42	1.039	1.066	1.03	0.35
Vicia	ervilia	domesticate	brown4	0.46	-0.41	0.718	0.50	0.46	0.43	1.085	1.157	1.07	0.36
Vicia	ervilia	domesticate	brown4	0.63	-0.20	0.551	0.65	0.54	0.43	1.205	1.498	1.24	0.42
Vicia	ervilia	domesticate	brown4	0.58	-0.25	0.643	0.55	0.51	0.48	1.076	1.15	1.07	0.46
Vicia	ervilia	domesticate	brown4	0.53	-0.31	0.669	0.52	0.49	0.48	1.053	1.082	1.03	0.42
Vicia	ervilia	domesticate	brown4	0.36	-0.62	0.541	0.44	0.38	0.36	1.163	1.206	1.04	0.33
Vicia	ervilia	domesticate	brown4	0.53	-0.34	0.596	0.50	0.48	0.46	1.032	1.069	1.04	0.42
Vicia	ervilia	domesticate	brown4	0.44	-0.49	0.567	0.46	0.44	0.39	1.039	1.176	1.13	0.35
Vicia	ervilia	domesticate	brown4	0.49	-0.38	0.653	0.50	0.47	0.44	1.078	1.132	1.05	0.40
Vicia	ervilia	domesticate	brown4	0.50	-0.45	0.452	0.48	0.46	0.41	1.044	1.173	1.12	0.37
Vicia	ervilia	domesticate	brown4	0.48	-0.48	0.457	0.46	0.45	0.40	1.038	1.149	1.11	0.34
Vicia	ervilia	domesticate	brown4	0.47	-0.36	0.862	0.49	0.48	0.45	1.017	1.079	1.06	0.40
Vicia	ervilia	domesticate	brown4	0.45	-0.44	0.679	0.47	0.44	0.43	1.078	1.109	1.03	0.40
Vicia	ervilia	domesticate	brown4	0.50	-0.39	0.627	0.48	0.46	0.45	1.044	1.081	1.04	0.42
Vicia	ervilia	domesticate	brown4	0.42	-0.52	0.559	0.46	0.41	0.39	1.11	1.169	1.05	0.36
Vicia	ervilia	domesticate	brown4	0.46	-0.46	0.545	0.52	0.51	0.31	1.02	1.69	1.66	0.31
Vicia	ervilia	domesticate	brown4	0.48	-0.42	0.607	0.47	0.45	0.43	1.047	1.11	1.06	0.39
Vicia	ervilia	domesticate	brown4	0.61	-0.23	0.58	0.57	0.53	0.48	1.065	1.18	1.11	0.45
Vicia	ervilia	domesticate	brown4	0.40	-0.54	0.581	0.44	0.43	0.39	1.013	1.136	1.12	0.32
Vicia	ervilia	domesticate	brown4	0.15	-0.91	0.612	0.34	0.32	0.29	1.063	1.163	1.09	0.24
Vicia	ervilia	domesticate	brown4	0.64	-0.41	0.206	0.52	0.46	0.44	1.132	1.182	1.05	0.31
Vicia	ervilia	domesticate	brown4	0.55	-0.34	0.519	0.51	0.48	0.47	1.058	1.087	1.03	0.38
Vicia	sativa	domesticate	salmon	0.82	-0.01	0.371	0.71	0.68	0.49	1.039	1.434	1.38	0.50
Vicia	sativa	domesticate	salmon	0.46	-0.38	0.816	0.54	0.48	0.39	1.118	1.39	1.24	0.38
Vicia	sativa	domesticate	salmon	0.53	-0.30	0.743	0.57	0.53	0.40	1.075	1.414	1.32	0.40
Vicia	sativa	domesticate	salmon	0.64	-0.18	0.59	0.62	0.55	0.46	1.116	1.333	1.19	0.46
Vicia	sativa	domesticate	salmon	0.69	-0.13	0.533	0.63	0.61	0.47	1.047	1.356	1.30	0.47
Vicia	sativa	domesticate	salmon	0.63	-0.15	0.732	0.63	0.61	0.44	1.032	1.417	1.37	0.46
Vicia	sativa	domesticate	salmon	0.58	-0.30	0.522	0.55	0.52	0.42	1.054	1.327	1.26	0.41
Vicia	sativa	domesticate	salmon	0.60	-0.17	0.815	0.63	0.56	0.46	1.123	1.353	1.20	0.46
Vicia	sativa	domesticate	salmon	0.62	-0.17	0.701	0.62	0.58	0.45	1.069	1.375	1.29	0.45
Vicia	sativa	domesticate	salmon	0.49	-0.37	0.701	0.53	0.46	0.42	1.139	1.257	1.10	0.40
Vicia	sativa	domesticate	salmon	0.73	-0.13	0.398	0.68	0.58	0.44	1.165	1.541	1.32	0.44
Vicia	sativa	domesticate	salmon	0.58	-0.22	0.784	0.57	0.55	0.47	1.04	1.212	1.17	0.46
Vicia	sativa	domesticate	salmon	0.54	-0.29	0.73	0.54	0.51	0.45	1.065	1.216	1.14	0.44

Vicia	sativa	domesticate	salmon	0.51	-0.29	0.887	0.54	0.53	0.44	1.029	1.243	1.21	0.43
Vicia	sativa	domesticate	salmon	0.53	-0.27	0.821	0.57	0.54	0.41	1.053	1.389	1.32	0.41
Vicia	sativa	domesticate	salmon	0.69	-0.09	0.635	0.64	0.61	0.50	1.037	1.278	1.23	0.50
Vicia	sativa	domesticate	salmon	0.55	-0.23	0.868	0.59	0.55	0.44	1.088	1.357	1.25	0.43
Vicia	sativa	domesticate	salmon	0.55	-0.26	0.804	0.59	0.54	0.42	1.103	1.43	1.30	0.42
Vicia	sativa	domesticate	salmon	0.60	-0.28	0.513	0.57	0.56	0.40	1.022	1.428	1.40	0.41
Vicia	sativa	domesticate	salmon	0.60	-0.19	0.737	0.62	0.55	0.45	1.113	1.362	1.22	0.45
Vicia	sativa	domesticate	salmon	0.55	-0.29	0.651	0.57	0.51	0.43	1.116	1.313	1.18	0.42
Vicia	sativa	domesticate	salmon	0.53	-0.28	0.819	0.57	0.53	0.42	1.082	1.358	1.26	0.41
Vicia	sativa	domesticate	salmon	0.60	-0.27	0.527	0.55	0.54	0.44	1.021	1.256	1.23	0.43
Vicia	sativa	domesticate	salmon	0.74	-0.06	0.528	0.70	0.64	0.48	1.087	1.45	1.33	0.47
Vicia	sativa	domesticate	salmon	0.53	-0.24	0.915	0.55	0.54	0.45	1.012	1.216	1.20	0.45
Vicia	sativa	domesticate	salmon	0.51	-0.28	0.913	0.58	0.55	0.40	1.055	1.455	1.38	0.40
Vicia	sativa	domesticate	salmon	0.48	-0.33	0.92	0.53	0.51	0.41	1.042	1.287	1.24	0.41
Vicia	sativa	domesticate	salmon	0.50	-0.31	0.895	0.53	0.52	0.43	1.032	1.237	1.20	0.44
Vicia	sativa	domesticate	salmon	0.58	-0.17	0.959	0.60	0.57	0.47	1.04	1.262	1.21	0.47
Vicia	sativa	domesticate	salmon	0.57	-0.19	0.896	0.59	0.57	0.46	1.043	1.302	1.25	0.45
Vicia	sativa	domesticate	salmon	0.61	-0.18	0.724	0.63	0.57	0.44	1.1	1.432	1.30	0.44
Vicia	sativa	domesticate	salmon	0.66	-0.15	0.587	0.65	0.58	0.45	1.133	1.435	1.27	0.46
Vicia	sativa	domesticate	salmon	0.58	-0.22	0.754	0.58	0.56	0.45	1.035	1.285	1.24	0.44
Vicia	sativa	domesticate	salmon	0.64	-0.16	0.671	0.62	0.57	0.48	1.088	1.299	1.19	0.48
Vicia	sativa	domesticate	salmon	0.68	-0.20	0.427	0.70	0.54	0.41	1.303	1.725	1.32	0.42
Vicia	sativa	domesticate	salmon	0.59	-0.18	0.798	0.58	0.57	0.48	1.023	1.21	1.18	0.47
Vicia	narbonesis	att_domest	hotpink	0.67	-0.02	0.978	0.68	0.59	0.57	1.162	1.207	1.04	0.55
Vicia	narbonesis	att_domest	hotpink	0.68	-0.02	0.929	0.66	0.63	0.55	1.048	1.191	1.14	0.52
Vicia	narbonesis	att_domest	hotpink	0.68	-0.02	0.926	0.64	0.60	0.59	1.067	1.081	1.01	0.56
Vicia	narbonesis	att_domest	hotpink	0.63	-0.09	0.915	0.63	0.58	0.53	1.084	1.194	1.10	0.49
Vicia	narbonesis	att_domest	hotpink	0.63	-0.11	0.904	0.62	0.58	0.53	1.08	1.174	1.09	0.47
Vicia	peregrina	att_domest	hotpink	0.68	-0.09	0.665	0.91	0.60	0.35	1.504	2.573	1.71	0.36
Vicia	peregrina	att_domest	hotpink	0.71	-0.05	0.636	0.97	0.64	0.34	1.503	2.81	1.87	0.33
Vicia	peregrina	att_domest	hotpink	0.61	-0.26	0.507	0.90	0.56	0.26	1.596	3.486	2.19	0.25
Vicia	peregrina	att_domest	hotpink	0.55	-0.24	0.855	0.66	0.55	0.39	1.197	1.694	1.42	0.38
Vicia	peregrina	att_domest	hotpink	0.64	-0.13	0.78	0.68	0.65	0.40	1.046	1.695	1.62	0.40
Vicia	peregrina	att_domest	hotpink	0.63	-0.11	0.889	0.64	0.61	0.48	1.051	1.337	1.27	0.46
Vicia	peregrina	att_domest	hotpink	0.55	-0.25	0.793	0.66	0.60	0.34	1.099	1.931	1.76	0.35
Vicia	narbonesis	att_domest	hotpink	0.63	-0.10	0.924	0.61	0.60	0.52	1.026	1.178	1.15	0.48
Vicia	narbonesis	att_domest	hotpink	0.71	0.00	0.841	0.63	0.62	0.61	1.009	1.036	1.03	0.54
Vicia	narbonesis	att_domest	hotpink	0.63	-0.13	0.784	0.62	0.61	0.48	1.001	1.271	1.27	0.43
Vicia	narbonesis	att_domest	hotpink	0.74	0.04	0.842	0.68	0.66	0.59	1.028	1.152	1.12	0.54
Vicia	narbonesis	att_domest	hotpink	0.76	0.04	0.715	0.75	0.69	0.51	1.084	1.461	1.35	0.45
Vicia	narbonesis	att_domest	hotpink	0.74	-0.01	0.631	0.79	0.72	0.42	1.096	1.894	1.73	0.40
Vicia	narbonesis	att_domest	hotpink	0.80	0.12	0.797	0.85	0.81	0.47	1.052	1.801	1.71	0.43
Vicia	narbonesis	att_domest	hotpink	0.73	0.02	0.806	0.72	0.65	0.53	1.101	1.35	1.23	0.51

Vicia	narbonesis	att_domest	hotpink	0.71	0.01	0.842	0.72	0.70	0.48	1.027	1.485	1.45	0.46

CHAPTER 2

1 INTRODUCTION

1.1 Biogeography

Biogeography is the branch of evolutionary biology that reconstructs the distribution of biodiversity and identifies the evolutionary processes and patterns shaping the distributions of organisms through time and space (Sanmartín, 2012). Biogeography dates back to the era when earliest naturalist explorers, the likes of A. von Humboldt (Humboldt,1805), observed that areas with similar climates exhibited faunas with identical life forms but in which the inhabiting species were very different (Sanmartín, 2012).

Biogeography includes two major approaches: (1) ecological biogeography focusses on the biotic and abiotic and species interactions on a short time scale and describes the coexistence of species in local areas (Jenkins et al., 2011). (2) historical biogeography investigates the species distribution over evolutionary time and space by combining phylogenetic and distributional information (Morrone, 2007). Patterns of species diversification can be influenced by three main events: dispersal, vicariance, and extinction (Morrone, 2010). Dispersal is the movement of species over a barrier from one area to another. Vicariance is the process by which a hindrance, like a mountain orogeny, occurs in the distribution area of an organism and splits this area and causes speciation. Through extinction, some of the ancestral population may have disappeared, causing the distribution of species to fragment; disconnected surviving populations may evolve into new species (Crisci, 2001; Morrone, 2009).

1.2 Regionalization and floristic regions

The regionalization of biodiversity divides the Earth's surface into different biogeographical regions, which is useful for carrying out diversification and biogeographical studies (Manafzadeh et al., 2017). Each bioregion is characterized by a range of biological, physical, and ecological factors, combined with geological and evolutionary events, which

identifies biotic similarities within and differences between bioregions (Mackey et al., 2008; Morrone, 2009; Kreft & Jetz, 2010). Thus, dividing the Earth into bioregions like floristic regions allows us to track plant distribution and floristic patterns, and provides us with a glimpse into evolutionary patterns. A floristic region is a geographical area defined by a unique composition of plants (i.e. certain genera and species) that are dominant in and restricted to that region (Cox, 2001; Kreft & Jetz 2010; McLaughlin, 1994; Takhtajan, 1986). Takhtajan (1986) used levels of endemism to define five floristic kingdoms for the World, which are subdivided into 35 regions. Takhtajan's classification shows that the distinctiveness of each floristic unit is the result of a series of historical events like vicariance and dispersal with an independent evolutionary background (Cox, 2001).

The western part of the Irano-Turanian (I-T) region , located in Southwest Asia is one of the most diverse floristic regions of the Holarctic Kingdom; the western part of the I-T possesses a high level of species diversity in Central Asia, the Anatolian plateau, and the Iranian plateau (Manafzadeh et al., 2014). The I-T region is defined by continentality with hot and dry summers, cold and harsh winters, and low precipitation from its surrounding regions, especially the Mediterranean floristic region (Djamali et al., 2012). The stark geological heterogeneity of the I-T floristic region can be traced back to two major tectonic events: the India-Asia and Arabia-Eurasia collisions. The latter one played a much more important role in shaping the western part of the I-T floristic region (Manafzadeh et al., 2017). Arabia-Eurasia convergence contributed greatly to the uplift of the plateaus and mountains of the I-T region (e.g. Zagros and Alborz mountains), from the middle to late Miocene (Mouthereau et al., 2012). Such uplifts, during the middle Miocene, have been shown to play an important role in the process of plant diversification within the western I-T region (Manafzadeh et al., 2017; Djamali et al., 2012). Therefore, uplifts of mountain chains (e.g. Zagros and Alborz Mountains) and plateau regions (e.g. Iranian and Anatolian plateaus) caused aridification in Southwest Asia during the middle Miocene (Flint, 1957; Hamilton, 1968), which facilitated the diversification of arid-adapted plants in the region (Manafzadeh et al., 2017; Noroozi et al., 2008).

The Mediterranean Basin is a biodiversity hotspot with a vast area around the Mediterranean Sea characterizing by a Mediterranean climate, i.e., mild, rainy winters and hot, dry summers (Feliner, 2014). The Mediterranean floristic region started to form during the Miocene when the convergence of Arabia–Eurasian plates and three associated smaller plates, Iberia, Apulia, and Arabia, took place (Krijgsman, 2002; Feliner, 2014). The Mediterranean

region, similarly to the I-T region, underwent various geological and palaeoclimatic interactions (Rosenbaum et al., 2002). Important climatic changes occurred in the Mediterranean region, such as the gradual global cooling since the Oligocene (Zachos et al., 2008) and aridification that started during the late Miocene and culminated in the Messinian Salinity Crisis (van Dam, 2006). Finally, a Mediterranean-type climate was established in the region in the late Pliocene (Mansion et al., 2008).

1.3 The Fertile Crescent and biogeographical patterns of domestication

The native areas of the oldest plant domestications are largely included within the western part of the I-T floristic region and also comprises the easternmost portion of the E-M region; this area is called the Fertile Crescent (FC), the origin of the wild relatives of domesticated barley, wheat, lentils, peas, and beans; these species remain among the most cultivated crops of the modern world (Zohary et al., 2000). Diamond (2002) hypothesizes that a single domestication event played the main role in the origin of most of the FC crops. The wild progenitors of crops had narrow geographical ranges in the FC, restricted to the area between Turkey and western Iran. At a later point, these crops were spread from east to west, across the continent by the expanding cultivation of domesticated crops (Zohary et al., 2000). The climatic changes at the end of the Pleistocene probably allowed the cultivation of domesticated species in areas where this would have been impossible during the glaciations (Manafzadeh et al., 2017). Therefore, geographical and ecological phenomena can play important roles in understanding the divergence process between wild relatives and domesticated forms (Guerra-García and Piñero, 2017; Schaefer et al., 2012).

Yet, understanding the spatial and temporal origins of domesticated plants, especially in the FC region, remains one of the least well-understood fields of biogeography, even though it is an enduring and increasingly active area of evolutionary biology. The spatial and temporal origins of wild progenitors of the domesticated crops and their migration routes in the FC require detailed biogeographical analyses to understand the evolutionary patterns of plant domestication in the FC (Manafzadeh et al., 2017). Furthermore, the understanding of the diversification patterns of wild progenitors, explained by biogeographical events, can play a

major role in understanding the process of domestication itself (Guerra-García and Piñero 2017; Schaefer et al., 2009).

In this chapter, we therefore aimed at understanding the temporal and spatial origins of the wild progenitors of the crops domesticated in the FC (i.e. *Vicia* and *Lens*); we also aim at understanding their migration routes. We carried out a phylogenetic study for which we used six nucleotide sequences from matK, rbcL, trnS-trnG, psbA-trnH, trnL, and ITS, with a special focus on *Vicia* and *Lens* species from the FC. This study addressed the temporal and spatial origins of wild progenitors of the Old World *Vicia* and *Lens* and their routes of migration via biogeographic analyses to answer the following principal question of this study: when and where did the origin and diversification of the wild progenitors of the domesticates of Old World *Lens* and *Vicia* take place?

2 MATERIALS AND METHODS

2.1 Floristic regions

In this part of the thesis, we aim to carry out a detailed phylogenetic study on the diversification of *Lens* and *Vicia* within three floristic regions: the Irano-Turanian region (I-T), Mediterranean region (divided into the eastern part (E-M) and the western part (W-M)), and the Circumboreal region (C-B). We thus generated a distribution map of *Vicia* and *Lens* using the floristic classification of Takhtajan (1986) and Manafzadeh et al. (2017) (Figure 11). The basis of Takhtajan's classification is geographical patterns of endemism, especially at the species and genus level. Definitions at the subcontinental scale make Takhtajan's classification compatible with the biogeographical investigation at wide spatial ranges (Manafzadeh et al., 2017; Zohary, 1973). For the detailed borders of the Irano-Turanian region, we used Manafzadeh et al. (2017). Moreover, we verified the accurate and precise distributional ranges for all *Vicia* and *Lens* species in this study from Floras (e.g. Flora of Turkey, Flora Iranica).

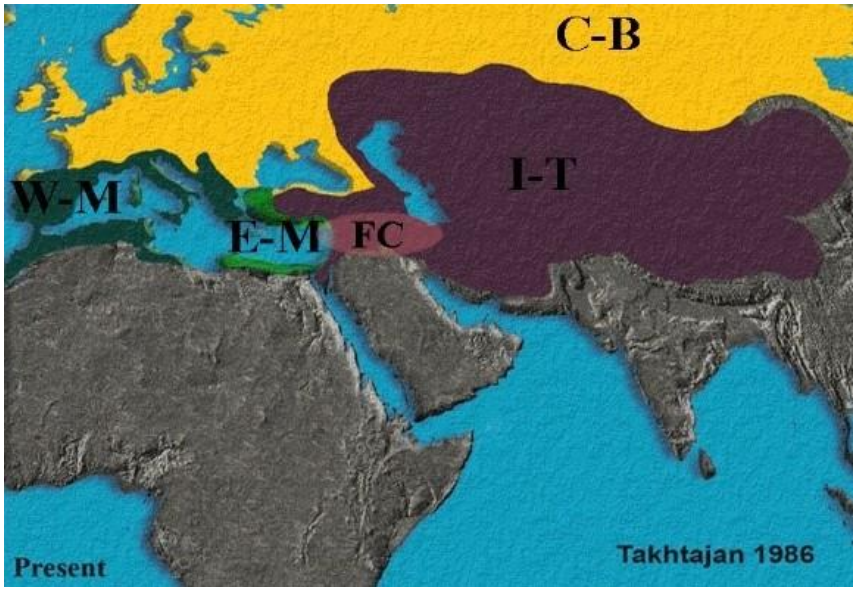


Figure 11 Floristic regions that were used to reconstruct ancestral areas: Irano-Turanian floristic region (I-T), Mediterranean floristic region (divided into the East Mediterranean and West Mediterranean (E-M & W-M)), and Circumboreal region (C-B). Fertile Crescent (FC) comprising areas in both the I-T and E-M.

2.2 Sampling

We reconstructed phylogenetic relationships using DNA sequences from Genbank. We gathered sequences of the chloroplast genome (cpDNA), as follows: rbcL gene, matK gene, trnSG-trnL intergenic spacer, and psbA-trnH intergenic spacer, and also one locus of the nuclear genome (nrDNA), the internal transcribed spacer (ITS). We chose taxa considering the taxonomic and geographical diversity of Fabaeae in the I-T, the W-M and the E-M, and the C-B with a particular focus on *Vicia* and *Lens*. Four genera of Fabeae were sampled as ingroup: *Lathyrus* (56 species), *Pisum* (7 species and subspecies), *Vicia* (81 species and 3subspecies), and *Lens* (5 species and 3 subspecies). Five outgroup taxa were selected according to the previous phylogenetic study by Schaefer et al. (2012): *Trifolium dubium, T. campestre, T. glomeratum T. pratense* and *Medicago polymorpha* (Schaefer et al., 2012). Furthermore, we corrected the taxonomic synonyms where needed for *Lens* and *Vicia* taxa following the Plant List website (http://www.theplantlist.org/) and the World Flora Online (http://www.plantsoftheworldonline.org/). The final dataset comprised 161 accessions, including 83 *Vicia* and 8 *Lens* accessions. Further details of the taxon sampling and Genbank accession numbers are given in Supplementary 5.4.

2.3 Molecular dating analyses

All sequences were first checked and edited manually in Mesquite (Maddison, 2011) and then aligned using the default multiple alignments in Geneious (https://www.geneious.com). The sequences of the 5 cpDNA and 1 nrDNA were concatenated into a single dataset. The final concatenated dataset comprised a total 5616 bp characters from 161 accessions are listed in Table 9.

Table 9 Sequence data information from GenBank for *Lens*, *Vicia*, *Lathyrus*, and *Pisum* (ingroups) and *Medicago polymorpha*, *Trifolium pratense*, *Trifolium glomeratum*, *Trifolium* campestre, and *Trifolium dubium* (outgroups) - markers, number of sequences, gene size (base pairs), and DNA origin

Markers	Number of sequences	Genome size (base pair)	DNA origin
ITS	149 sequences	668bp	Nuclear
matK	63 sequences	1160bp	Chloroplast
psbA-trnH	58 sequences	654bp	Chloroplast
rbcL	49 sequences	1352bp	Chloroplast
trnL	79 sequences	811bp	Chloroplast
trnS-trnG	55 sequences	971bp	Chloroplast

The optimal evolutionary model of each DNA region was determined by fitting the best evolutionary substitution model using a Maximum Likelihood method performed in MEGA (Molecular Evolutionary Genetics Analysis) version 10.0.4 (Kumar et al., 2018). The best model was chosen by selecting the model with the lowest BIC (Bayesian Information Criterion) (Posada and Crandall, 1998). Results for the best models based on the lowest BIC are available in Table 10.

Table 10 Best fitting substitution models for the six DNA regions

Markers	Best Models
ITS	K2+G
rbcL	T92+G+I
matK	GTR+G
trnSG	GTR+G
psbA-trnH	GTR+G
trnL	GTR+G

BEAST version 1.8.4 (Drummond et al., 2012) was used for carrying out molecular dating analysis within a Bayesian framework by applying an uncorrelated lognormal relaxed clock model. For subsequent molecular dating analyses, the dataset included 161 accessions, comprising mostly the Fabeae species occurring in the I-T, E-M, W-M, and C-B. Since no fossil has yet been unearthed within the Fabeae, a secondary calibration from a previous study (Schaefer et al., 2012) was applied to estimate the divergence times. Normal distribution was modeled where 95% of the prior weight fell within the highest posterior density (HPD) interval, for each calibrated node. The following calibration points from the previous study by Schaefer et al. (Schaefer et al. 2012) were used to date the phylogenetic tree: (1) a normal distribution

prior with a median=17.5 Mya was used to calibrate the crown node of Fabeae, and (2) a normal distribution with a median=24.7 Mya was used to calibrate the stem node of Fabeae (i.e. root of the tree). Details of calibrations of nodes of interest are given in Table 11.

Table 11 Settings of the normal prior distribution for root height and secondary calibration for the molecular dating analyses.

Prior distribution	Fabeae (crow node) Normal	Root height Normal
Normal mean age (Mya)	17.5	24.7
Normal Standard Deviation	1.9	2.3
Lower (5%) &upper (95%) boundary	12.9- 22.8	17.1- 30.2

An uncorrelated relaxed-clock model was applied to a random tree (as the tree prior), and different substitution models following Table 10 were selected for each nucleotide region. Four independent runs of 50,000,000 generations, each sampling every 1000th generation were performed. The consistency of the results between four runs and effective sample size (ESS) scores were checked in Tracer v 1.6 (Drummond et al., 2012) to verify the best convergence between the runs and the amount of burn-in. After discarding the initial 10% as burn-in, we combined the four runs employing Logcombiner 1.6.2 (Drummond and Rambaut, 2007). Finally, the tree with maximum clade credibility (MCC), with a limit of posterior probability of 0.5 was obtained employing TreeAnnotator v 1.8.4 (Drummond et al., 2012) and visualized with FigTree v 1.4.3 (Rambaut, 2017).

2.4 Ancestral range reconstruction

The distribution ranges of the Old Word *Vicia* and *Lens* were divided into four areas, based on the extant geographical distribution of the abovementioned genera and the precise boundaries of the floristic regions (Figure 11). These areas are as follows: the Circumboreal floristic region (C-B), the Irano-Turanian (I-T) floristic region, and the eastern (E-M) and western (W-M) portions of the Mediterranean floristic region. For ancestral range reconstruction analyses, the initial 166 accessions-dataset was reduced to a 84 accessions-dataset that comprised only the Old World's wild *Lens* and *Vicia* species.

Ancestral ranges were estimated under two models: The Dispersal-Extinction-Cladogenesis (DEC) and the Dispersal Vicariance Analysis (DIVA-LIKE), as well as the +J

counterparts for the latter one. In RASP version 4.0 (Yu et al., 2015), these models were implemented to reconstruct the probable ancestral ranges of *Vicia* and *Lens* on our calibrated phylogenetic tree. The abovementioned models differ in the types of cladogenetic events they allow. The RASP version of DEC calculates the relative likelihood of all possible ancestral-range scenarios estimated at a given node (Ree et al., 2005; Yu et al., 2015). In the DEC model, we selected all the distribution ranges and restricted the maximum number of ancestral areas to two. The DIVA-LIKE model is a likelihood version of DIVA, which allows for both narrow vicariance and widespread vicariance. The J variant of this model stands for jump dispersal, also known as founder-event speciation (Matzke, 2014). We used DEC and DIVA-LIKE analyses to generate a modified Gaussian distribution for a time-event algorithm modelled on dispersal and vicariance events at each node (Yu et al., 2015). The list of the taxa of interest together with their extant distribution can be found in Supplementary 5.1.

3 RESULTS

3.1 Molecular dating analyses

Fabeae of the Old World originated during Oligocene/Miocene transition (23.84 Mya: node A, Figure 12 I), and started to diversify towards the end of the early Miocene (17.79 Mya: node B, Figure 12 I). The molecular dating analyses suggest that the *Vicia* species occurring in the Old-World do not form a monophyletic group (Figure 12 I). Diversification of *Vicia* in the Old World appears to have happened in several steps in the middle Miocene. A clade of *Vicia* diverged from *Lathyrus* and *Pisum* around the middle Miocene (13.63 Mya: node C, Figure 12 I) and diversified later at the end of the Pliocene (2.66 Mya: node D, Figure 12 I) in the Mediterranean Basin and the Irano-Turanian region. The domesticate *Vicia ervilia* diverged from its sister species in–the late Miocene (8.18 Ma: node E, Figure 12 I). The second domesticate, *Vicia sativa*, originated at the end of Miocene around 5.28 Ma (node J, Figure 12 I), and started to diversify towards the end of the Pliocene (2.8 Ma: node K, Figure 12 I). The third domesticate *Vicia faba* diverged from its sister clade around the early Pliocene (4.12 Mya: node L, Figure 12 I). Finally, there are two species of attempted domesticates among the *Vicia* of the Old World: (1) the older attempted domesticate species *Vicia narbonesis* originated in the end of the Pliocene (2.9 Mya: node I, Figure 12 I), and (2) the younger attempted domesticate *Vicia peregrina* diverged from its sister species towards the end of the Pleistocene (ca. 0.39 Mya: node M, Figure 12 I).

Our phylogenetic tree demonstrates that *Lens* is a monophyletic genus, which originated from *Vicia* at the beginning of the late Miocene (10.86 Mya: node F, Figure 12 I) and started to diversify towards the late Pliocene (3.31 Mya: node G, Figure 12 I). *Lens nigricans*, the only attempted domesticate species of the genus *Lens* split from the rest of *Lens* in the late Pliocene (3.31 Mya: node G, Figure 12 I). *Lens culinaris* subsp. *culinaris*, the domesticated *Lens*, diverged from its wild progenitor, *Lens culinaris* subsp. *orientalis* towards the end of the Pleistocene (ca. 0.32 Mya: node H, Figure 12 I).

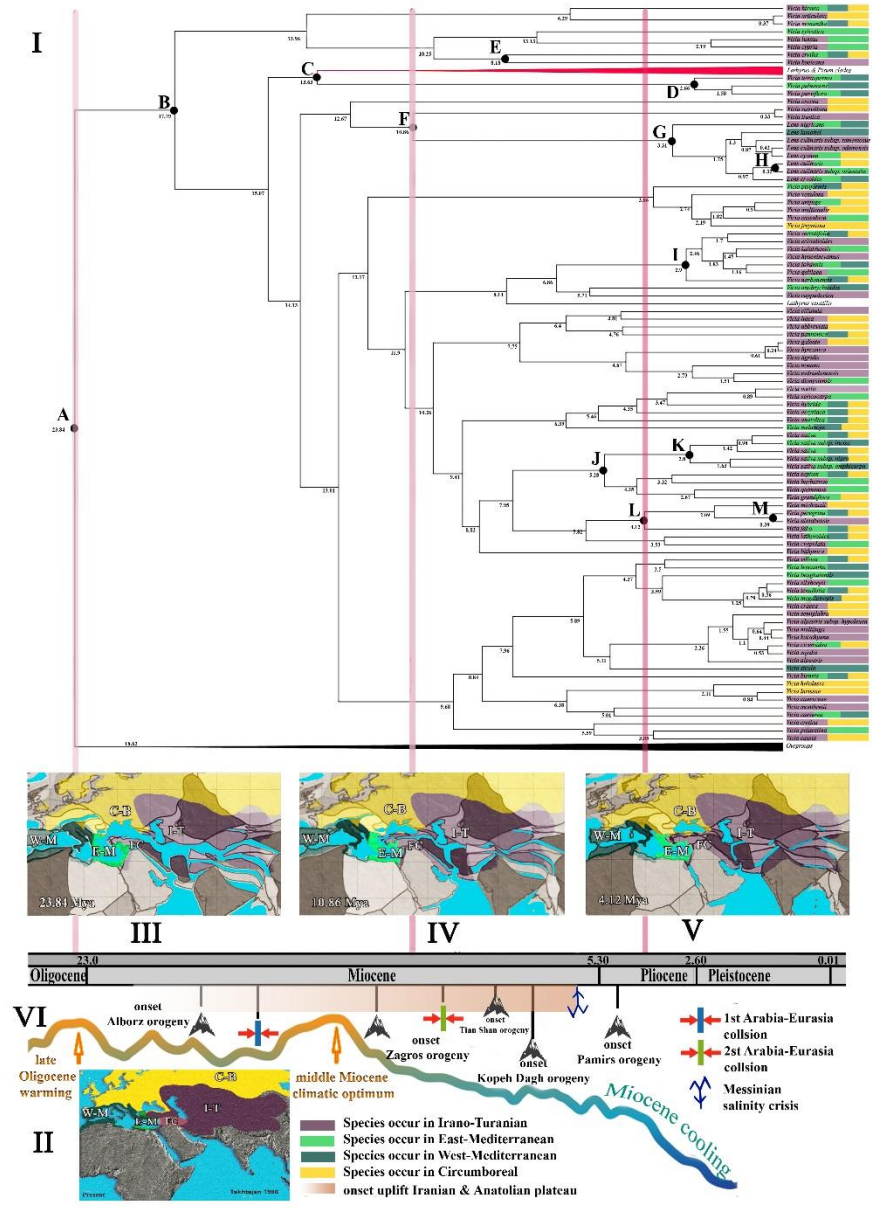


Figure 12 Chronogram inferred from Bayesian dating analysis (BEAST) of the 161-taxon data set including four genera of Fabeae and five species from outgroup. (I) Tree with the branches for all genera of Fabaea except Old World *Vicia* and *Lens* collapsed and major geological/climatic events during the evolution of the focussed genera represented by vertical bars; (II) Relevant current floristic regions in this study; (III, IV, V) Time series of palaeomaps ranging from 23.84 Mya to 4.12 Mya highlighting the major geological/tectonic events during the evolution of the *Vicia* and *Lens* in the I-T floristic region. Plaeomaps generated by Paleomap Maker (https://portal.gplates.org/portal/paleomapmaker/); (VI) Sequence of key climatic changes based on average global deep ocean temperature relative to present mean (from Hansen et al., 2008; Manafzadeh et al., 2017). Nodes of biogeographical interest: A, split of Old-World Fabeae from its sister; B, initial diversification of Fabaea; C, divergence of *Lathyrus* and *Pisum* from *Vicia*; D, initial diversification of a clade of *Vicia* wich split from *Lathyrus* and *Pisum* E, divergence of *Vicia ervilia* from its sister; F, origin of the genus *Lens*; G, initial diversification of genus *Lens*; H, divergence of the domesticate *Lens culinaris* subsp. *culinaris* from its wild ancestor; I, origin of attempted domesticate *Vicia narbonesis*; J, origin of domesticate *Vicia sativa*; K, initial diversification of *Vicia sativa*; L, split of *Vicia faba* from its sister clade; M, divergence of attempted domesticate *Vicia peregrine* from its sister species.

3.2 Ancestral area reconstruction

The results of the ancestral range reconstruction indicate that Old-World *Vicia* and *Lens* required a total of either 118 dispersal and nine vicariance events (inferred by DIVALIKE +J) or 133 dispersal and 12 vicariance events (inferred by DEC) to reach their current distribution in the Old World.

The analyses of ancestral range reconstruction suggest that the most recent common ancestor (MRCA) of Old-World *Vicia* and *Lens* most likely inhabited the Irano-Turanian region (node A, Figure 13 IV & V; 40% probability inferred by DIVALIKE+J and 24% Probability inferred by DEC). The MRCA of *V. koeieana*, the wild progenitor of *Vicia ervilia*, probably originated in the the I-T and E- M regions (node B, Figure 13 IV & V; 75% probability inferred by DIVALIKE+J and 26 % probability inferred by DEC). The MRCA of a clade including *V. peregrina*, *V. michauxii*, and *V. aintabensis*, the probable wild progenitors of *Vicia faba* most likely originated in the I-T region (node C, Figure 13 IV & V; 30% probability inferred by DIVALIKE+J and 61 % probability inferred by DEC). Ancestral area reconstruction analyses also suggest that the MRCA of a clade including *V. sativa* subsp. *incisa* and *V. sativa* subsp. *amphicarpa*, the possible wild progenitors of *Vicia sativa* most probably originated in the I-T, the E-M, and the W-M regions (node D, Figure 13 IV & V; 28% probability inferred by DIVALIKE+J and 31% probability inferred by DEC).

Finally, our historical biogeographical analyses suggest that the most recent common ancestor of genus *Lens* most likely originated in the I-T region (node E, Figure 13 IV & V; 40% probability inferred by DIVALIKE+J and 40% probability inferred by DEC). Moreover, the MRCA of *L. culinaris* subsp. *orientalis*, the wild progenitor of the domesticated *Lens* originated in the I-T region (node F, Figure 13 IV & V; 65% probability inferred by DIVALIKE+J and 59% probability inferred by DEC).

The time–event graph inferred by both DIVALIKE+J and DEC methods are largely congruent and demonstrate a predominance of dispersal events over vicariance events in the evolutionary history of both genera in the Old World (Figure 13 II & III). Both methods reconstructed a sharp increase in dispersal events during late Pliocene, since 3 Mya. Moreover, both methods also reconstructed an increase in the number of vicariance events towards the end of Pliocene, since 4 Mya (Figure 13 II & III).

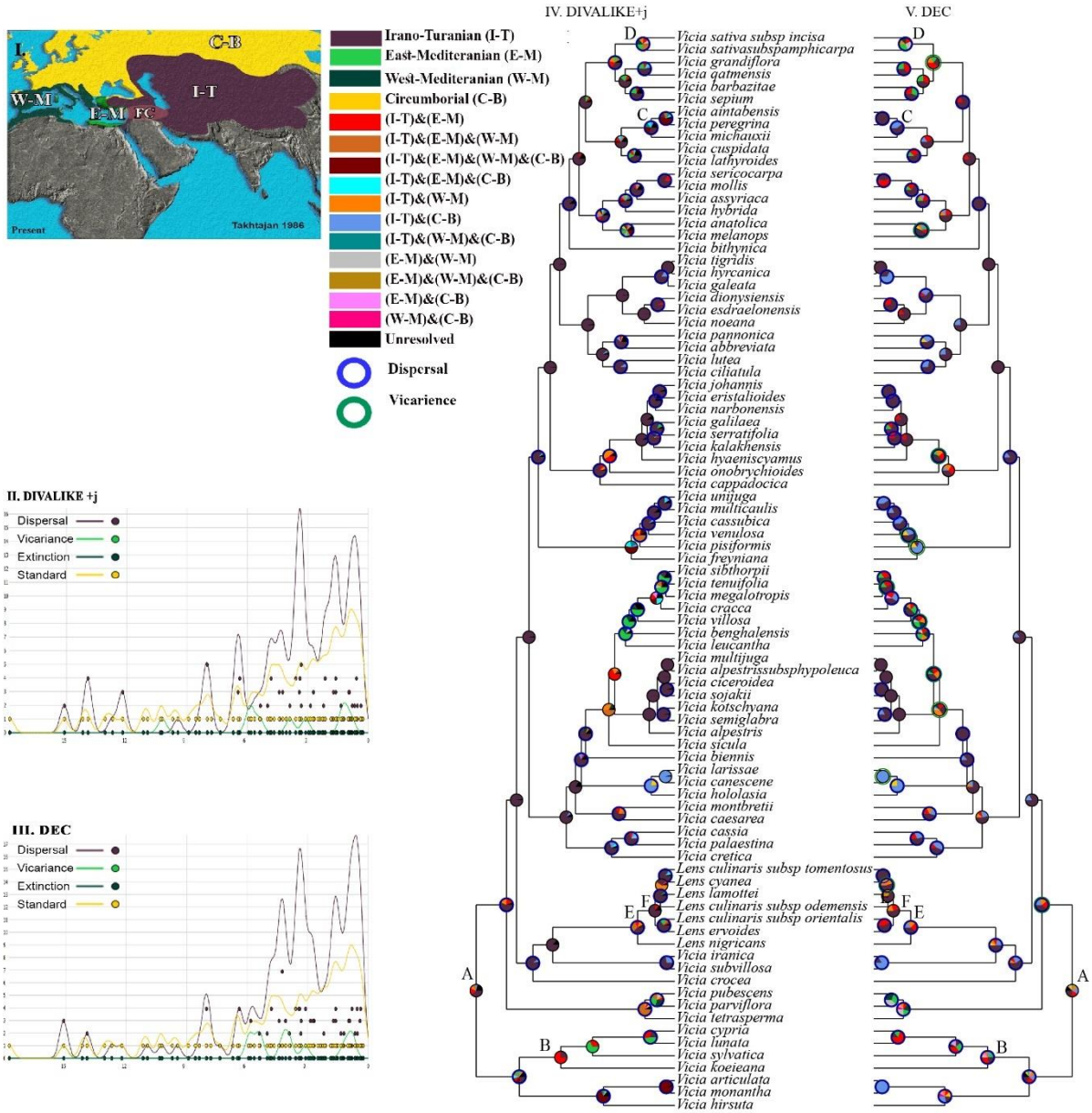


Figure 13 Biogeographical analyses. (I) Relevant current floristic regions in this study (II and III) Probability distributions of dispersal (violet) and vicariance (green) events at each node based on the time–event algorithm calculated by DIVALIKE+J and DEC analysis, respectively. The x-axis, time range (0–17.79 Mya, right to the left) corresponding to the time spanned by the tree of Figure 13; y-axis, number of events. (IV AND V) Ancestral area reconstructions estimated with DIVALIKE+J and DEC methods implemented in RASP. The ancestral areas inferred at the nodes are illustrated by pie charts of relative probabilities for each region. Dispersal with the symbol of the blue circle and vicariance with the symbol of the pink circle were displayed.

4 DISCUSSION

The main goal of our study was to provide biogeographical insights by integrating the temporal and spatial origin of the Old-World *Vicia* and *Lens* with geologic and palaeoclimatic events. Our time-calibrated phylogenetic tree, with extensive additional sampling from the I-T region, agrees with several previous studies and confirms that *Vicia* in the Old World is a non-monophyletic genus, whereas monophyly of the genus *Lens* was clearly supported (Kupicha, 1976; Leht, 2009; Leht and Jaaska, 2002; Schaefer et al., 2012).

Our molecular dating analyses suggested that Fabeae split from its sister clade in the late Oligocene (ca. 24 Mya, Figure 12 I, node A) and most likely started to diversify in the Irano-Turanian and eastern part of the Mediterranean in the early Miocene (ca. 18 Mya, Figure 12 I, node B; Figure 13 IV & V, node A). Land bridges in the late Oligocene and the beginning of the Miocene several times connected (and were later disconnected) the Tethys and Paratethys seas (Oosterbroek and Arntzen, 1992; Quézel, 1985; Sanmartín, 2003; Thompson, 2005). While long-distance dispersal events are common phenomena in Fabeae (Schaefer et al., 2012), these land connections would have accelerated the diversification of the Fabeae by facilitating dispersal events across the entire Mediterranean and Irano-Turanian regions(Manafzadeh et al., 2014).

One of the earliest diversifications of *Vicia* in the Old World took place during the middle Miocene (ca. 14 Mya) in a small clade with eight species, sister to rest of the Fabeae (Figure 12 I). Another diversification of the Old World *Vicia* during the middle Miocene occurred among species in a small clade, which split from all *Lathyrus* species (except *L. saxatilis*) plus *Pisum* around 14 Mya (Figure 12 I, node C). In the middle Miocene, the second closure of the Arabian plate with Eurasia initiated drier climates in the Mediterranean Basin, Arabia, the Iranian and the Anatolian plateau. The new climate caused the expansion of dry-adapted plants such as *Vicia* in the region. The domesticate *V. ervilia* (i.e. its possible wild progenitor) is nested within the clade, which is sister to all other Fabeae. Our results suggest that *V. ervilia* diverged from its sister species *V. koeieana*, an I-T species, in the late Miocene (Figure 12 I, node E), most probably in the eastern Mediterranean and Irano-Turanian regions (Figure 13 IV & V, node B). Our results, due to extensive additional sampling from the I-T region do not support Schaefer´s (2012) phylogenetic relationship and thus also do not support

Schaefer´s (2012) spatial reconstructions, which only present the Mediterranean region as the origin of *V. ervilia*. Based on our results, the *V. sativa* group originated most likely in the I-T region in the early Pliocene (Figure 12 I, node J) and started to diversify towards early Pleistocene in Eurasia (Figure 12 I, node K; Figure 13 IV & V, node D). Our results demonstrate that the domesticate *V. sativa* is not a monophyletic taxon and its wild progenitors started to diversify towards the end of Pleistocene. During the Pleistocene glaciations, climate change on lower latitudes led to extreme aridification, which caused the formation of deserts, which in turn fragmented the distributions of many plant species (Bobek, 1937; Shroder and Bishop, 2010; Wright, 1962). Therefore, this may have promoted conditions for allopatric divergence among isolated populations of *V. sativa* and shaped its geographical and ecological patterns of intraspecific genetic diversity. The domesticate *V. faba* (i.e. its possible wild progenitor) diverged from a small clade in the early Pliocene (Figure 12 I, node L); our spatial reconstruction analyses suggest that the MRCA of the sister clade to *V. faba* most likely originated in the I-T region (Figure 13 IV & V, node C). Acceleration of the uplift of the Zagros and Alborz mountains caused the separation of the Iranian plateau from the rest of Eurasia in the early Pliocene (e.g. Mouthereau, 2011); these tectonic events might have facilitated the expansion of wild progenitor of *V. sativa* in the Iranian Plateau. The two attempted domesticate *Vicia* species, *V. narbonensis* and *V. peregrina* diverged from their sister taxa during the late Pliocene (Figure 12 I, node I) and the early Pleistocene (Figure 12, node M) in the I-T region, respectively. During the Pliocene- Pleistocene, climate change led to extreme aridification, which might have provided the ecological opportunity needed for the diversification of *V. narbonensis* and *V. peregrina* via dispersal into new environments. In general, the number of dispersal events abruptly increased for Old world *Vicia* species during the Pliocene-Pleistocene epochs (Figure 13 II & III).

Our biogeographical results demonstrate that the genus *Lens* originated in the late Miocene (Figure 12 I, node F), most likely in the I-T region (Figure 13 VI & V, node E) and started to diversify in the late Pliocene (Figure 12 I, node G) mostly in the I-T region (Figure 13 VI & V, node E). Our results are temporally congruent with those obtained by Schaefer (2012); however, owing to our improved classification of the geographic distribution of species, our results do not confirm Schaefer's (2012) spatial reconstructions, which only present the Mediterranean floristic region as the origin of *Lens.* The attempted domesticate *L. nigricans* (i. e. wild progenitor) split from all other *Lens* species in the late Pliocene (Figure 12

I, node G) and our spatial reconstruction analyses suggest that the MRCA of *L. nigricans* most probably inhabited the I-T and E-M regions at the end of the Messinian Salinity Crisis. At that time, increasing aridification caused increasing desiccation in the Mediterranean Basin (van Dam, 2006; Suc, 1984; Thompson, 2005), which might have favoured the expansion of arid plants such as *L. nigricans* in the Mediterranean region. *L. orientalis*, the wild progenitor of the domesticate *Lens* diversified in the I-T region (Figure 13 IV & V, node F) in the late Pleistocene (Figure 12 I, node H), possibly due to the increased aridification that occurred during this epoch.

In conclusion, our results demonstrate the dependence of spatial reconstruction analyses on sampling and the proper classification of distributional data (i.e. the correct definition of the boundaries of floristic regions). Moreover, we expect that climate change at the end of the Pleistocene made agriculture possible in areas where it would have been impossible during the Glaciations. Therefore, within *Vicia* and *Lens* the application of ecological niche modeling will be useful to test expansion versus a contraction of the distribution of wild progenitors of *Vicia* and *Lens* in the Fertile Crescent.

5 SUPPLEMENTARY

5.1 Distribution of *Vicia* and *Lens* for the selected area

NUMBER	SPECIES	DISTRIBUTION
1	Lens_culinaris_subsp_odemensis	I-T
2	Lens_culinaris_subsp_orientalis	I-T, E-M, W-M
3	Lens_culinaris_subsp_tomentosus	I-T
4	Lens_cyanea	I-T, E-M, C-B
5	Lens_ervoides	I-T, E-M, W-M
6	Lens_lamottei	W-M
7	Lens_nigricans	I-T, E-M, W-M
8	Vicia_abbreviata	I-T, C-B
9	Vicia_aintabensis	I-T
10	Vicia_alpestris	I-T
11	Vicia_alpestrissubsphypoleuca	I-T
12	Vicia_anatolica	I-T, E-M, W-M, C-B
13	Vicia_articulata	I-T, C-B
14	Vicia_assyriaca	I-T, E-M, W-M, C-B
15	Vicia_barbazitae	I-T, E-M
16	Vicia_benghaLensis	E-M, W-M
17	Vicia_biennis	I-T, E-M, W-M, C-B
18	Vicia_bithynica	I-T, C-B
19	Vicia_caesarea	I-T, E-M, W-M
20	Vicia_canescene	I-T
21	Vicia_cappadocica	I-T
22	Vicia_cassia	I-T, C-B
23	Vicia_cassubica	I-T, E-M
24	Vicia_ciceroidea	I-T, BD
25	Vicia_ciliatula	I-T
26	Vicia_cracca	I-T, C-B
27	Vicia_cretica	I-T, C-B
28	Vicia_crocea	I-T, C-B
29	Vicia_cuspidata	I-T, W-M
30	Vicia_cypria	I-T, W-M

31	Vicia_dionysiensis	I-T, W-M
32	Vicia_eristalioides	I-T
33	Vicia_esdraelonensis	I-T
34	Vicia_freyniana	C-B
35	Vicia_galeata	I-T, C-B
36	Vicia_galilaea	I-T, E-M
37	Vicia_grandiflora	I-T, E-M, C-B
38	Vicia_hirsuta	I-T, E-M, W-M, C-B
39	Vicia_hololasia	C-B
40	Vicia_hyaeniscyamus	I-T
41	Vicia_hybrida	I-T, E-M, W-M, C-B
42	Vicia_hyrcanica	I-T
43	Vicia_iranica	I-T
44	Vicia_johannis	I-T, E-M, W-M
45	Vicia_kalakhensis	I-T, W-M
46	Vicia_koeieana	I-T
47	Vicia_kotschyana	I-T
48	Vicia_larissae	E-M, W-M
49	Vicia_lathyroides	I-T, E-M, W-M, C-B
50	Vicia_leucantha	E-M, W-M
51	Vicia_lunata	I-T, E-M
52	Vicia_lutea	I-T, C-B
53	Vicia_megalotropis	E-M, W-M, C-B
54	Vicia_melanops	E-M, W-M, C-B
55	Vicia_michauxii	I-T, C-B
56	Vicia_mollis	I-T
57	Vicia_monantha	I-T, E-M, W-M, C-B
58	Vicia_montbretii	I-T
59	Vicia_multicaulis	I-T, C-B
60	Vicia_multijuga	I-T
61	Vicia_narbonensis	I-T, E-M, W-M, C-B
62	Vicia_noeana	I-T
63	Vicia_onobrychioides	E-M, W-M
64	Vicia_palaestina	I-T, W-M
65	Vicia_pannonica	I-T, E-M, W-M, C-B
66	Vicia_parviflora	I-T, BC
67	Vicia_peregrina	I-T, E-M, W-M, C-B
68	Vicia_pisiformis	E-M, W-M, C-B
69	Vicia_pubescens	E-M, W-M
70	Vicia_qatmensis	I-T, E-M
71	Vicia_sativa_subsp_incisa	E-M, W-M

72	Vicia_sativasubspamphicarpa	I-T, E-M, W-M
73	Vicia_semiglabra	I-T, C-B
74	Vicia_sepium	I-T, E-M, W-M, C-B
75	Vicia_sericocarpa	I-T, E-M
76	Vicia_serratifolia	I-T, E-M, W-M, C-B
77	Vicia_sibthorpii	I-T, E-M
78	Vicia_sicula	W-M
79	Vicia_sojakii	I-T
80	Vicia_subvillosa	I-T, C-B
81	Vicia_sylvatica	E-M
82	Vicia_tenuifolia	I-T, E-M, W-M, C-B
83	Vicia_tetrasperma	I-T, E-M, W-M
84	Vicia_tigridis	I-T
85	Vicia_unijuga	I-T, E-M, C-B
86	Vicia_venulosa	I-T, C-B
87	Vicia_villosa	I-T, E-M, W-M, C-B

5.2 Results obtained from inferred by BioGeoBEARS divalike +j analysis

Node A: A 39.736820 AB 16.987550 AC 8.599073 ABC 7.308482 AD 6.130510 ABD 4.633855 B 3.836366 ACD 3.223540 BC 2.692290 ABCD 2.487062 C 1.607377 BD 0.927189 BCD 0.847977 CD 0.847214 D 0.134692 / 0.000000

EVENT MATRIX:
Dispersal:0
Vicariance:0
Extinction:0
Event Route:
A->A^A->A|A
PROBABILITY: 0.0506

Node B: AB 75.104210 A 24.433130 B 0.462659 ABD 0.000000 ABC 0.000000 BD 0.000000 BC 0.000000 AD 0.000000 AC 0.000000 D 0.000000 C 0.000000 ABCD 0.000000 BCD 0.000000 ACD 0.000000 CD 0.000000 / 0.000000

EVENT MATRIX:
Dispersal:0
Vicariance:1
Extinction:0
Event Route:
AB->A|B
PROBABILITY:
0.5070

Node C: A 30.256960 ABCD 22.999260 ACD 11.056330 ABD 10.147080 AD 7.752743 D 3.935079 ABC 3.211016 AB 2.634928 AC 2.630790 BCD 2.495194 BD 1.464392 CD 1.333604 BC 0.032861 B 0.029417 C 0.020339 / 0.000000

EVENT MATRIX:
Dispersal:4
Vicariance:0
Extinction:0
Event Route:
A->A^A^D->ABCD^A^D->AD|ABCD
PROBABILITY:
0.1702

Node D: ABC 28.058580 B 19.944330 C 15.684210 AC 13.190160 AB 12.776570 BC 9.886551 A 0.459599 ABCD 0.000000 BCD 0.000000 ACD 0.000000 ABD 0.000000 AD 0.000000 CD 0.000000 BD 0.000000 D 0.000000 / 0.000000

EVENT MATRIX:
Dispersal:2
Vicariance:0
Extinction:0
Event Route:
ABC->ABC^B^C->BC|ABC
PROBABILITY:
0.2806

Node E: A 38.431990 ABC 29.305750 AB 12.580550 AC 11.897570 ABCD 6.000707 B 0.388030 ABD 0.380331 ACD 0.363141 BC 0.313181 C 0.146139 BCD 0.121245 AD 0.047961 BD 0.011628 CD 0.011593 D 0.000181 / 0.000000

EVENT MATRIX:
Dispersal:2
Vicariance:0
Extinction:0
Event Route:
A->A^A->ABC^A->ABC|A
PROBABILITY:
0.2875

Node F: A 64.716870 B 15.250400 ABC 8.077603 AB 6.627198 AC 3.104009 BC 2.163155 C 0.060764 ABCD 0.000000 BCD 0.000000 ABD 0.000000 ACD 0.000000 BD 0.000000 AD 0.000000 CD 0.000000 D 0.000000 / 0.000000

EVENT MATRIX:
Dispersal:3
Vicariance:0
Extinction:0
Event Route:
A->A^A^B->ABC^A^B->AB|ABC
PROBABILITY:
0.6472

5.3 Results obtained from inferred by DEC analysis

Node A: A 24.69 AB 17.63 AD 16.40 AC 13.87 B 5.33 D 5.31 BD 5.23 CD 3.98 BC 3.94 C 3.62

EVENT MATRIX:
Dispersal:0
Vicariance:0
Extinction :0
Event Route:
A->A^A->A|A
PROBABILITY:
0.0205

Node B: AB 29.20 A 22.70 B 12.14 AD 11.64 AC 10.27 BD 7.59 BC 6.47

EVENT MATRIX :
Dispersal :1
Vicariance :0
Extinction :0
Event Route:
AB->AB^A->A|AB
PROBABILITY:
0.1016

Node C: A 60.87 AD 39.13

EVENT MATRIX :
Dispersal :1
Vicariance :0
Extinction :0
Event Route:
A->A^A->AD^A->AD|A
PROBABILITY:
0.6087

Node D(LR): B 31.80 BC 25.75 AB 15.68 C 14.87 AC 11.89

EVENT MATRIX :
Dispersal :3
Vicariance :0
Extinction :0
Event Route:
B->B^B^C->ABC^B^C->BC|ABC
PROBABILITY:
0.3180

Node E (LR): A 39.34 AB 23.50 AC 21.91 AD 15.24
EVENT MATRIX :
 Dispersal :2
 Vicariance :0
 Extinction :0
Event Route:
 A->A^A->ABC^A->ABC|A
PROBABILITY:
 0.2221

Node F: A 58.86 AB 41.14

EVENT MATRIX :
 Dispersal :3
 Vicariance :0
 Extinction :0
Event Route:
 A->A^A^B->ABC^A^B->AB|ABC
PROBABILITY:
 0.5886

5.4 Genbank accessions numbers for rbcL, matK, trnSG, trnL, and psbA-trnH and their voucher information

Species	rbcL	matK	trnSG	trnL	psbA-trnH	ITS	Voucher
L. annuus	--	--	AY839525	AY839412	--	AY839344	
L. aphaca	--	--	JX505524	--	JX505918	--	Polunin, Sykes & Williams 3710 (GH)
L. aphaca	--	--	JX505525	--	JX505919	JX506050	H. Chandhuri s.n. (GH)
L. aphaca	JX505474	--	--	JX505653	--	JX506051	H. Schaefer 2012/25 (GH)
L. aphaca	--	--	JX505528	JX505652	--	JX506054	
L. aphaca	--	JX505788	JX505526	JX505650	--	JX506052	S. Norton 1991-08
L. aphaca	--	JX505789	JX505529	--	--	JX506055	H. Schaefer 2008/81 (BM)
L. aphaca	--	--	JX505527	JX505651	--	JX506053	RBGE Living collection, from S. Norton
L. articulatus	--	JX505790	JX505530	JX505654	--	JX506056	P. & J. Davis D49242 (NY)
L. articulatus	--	--	JX505531	JX505655	--	JX506057	C. Asmussen (cultivated)
L. articulatus	JN661181	JX505791	JX505532	JX505656	JX505920	JX506058	H. Schaefer 2011/67 (GH)
L. aureus	--	--	JX505534	JX505657	--	JX506059	S. Norton 1991-122
L. aureus	--	--	JX505533	JX505658	--	JX506060	RBGE living collection accession 19716552
L. bauhinii	JX505475	--	JX505535	JX505659	--	JX506061	L. Remond 623 (GH)
L. belinensis	JX505476	JX505792	--	--	JX505921	JX506062	seeds from "Owl's Acre Seeds", unvouchered
L. blepharicarpus	--	--	JX505536	JX505660	--	JX506063	G. Samuelsson 4135 (NY)
L. boissieri							
L. cassius							
L. chloranthus	--	--	--	--	--	JX506064	K. Hammett s.n. (GH)
L. cicera	--	--	AY839518	AY839416	--	AY839348	
L. clymenum	--	JX505793	JX505537	JX505661	--	JX506065	C. Asmussen 1994-2
L. cyaneus							
L. czeczottianus	--	--	--	--	--	JX506067	J. Bornmueller 14048 (GH)
L. digitatus	--	--	AY839514	AY839420	--	AY839352	
L. Elongatus							
L. emodi	--	JX505795	--	--	--	JX506068	M.N. Chaudhri & M.A. Siddiqi 1282 (GH)
L. gloeosperma	--	--	JX505550	JX505663	--	JX506070	S. Norton 1996-540
L. gloeosperma	--	JX505796	JX505551	JX505664	--	JX506071	Southampton 868074
L. gorgoni	--	--	--	--	--	JX506074	F.P. Shepard s.n. (GH)
L. grandiflorus	--	JX505797	JX505540	--	JX505924	JX506075	J. Bornmueller 143 (GH)

L. Haussknechtii							
L. hiersolymitanus	JX505477	--	JX505542	--	JX505925	JX506079	Mattatia s.n. (GH)
L. hirsutus	JN661182	JX505798	--	--	JX505926	JX506080	H. Schaefer 2011/400 (GH)
L. humilis	--	--	AY839494	AY839427	--	AY839360	
L. inconspicuus	--	--	--	--	--	AM087145	misidentified as Vicia abbreviata
L. inconspicuus	JX505479	--	JX505543	--	JX505928	JX506083	M.E.J. Coode & B.M.G. Jones 2598 (GH)
L. inconspicuus	--	--	--	--	--	JX506084	R.R. Stewart 25471 (GH)
L. inconspicuus	JX505480	--	--	--	JX505929	JX506085	R.R. Steward 25771 (GH)
L. incurvus	--	--	--	--	JX505930	JX506086	J. Bornmueller 14040 (GH)
L. incurvus	--	--	JX505544	JX505668	--	JX506087	Abemucen s.n. (E)
L. jordanii	--	--	--	--	--	JX506091	V. Mansi 1876 (GH)
L. Karsianus							
L. laxiflorus	--	--	AY839482	AY839434	--	AY839367	
L. laxiflorus	--	--	--	--	JX505933	JX506094	A. Radzhi 5929 (GH)
L. luteus	--	JX505802	--	--	JX505935	JX506098	W. Koelz 9363 (GH)
L. lycius	--	--	--	--	--	JX506099	Girouin s.n. (GH)
L. mulkak	--	--	JX505548	--	JX505940	JX506105	A. Regel s.n. (GH)
L. niger	--	--	AY839488	AY839442	--	--	
L. nissolia	--	JX505805	JX505552	JX505674	--	JX506109	C. Asmussen 1994-22
L.nivalis							
L. ochrus	JN661184	JX505807	TBA	JX505675	JX505943	JX506111	H. Schaefer 2011/69 (GH)
L. pallescens	--	--	AY839515	AY839445	--	AY839378	
L. palustris	JN890637	HM026396	AY839502	AY839446	--	AY839379	
L. palustris	--	--	JX505553	JX505676	--	JX506112	C. Asmussen 1994-44
L. Phaselitanus							
L. pilosus	--	HM026396	JX505557	JX505679	--	JX506118	Lee 10622 (IUI)
L. pilosus	--	--	JX505558	JX505680	--	JX506119	G. Kenicer 61 (E)
L. pisiformis	--	--	AY839491	AY839450	--	AY839382	
L. pratensis	--	--	--	--	FJ395489	--	BM000954775
L. pratensis	--	--	--	--	--	JX506121	M. Shah & D. Khan 2108 (GH)
L. pratensis	JN661185	JX505810	JX505559	JX505682	JX505947	JX506122	H. Schaefer 2011/214 (GH)
L. pratensis	--	JX505811	--	JX505683	--	JX506123	C. Asmussen 1994-47
L. pratensis	--	--	JX505560	JX505684	--	JX506124	G. Kenicer 228
L. pseudo- cicera							
L. pulcher	--	--	--	--	--	JX506127	Bourgeau 980 (GH)
L. roseus	--	JX505815	JX505563	JX505687	JX505951	JX506131	M. Oganesian et al. s.n. (NY)
L. rotundifolius	--	--	AY839535	AY839455	--	AY839388	
L. rotundifolius	--	--	JX505564	JX505688	JX505952	JX506132	seeds bought from "Owl's Acre Seeds", unvouchered
L. rotundifolius	--	JX505816	JX505565	JX505689	--	JX506133	M Oganesian et al. 08-0211 (NY)
L. rotundifolius	--	--	JX505566	JX505690	--	JX506134	S. Norton 2000443

L. rotundifolius	--	--	--	JX505671	--	JX506104	S. Norton 1995-476
L. rotundifolius	--	--	--	JX505703	--	JX506152	S. Norton s.n.
L. Satdaghensis							
L. sativus	NC014063	AF522086	AY839517	AY839456	--	AY839389	unvouchered
L. saxatilis	--	--	--	JX505691	JX505953	JX506135	V. Finn s.n. (GH)
L. saxatilis	--	JX505817	--	JX505692	--	JX506136	
L. setifolius	--	JX505818	JX505567	JX505693	JX505954	JX506137	A.S. Pease 8958 (GH)
L. setifolius	--	--	JX505568	JX505694	--	JX506138	H. Ross 331 (GH)
L. spathulatus	--	--	JX505569	JX505695	--	JX506139	H. Ern. s.n. (E)
L. sphaericus	--	--	AY839512	AY839461	--	AY839393	
L. sphaericus	--	JX505819	JX505570	JX505696	--	--	M. Shah & D. Khan 607 (GH)
L.stenolobus							
L. sylvestris	--	--	JX505572	JX505697	--	JX506144	H. Schaefer 2011/522 (GH)
L. sylvestris	--	--	JX505573	JX505698	--	JX506145	C. Asmussen 1994-16
L. tauricola							
L. tefennicus							
L. Trachycarpus							
L. transsylvanicus	--	--	AY839509	AY839467	--	AY839400	
L. tuberosus	JN661188	--	JX505576	JX505701	--	JX506149	H. Schaefer 2011/402 (GH)
L. tuberosus	--	--	JX505577	JX505702	--	JX506150	C. Asmussen 1994-18
L. tukhenensis	--	--	JX505578	--	JX505960	JX506151	R. Goerz 375 (GH)
L. Undulatus							
L. Variabilis							
L. vernus	--	--	JX505581	JX505706	--	JX506155	H. Schaefer 2011/524 (GH)
L. vernus	--	--	AY839479	AY839471	--	AY839403	Asmussen & Liston (OSU)
L. vinealis							
L.woronowii							
Lens culinaris	JN661189	JX505825	JX505583	JX505708	JX505962	JX506157	unvouchered
Lens culinaris							
Lens cyanea	--	--	AB546822	AB546806	--	AB546790	
Lens ervoides	--	AF522089	AB546823	AB546807	--	EU224444	
Lens lamottei	--	--	--	--	--	AF432168	
Lens nigricans	JX505485	--	JX505584	--	JX505963	JX506158	A. Charpin & W. Greuter 8317 (GH)
Lens montbretii							
Lens odemensis	--	--	--	--	--	AJ441063	
Lens orientalis	--	--	--	--	JX505964	--	collector unknown (GH)
Lens tomentosus	--	--	--	--	--	AJ441061	
P. elatius	--	--	--	--	FR856872	AY143453	
P. elatius	--	--	--	--	--	AY143446	
P. elatius	--	--	--	--	--	AY143450	
P. elatius	--	--	--	--	--	AY143442	

P. elatius	--	--	--	--	JX505965	JX506159	W.N. Koelz 17499 (GH)
P.formosum							
P. fulvum	--	--	AB546819	AB546803	FR856875	AY143451	
P. humile	--	--	--	--	JX505966	JX506160	J.D. Angelis & I. Amdursky 544 (GH)
P. sativum	--	JX505828	JX505585	JX505709	--	JX506161	G. Kenicer 65
P. sativum							
P. sativum	--	--	--	--	FR856867	AY143444	
P. sativum	--	--	--	--	--	AY143441	
P. sativum	--	--	--	--	--	AY143468	
P. sativum	--	--	--	--	--	AY143465	
P. sativum	--	--	--	--	--	AY143475	
P. sativum	--	--	--	--	--	AY143482	
P. sativum	JN661190	JX505829	JX505586	JX505710	JX505967	JX506162	unvouchered
P. sativum	--	--	--	--	--	AY143464	
P. sativum	--	--	--	--	--	AY143483	
P. sativum	--	--	--	--	--	AY143478	
V. abbreviata	JX505492	JX505833	--	--	--	JX506167	S. Charkovicz s.n. (GH)
V.afghanica							
V. aintabensis	--	--	--	--	--	AJ566207	
V.akhmaganica							
V. alpestris	JX505494	--	--	JX505713	JX505972	JX506170	V. Prima s.n. (GH)
V. amphicarpa	JN661191	--	JX505588	--	--	JX506174	M.J.E. Coode & B.M.G. Jones 1041 (GH)
V.amphicarpa							
V. anatolica	--	--	--	--	--	JX506176	N. Maxted et al. 4498 (E)
V. angustifolia	--	--	--	--	--	GB	
V. angustifolia	JX505496	JX505837	--	--	--	JX506177	H. Schaefer 2012/23 (GH)
V. angustifolia	--	TBA	JX505589	--	JX505975	JX506178	H. Schaefer 2011/210 (GH)
V. angustifolia	--	JX505840	--	--	--	TBA	H. Schaefer 2008/495 (BM)
V. angustifolia	JN661192	JX505838	JX505590	--	JX505976	JX506179	H. Schaefer 2011/75 (GH)
V. angustifolia	--	JX505839	JX505591	--	JX505977	JX506180	H. Schaefer 2011/79 (GH)
V. armena							
V. articulata	--	--	--	--	--	JX506181	Maxted et al. 4432 (E)
V. assyriaca	--	--	--	--	--	AJ851217	
V.balansae							
V. barbazitae	JX505497	JX505841	JX505593	--	JX505978	JX506183	E & A Huet du Pavillon s.n. (GH)
V. benghalensis	--	--	--	--	--	JX506184	F. Sales & I. Hedge 99/5 (E)
V. benghalensis	JN661193	JX505842	JX505594	JX505717	JX505979	JX506185	H. Schaefer 2011/76 (GH)
V. benghalensis	JN661194	JX505843	JX505595	JX505718	JX505980	JX506186	H. Schaefer 2011/77 (GH)
V. benghalensis	--	--	--	--	--	JX506187	H. Schaefer 2008/169 (BM)
V. biennis	JX505498	--	--	JX505719	--	JX506188	Herb. J. Gay s.n. (GH)
V. biennis	--	--	--	--	--	JX506189	A. Sukhorukov s.n. (E)

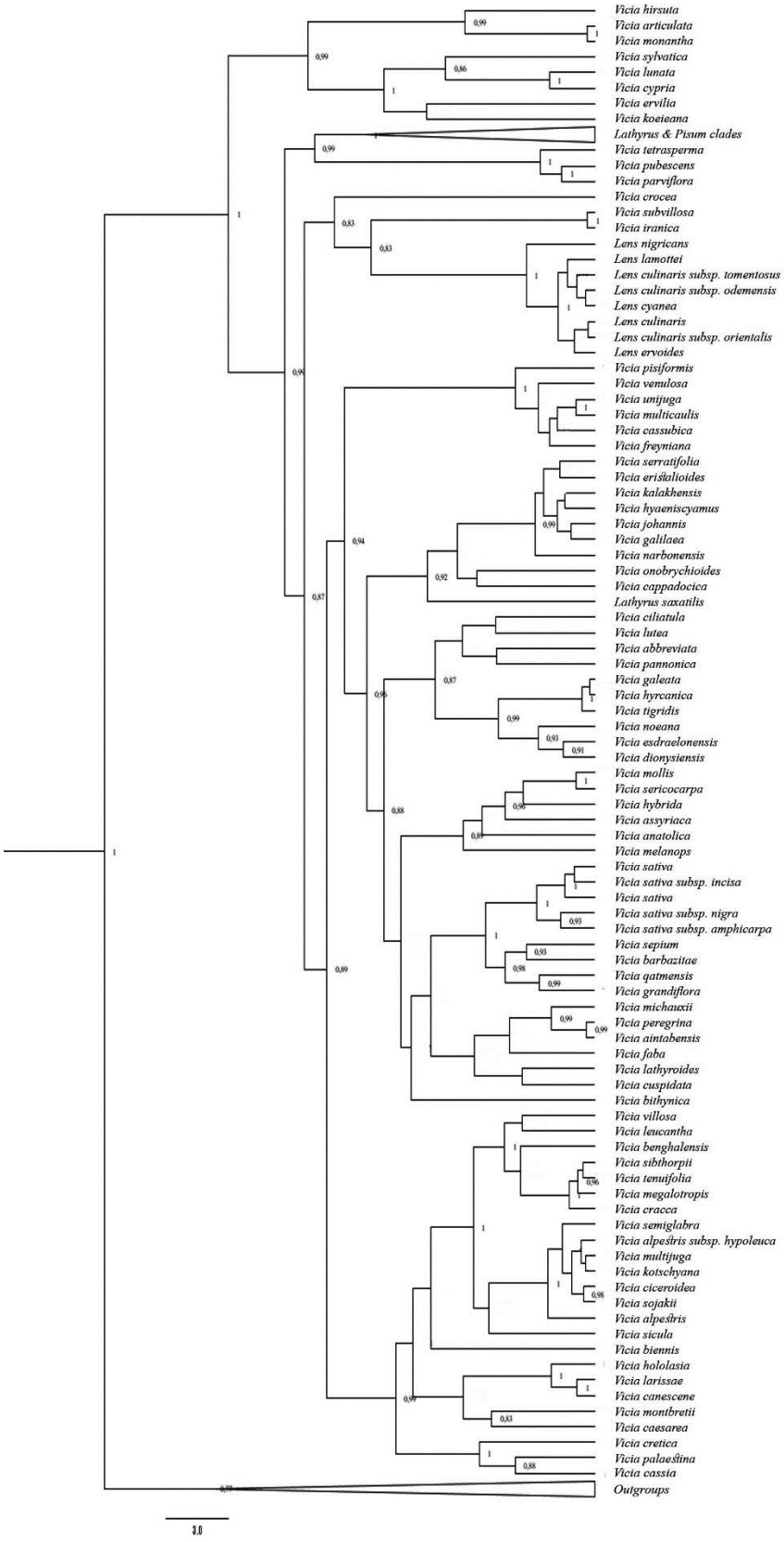
V. bithynica	--	--	--	--	JX505981	JX506190	M.J.E. Coode & B.M.G. Jones 2825 (GH)
V. bithynica	JN661195	JX505844	--	--	--	JX506191	H. Schaefer 2008/574 (BM)
V. caesarea	--	--	--	--	--	JX506193	O. Polunin 15904 (E)
V.canescens							
v.canescens subsp							
V. cappadocica							
V. cassia	--	--	--	--	--	JX506196	N. Maxted et al. 4384 (K)
V. cassubica	--	JX505848	--	--	--	JX506197	A. Jasewicz 237 (GH)
V. ciceroidea							
V. ciliatula	--	--	--	--	--	AJ851218	
V. cinerea							
V. cracca	--	--	--	--	--	JQ309787	
V. cracca	--	--	--	--	--	AY839339	
V. cracca	JN661198	--	JX505603	JX505732	JX505993	JX506204	H. Schaefer 2011/405 (GH)
V. cretica	JX505499	JX505856	--	JX505733	--	JX506205	J. Barnum Brown s.n. (GH)
V. crocea	--	HM026405	--	--	--	HM026431, H Maxted et al. 6843 (E)	
V. crocea	--	HM026406	--	--	--	HM026431, H Davis et al. 37715 (E)	
V. crocea	JX505500	--	--	--	JX505994	JX506206	A. Groeger et al. 1655 (M)
V. cuspidata	--	--	--	--	--	AM087147	
V. cypria	JX505501	JX505857	--	JX505734	JX505995	JX506207	I. Al-Shehbaz et al. (GH)
V. cypria	--	--	--	--	--	JX506208	F.N. Hepper & D.E. Viney 9626 (K)
V. faba L.	JX505998	JX506216	V. faba L.	unvouchered			
V.dadianorum							
V. ervilia	--	--	--	AB546808	--	AB546792	
V. ervilia	--	--	--	--	--	JX506213	N. Maxted et al. 4087 (E)
V.erzurumica							
V. fedtschenkoana							
V. freyniana	--	--	--	--	--	JX506221	M.J.E. Coode & B.M.G. Jones (M)
V. galeata	--	--	--	--	--	AJ851219	
V. galilaea	--	--	--	--	--	AJ131077	
V. glareosa							
V. grandiflora	--	JX505868	--	--	JX506009	JX506228	H. Schaefer s.n. (BM)
V. grandiflora	--	JX505869	JX505610	--	--	JX506229	G. Kenicer 85
V. grandiflora	--	--	--	--	--	JX506230	A. Strid & Tan 31542 (E)
V. gregaria							
V. hirsuta	--	--	--	--	--	DQ351827	Kakinuma 2
V. hirsuta	--	--	--	JX505742	JX506010	JX506231	H. Schaefer 2011/314 (GH)
V. hirsuta	JN661201	JX505871	--	--	JX506011	JX506233	H. Schaefer 2011/124 (GH)
V. hirsuta	--	JX505870	JX505611	JX505743	--	JX506232	G. Kenicer 88

V.hirta							
V. hololasia	JX505506	JX505872	JX505612	JX505744	--	JX506234	A. Radzhi 5687 (GH)
V. hyaeniscyamus	--	--	--	--	--	AJ131073	
V. hybrida	--	--	--	--	--	AJ851220	
V. hyrcanica	--	--	AB546825	AB546809	--	AJ851221	
V. hypoleuca							
V. incisa	--	--	--	--	--	HM470605	
V. iranica	--	--	--	--	JX506012	--	Mapkoba s.n. (GH)
V. johannis	--	--	--	--	--	AJ131080	
V. johannis	--	--	--	--	--	HM470597	
V. kalakhensis	--	--	--	--	--	AJ131071	
V.koeieana							
V.kotschyana							
V. larissae	--	--	--	JX505746	JX506013	JX506236	V. Prima 6123 (GH)
V. lathyroides	--	--	--	--	--	AM087148	
V. lathyroides	--	--	--	--	--	JX506237	G. Lewis & B.B. Klitgaard 3847 (K)
V. laxiflora							
V. leucantha	--	JX505875	--	JX505748	--	JX506239	
V. lunata	JX505507	--	--	JX505749	--	--	W. Lang 5.4.1999 (M)
V. lutea	--	JX505876	JX505615	JX505750	--	JX506240	P. & J. Davis D-49244 (NY)
V. lutea	--	JX505877	--	JX505751	JX506014	JX506241	D. Podlech 42107 (M)
V. lutea	--	--	--	JX505752	--	JX506242	T. Barta 2004-470
V. lutea	JN661202	JX505878	JX505616	JX505753	--	JX506243	H. Schaefer 2011/64 (GH)
V. lutea	--	--	JX505617	JX505754	JX506015	JX506244	H. Schaefer 2011/71 (GH)
V. malosana	--	--	JX505618	JX505755	JX506016	JX506245	A. Stolz 265 (GH)
V. megalotropis	JX505508	JX505879	JX505619	JX505756	--	JX506246	D. Boufford et al. 37491 (GH)
V. melanops	--	--	--	--	--	AJ851223	
V. meyeri							
V. michauxii	--	--	--	--	--	AJ414585, AJ414586	
V. michauxii	--	--	--	--	--	JX506249	N. Maxted et al. 5069 (E)
V. michauxii	--	--	--	--	--	AJ414586	
V. mollis	--	--	--	--	--	AJ566208	
V. monantha	JX505509	--	--	JX505758	JX506018	JX506252	M.F. Spencer s.n. (GH)
V. montbretii	--	--	--	--	--	EU202644, AF228075	
V. multicaulis	JX505510	JX505881	JX505622	JX505761	--	JX506255	A. Henry 62 (GH)
V.multijuga							
V. narbonensis	--	--	--	--	--	HM470594	
V. narbonensis	--	--	--	--	--	AJ130833	
V. narbonensis	--	--	--	--	--	HM470593	
V. noeana	JX505512	JX505887	--	--	--	JX506261	M.J.E. Coode & B.M.G. Jones 2205 (GH)

V. noeana	--	--	--	JX505764	--	JX506262	J. Bornmueller 14046 (GH)
V.ohwiana							
V. onobrychioides	JX505514	JX505889	--	JX505766	JX506024	JX506264	D. Geerinck-Coutrez 8807 (GH)
V. palaestina	--	--	--	--	--	JX506267	N. Maxted et al. 4099 (E)
V. pannonica	--	JX505891	--	--	JX506025	JX506268	H. Schaefer s.n. (BM)
V. pannonica	--	--	--	--	--	HM026415/H	G. Kenicer 98 (TUS)
V.parviflora							
V.parvula							
V. peregrina	--	--	--	--	--	AJ566206	
V. peregrina	--	--	--	--	--	JX506271	M.J.E. Coode & B.M.G. Jones 701 (GH)
V. peregrina	--	--	--	--	--	JX506272	A. Strid & Tan 31232 (E)
V. persica							
V. pisiformis	--	--	--	--	--	AF333581/AF 333582	
V. pisiformis	JX505517	JX505895	--	JX505769	JX506029	JX506276	H. Schaefer s.n. (BM)
V. pisiformis	--	JX505896	JX505629	JX505770	--	JX506277	G. Kenicer 107
V. pesudocassubica							
V. pubescens	JN661203	JX505897	--	JX505771	--	JX506278	H. Schaefer 2011/74 (GH)
V. qatmensis	--	--	--	--	--	AM087149	
V. quadrijuga							
V. rafigae							
V. rechingeri							
V. sativa	--	--	--	--	HQ596890	--	
V. sativa	--	--	--	--	--	HM470602	
V. sativa	--	--	--	--	--	JX506280	M. Imam s.n. (GH)
V. sativa	--	JX505898	--	--	--	--	H. Schaefer 2012/06 (GH)
V. sativa	JN661204	JX505899	JX505630	--	JX506030	JX506281	H. Schaefer 2011/78 (GH)
V. semiglabra	--	--	--	--	--	JX506283	Becker 101 (GH)
V. sepium	JN661205	--	--	--	JX506033	JX506284	H. Schaefer 2011/407 (GH)
V. sericocarpa	--	--	--	--	--	AJ851226	
V. serratifolia	--	--	--	--	--	AJ131075	
V. sibthorpii	--	JX505902	JX505632	JX505773	--	JX506285	A. Baldacci s.n. (GH)
V. sicula	--	--	JX505633	--	JX506034	JX506286	H. Ross 530 (GH)
V. sicula	--	--	JX505634	JX505774	--	JX506287	Lefevre s.n. (GH)
V. sojakii							
V.splendens							
V. subvillosa	--	--	--	--	--	JX506292	J.E.T. Aitchison 948 (GH)
V. subvillosa	JX505518	--	--	JX505778	JX506036	JX506293	collector unknown (GH)
V. sylvatica	JX505519	--	JX505638	--	JX506037	JX506294	H. Schaefer 2011/213 (GH)
V. sylvatica	JX505520	JX505904	JX505639	--	JX506038	JX506295	H. Schaefer s.n. (BM)

V. tenuifolia	--	--	JX505640	JX505779	JX506040	JX506297	H. Schaefer s.n. (BM)
V. tenuifolia	--	JX505905	JX505641	JX505780	--	JX506298	G. Kenicer 99
V. tetrasperma	--	--	--	--	--	DQ351828	
V. tetrasperma	--	--	--	--	FJ395522	--	BM000954738
V. tetrasperma	JN661207	JX505909	JX505642	JX505781	JX506042	JX506302	J.B. Nelson 27040 (GH)
V. tetrasperma	--	JX505910	JX505643	JX505782	--	JX506303	G. Kenicer 87
V. tigridis Mouterd --	--	--	--	--	AJ851216		
V. truncatula							
V. unijuga	--	HM026402	AY839531	AY839408	--	AY839337	(IUI), G. Kenicer 27 (E)
V. venosa	--	HM026403	--	--	--	AF335197	
V. venosa	--	--	--	--	--	AF335199	
V. venosa	--	--	--	--	--	AF335201	
V. venulosa	--	JX505911	JX505644	JX505783	JX506043	JX506304	V.V. Nikitin s.n. (GH)
V. villosa	--	--	JX505636	JX505776	--	--	P. & J. Davis D-48203 (NY)
V. villosa	--	--	--	DQ311955	--	DQ312199	AL4595
V. villosa	--	JX505913	--	--	--	--	S. Choulette s.n. (GH)
V. villosa	--	JX505914	JX505645	JX505784	JX506045	JX506306	R. Convey & P. Hind 10755 (GH)
V. villosa	--	--	JX505646	JX505785	JX506046	JX506307	H. Schaefer 2011/211 (GH)
V. villosa	JN661208	JX505915	--	--	--	JX506308	H. Schaefer 2008/575 (BM)

5.5 The Posterior Probabilities (pp) for each node



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