A PHENETIC INVESTIGATION OF *VICIA* SECTION *PEREGRINAE* KUPICHA (LEGUMINOSAE, PAPILIONOIDEAE, VICIEAE)

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The taxonomic relationships between the four species of *Vicia* L. sect. *Peregrinae* Kupicha (1976) have been studied using 174 morphological characters. The results of the phenetic study are considered in conjunction with a literature review of the taxonomic history, cytology, phytogeography and ecology of the taxa involved. It is concluded that *V. mollis* is peripheral within sect. *Peregrinae*, and an investigation of the taxa of both sections *Peregrinae* and *Hypechusa* shows the species to be a natural member of sect. *Hypechusa*, to which it is transferred. The relationship between the three remaining species of sect. *Peregrinae* is discussed, and a key and conspectus to taxa are provided.

INTRODUCTION

The genus *Vicia* L. (Leguminosae, Vicieae) comprises approximately 166 species (Allkin et al., 1986). These species are chiefly located in Europe, Asia and North America, but extend to temperate South America and tropical East Africa. The genus, as a whole, was revised by Kupicha (1976), who divided the species into two subgenera and 22 sections. The order of species treated in her classification ranges from the shrubby perennial forms to annual herbs. Her sect. *Peregrinae* Kupicha is placed at the latter extreme, the twenty-second section in *Vicia* and the fifth in subgenus *Vicia*.

In her key, Kupicha distinguishes sect. *Peregrinae* from its closest ally, sect. *Hypechusa* (Alef.) Aschers. & Graebner, on the basis of flower colour and the relative position of the seed lens to hilum:

'Flowers yellow or white; lens of seed opposite hilum . . . . sect. **Hypechusa**

Flowers purplish; lens of seed close to hilum . . . . sect. **Peregrinae**'

Sect. *Peregrinae*, as circumscribed by Kupicha, contains four species: *V. aintabensis* Boiss. & Hauskn., *V. michauxii* Sprengel, *V. mollis* Boiss. & Hauskn. ex Boiss. and the type species, *V. peregrina* L. The four species are endemic to southern Europe, north Africa, Crimea and south-west Asia eastward to Pakistan, though the distributional range of the section is largely identical to the distribution of *V. peregrina* alone, the other species being rarer and much more restricted within south-west Asia. Kupicha provided the following description for the section:

> 'Plants annual. Stems with complete replacement of cortical vascular bundles at the nodes. Leaves weakly epi-amphistomatic, tendrillous, multijugate. Inflorescence 1-flowered, not pedunculate but flowers borne on fairly long pedicels. Flowers whitish, pale yellow or dark violet. Calyx irregular; vexillum stenonychioid, glabrous. Legume rhomboidal (sutures not parallel). Seeds with very short hila; lens near hilum; testa smooth.'

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Fedtschenko (1948) used the name *Peregrinae* for a series containing four species: *V. peregrina*, *V. gracilior* Popov (syn. *V. peregrina*), *V. megalosperma* M. Bieb. (syn. *V. peregrina*) and *V. michauxii*, but he only provided a description in Russian and this does not constitute valid publication. Plitmann (1967) uses the name for his series *Peregrinae* which contained *V. aintabensis*, *V. michauxii* and *V. peregrina*. Valid publication of the name was, however, undertaken by Radzhi (1971) following a study of *Vicia* in the Caucasus. He published sect. *Vicia* subsect. *Peregrinae* and included the single species *V. peregrina* (*V. aintabensis* and *V. michauxii* are not found in the Caucasus). Kupicha (1976) considered that the taxon containing *V. peregrina* and its allies warranted sectional status and so published the sect. *Peregrinae*.

The five sections of *Vicia* subgenus *Vicia sensu* Kupicha (1976) were recently revised by Maxted (1991, 1993). During this revision some inconsistencies in Kupicha's concept of sect. *Peregrinae* were met with. In her key to *Vicia* subgenera and sections, she distinguished sect. *Peregrinae* on the basis of flower colour and relative seed lens to hilum position. She used the presence of purple flower colour to distinguish sect. *Peregrinae* from sect. *Hypechusa*. This is a poor character to use to distinguish between these two sections. Three of the four species included by her in sect. *Peregrinae* have yellowish cream-coloured flowers and *V. peregrina* occasionally has very pale purple-flowered specimens, while within sect. *Hypechusa*, *V. esdraelonensis* Warb. & Eig and certain forms of *V. pannonica* Crantz and *V. lutea* L. have purple flowers. This point is, however, corrected in her description of her sect. *Peregrinae*, where flower colour is said to be 'whitish, pale yellow or dark violet'.

One species, *V. mollis*, stands out within Kupicha's concept of sect. *Peregrinae*; this species does not fit the description provided for the section. The taxa of sect. *Peregrinae* should be 1-flowered, not pedunculate, the flowers should be borne on relatively long pedicels and the seed lens should be near the hilum. However, *V. mollis* can have two flowers per inflorescence, has an obsolescent peduncle, a relatively short pedicel (compared with the other three species of the section) and the seed lens is found opposite the hilum.

The primary aim of this research was to clarify the relationships between the species of sect. *Peregrinae* Kupicha (1976) and to determine whether *V. mollis* was a natural member of this section. Also, throughout the taxonomic history of *Vicia* three sect. *Peregrinae* species, *V. peregrina*, *V. aintabensis* and *V. michauxii*, have often been thought to constitute a closely associated complex (Seringe, 1825; Boissier, 1872; Bouloumoy, 1930; Fedtschenko, 1948; Plitmann, 1967; Stankevich, 1970; Kupicha, 1976). The secondary aim of this research was to investigate the rank of the distinct taxa within this complex.

Taxonomic History

The taxonomic history of *Vicia* is extensive and contentious: twenty major classifications of the group have been produced since the work of Linnaeus (Maxted, 1993). Alefeld, in a series of publications (Alefeld, 1859, 1860, 1861a, b and c), produced one of the earliest and most detailed classifications of *Vicia*. He recognized two sect. *Peregrinae* species and considered each was sufficiently distinct from other *Vicia* species to warrant distinct subgeneric or generic rank; *V. peregrina* was placed in the monospecific *Vicia* subgenus *Alangula* Alefeld (1861a) and

V. michauxii was separated into the monospecific genus *Tuamina michauxii* (Sprengel) Alefeld (1861b).

Boissier (1872) was the first author to group as a distinct unit the four species considered by Kupicha to compose sect. *Peregrinae*. Boissier did not give a taxonomic rank to this group, but it was contained within his sect. *Euvicia*. He includes in the grouping a new species, *V. mollis* Boiss. & Hausskn. ex Boiss., based on material collected by Hausknecht near Aleppo, Syria on 17 March 1865 (this species should not be confused with *V. mollis* Benth. ex Baker in Hooker (1876), which is a synonym of *V. benthamiana* Ali). The grouping of the four species suggested by Boissier was not immediately taken up by subsequent authors, but Bouloumoy (1930) reinstated the grouping for *Flore du Liban et de la Syrie*. Like Boissier, Bouloumoy does not give rank to this grouping, but from the key characters used to distinguish the group it is clear that his concept is derived from Boissier (1872).

The rarer species of sect. *Peregrinae* (*V. aintabensis* and *V. mollis*) are not found in the former Soviet Union, but the two more common species (*V. peregrina* and *V. michauxii*) constitute series *Peregrinae* in the classification of Fedtschenko (1948). Plitmann (1967), in his study of the annual species of *Vicia* of the Middle East, retains the concept of this grouping and adds *V. aintabensis* to *V. peregrina* and *V. michauxii*. Plitmann does not include *V. mollis* in his ser. *Peregrinae*. This species is included in the related but distinct ser. *Sericocarpae*, with *V. sericocarpa* Fenzl, Plitmann having noted that *V. mollis*, unlike the other three species of sect. *Peregrinae sensu* Kupicha, does possess an obsolescent peduncle.

MATERIALS AND METHODS

For the investigation, 148 specimens of sect. *Peregrinae* were seen; these specimens are listed in Appendix I. Specimens were borrowed from BM, E, ERE, G, HUJ, K, LE, MPU, W and WIR (abbreviations follow Holmgren et al., 1990). This material was used in conjunction with fresh material of each species collected by Maxted et al. and held at SPN.

Each specimen was scored, where possible, for 174 continuous or discrete variables including 43 vegetative, 84 inflorescence, 23 legume and 24 seed features. These characters were selected from the literature (Plitmann, 1967; Ball, 1968; Davis & Plitmann, 1970; Gunn, 1970; Kupicha, 1974, 1976; Gunn & Kluve, 1976; Perrino et al., 1984) and from personal observations on the material. The characters and character states recognized are listed in Appendix II. The number of character states recognized was determined to permit the greatest separation of Operational Taxonomic Units (OTUs). The code of 0 was taken to represent missing data.

The dataset was analysed using four different methods of cluster analysis, so that a general view of specimen relatedness could be established and any bias introduced by the use of a single analysis method could be avoided. The program SPSS^{x} (Norusis, 1988) via procedure DISCRIMINANT was used to calculate character F-ratio values, which can be used to indicate a character's diagnostic value. Characters with relatively high F-ratio values were then used to undertake the analysis. The program CLUSTAN 3 procedure CLUSTER (Wishart, 1987) was used for centroid linkage, average linkage and Ward's method of cluster analysis. The program LINKAGE (Wirth et al., 1966) was used for single linkage (nearest neighbour) cluster analysis. All analyses were undertaken using the IBM 3090 mainframe computer at the University of Southampton, Southampton, UK.

RESULTS

A morphological dataset for 96 specimens (OTUs = specimens) representing the four species of sect. *Peregrinae* was analysed using 80 characters selected because their SPSS[x] procedure DISCRIMINANT F-ratio values were greater than 10 (character set A in Appendix II). The dendrogram resulting from the centroid linkage cluster analysis is shown in Fig. 1. The specimen numbers are taken from Maxted (1991) and the taxon identification symbols are explained in the legend to Fig. 1. The results indicate nine clusters, of which five are composed of single specimens. The five specimens (5007, *V. peregrina* - *Foures* 983, MPU; 110, *V. aintabensis* - *Hausknecht* s.n., G; 3506, *V. michauxii* - *Willdenow* s.n., K; 5018, *V. peregrina* - *Bourgeau* 979, K; and 102, *V. aintabensis* - *Hausknecht* s.n., K) each contained a high proportion of missing data, which possibly explains their distinct placement in this analysis. The bulk of the specimens, however, are contained in four clusters. The most distinct of these multiple specimen clusters is composed of all the *V. mollis* specimens. The second most distinct cluster contains the *V. peregrina* specimens (except 5007 and 5018). The two remaining multiple specimen clusters contain specimens of *V. aintabensis* and *V. michauxii* respectively.

The same morphological dataset was re-analysed using Ward's method of cluster analysis and the resulting dendrogram is shown in Fig. 2. Following this analysis the specimens cluster into six main groupings. Two of the distinct specimens found in the previous analysis again form single specimen units (102 - *Hausknecht* s.n., K and 5007 - *Foures* 983) linked remotely with each other. One of the other specimens shown to be distinct in the previous analysis, 5018 - Bourgeau 979, following this analysis is linked to the *V. michauxii* specimen cluster. However, the other two specimens placed distinctly in the previous analysis are following this analysis linked more closely with other specimens of the same taxon: 110 - *Hausknecht* s.n., G is linked with *V. aintabensis* and 3506 - *Willdenow* s.n. is linked with *V. michauxii*. The most distinct multispecimen cluster produced using this method of analysis is made up of all the *V. mollis* specimens. This analysis splits the *V. peregrina* specimens into three linked multispecimen clusters. A re-examination of these groupings and the dataset does not provide a clear set of character correlations that might be used to distinguish subspecific taxa. The specimens of the two taxa shown to be most closely allied in the centroid analysis, *V. aintabensis* and *V. michauxii*, form three distinct clusters, two of *V. aintabensis* and one *V. michauxii*. The Ward's method of cluster analysis has not proved as successful as the centroid linkage method of cluster analysis in clearly differentiating between the specimens of the two closely related taxa.

V. aintabensis and *V. michauxii* are undoubtedly closely related, and to help further clarify the relationship between these two species a dataset including 14 characters selected for F-ratio values over 15 (character set B in Appendix II) was analysed. The results of the centroid linkage cluster analysis using this dataset are shown in Fig. 3. This character set does effectively distinguish the specimens of the two taxa, placing them in two distinct clusters. Even the three specimens of these two taxa shown in the previous analysis to remain distinct from the main taxon cluster, 110 - *Hausknecht* s.n., G and 102 - *Hausknecht* s.n., K, and 3506 - *Willdenow* s.n., K, using this character set are linked as peripheral members of their respective taxon clusters.

The results of both the centroid linkage and Ward's method of cluster analysis for the specimens of sect. *Peregrinae* indicate that *V. mollis* is the most peripheral within the section.

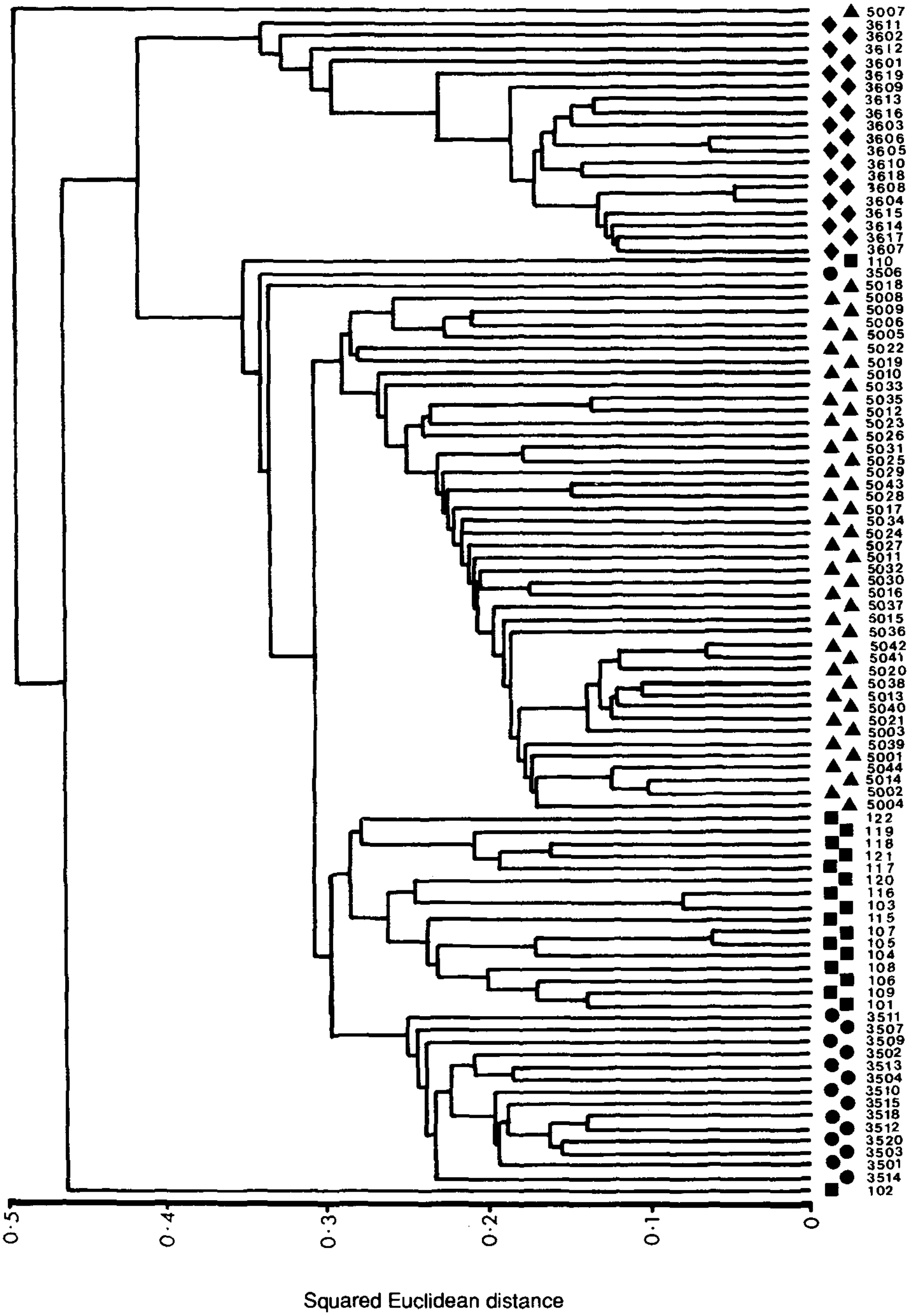

FIG. 1. Dendrogram resulting from centroid linkage cluster analysis of 96 specimens of *Vicia* sect. *Peregrinae* Kupicha (1976). ■, *V. aintabensis*; ●, *V. michauxii*; ♦, *V. mollis*; ▲, *V. peregrina*.

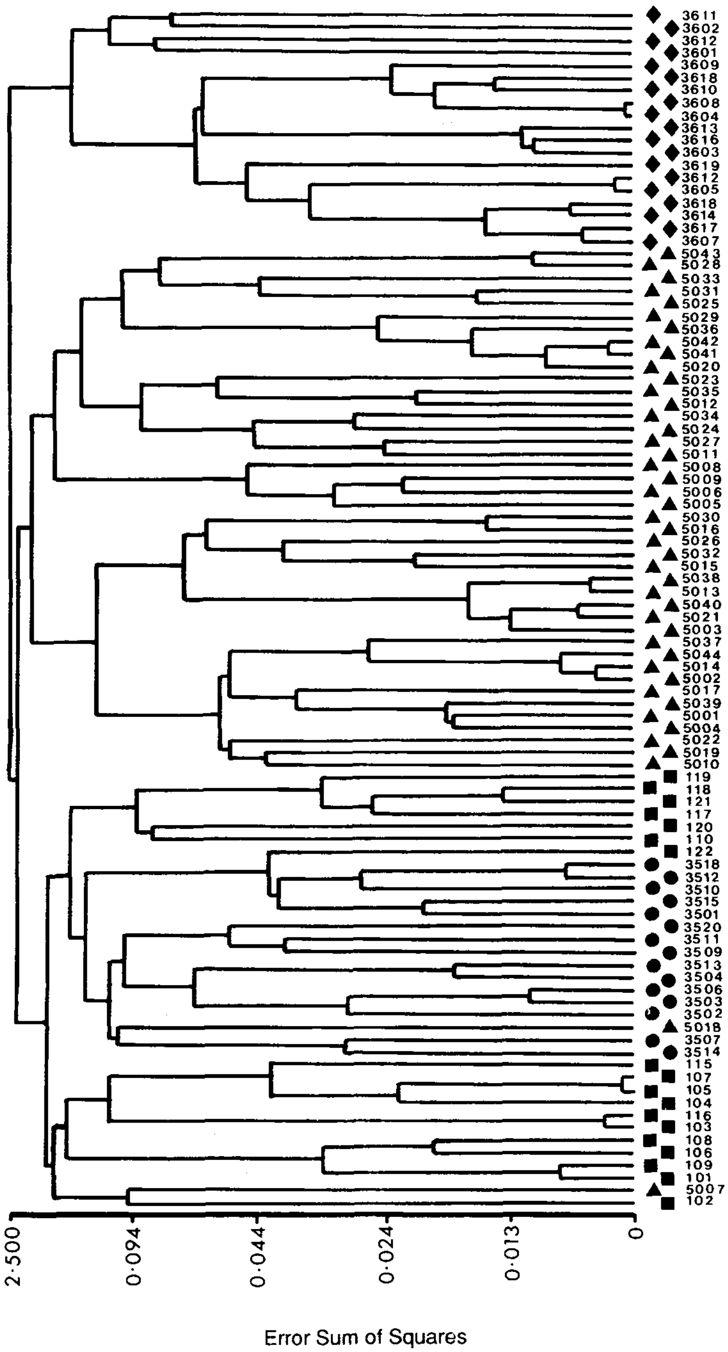

FIG. 2. Dendrogram resulting from Ward's method of cluster analysis of 96 specimens of *Vicia* sect. *Peregrinae* Kupicha (1976). ■, *V. aintabensis*; ●, *V. michauxii*; ◆, *V. mollis*; ▲, *V. peregrina*.

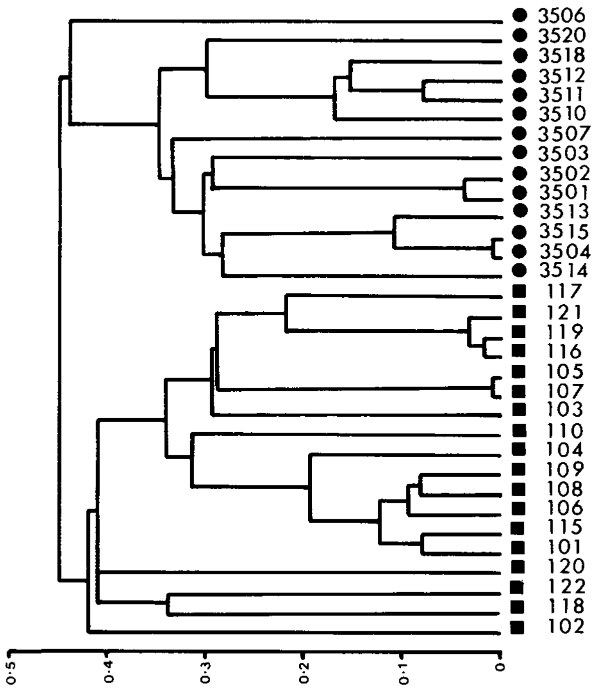

FIG. 3. Dendrogram resulting from centroid linkage cluster analysis of 32 specimens of *Vicia aintabensis* and *V. michauxii*.

As discussed in the taxonomic history above, the placement of *V. mollis* with *V. peregrina*, *V. aintabensis* and *V. michauxii* in a single section is controversial. Several authors (Plitmann, 1967; Townsend, 1967; Chrtková-Zertová, 1979) consider *V. mollis* a more natural ally of *Vicia* sect. *Hypechusa sensu* Kupicha taxa. To help resolve this dispute the relationship between the taxa of the two sections *Peregrinae* and *Hypechusa* was examined. The detailed relationships between the taxa of sect. *Hypechusa* will be discussed elsewhere (Maxted, in prep.).

For this analysis taxon data rather than individual specimens were analysed (taxa = OTUs). To produce the taxon scores for each taxon the mode was calculated for each continuous character and the most common character state was used for the multistate characters. The method of calculating the taxon scores for the multistate characters does imply a certain characteristic for the multistate data: that only one score is common, the character scores not being evenly distributed between two or more states. This assumption is valid for the majority of characters and so was considered a satisfactory assumption for the analysis as a whole. A listing of the taxa included in this study, the taxon codes used and the number of specimens used to produce the taxon scores is provided in Appendix III.

From the complete taxon character set of 174 characters, 97 were selected for use in the single linkage cluster analysis. Characters were selected which had an SPSS^{x} procedure DISCRIMINANT F-ratio value higher than 10 (character set C in Appendix II). This dataset was initially analysed using single linkage cluster analysis via the program LINKAGE. The results are displayed in the form of linkage diagrams, 20 diagrams for the dataset analysed. The diagrams are arranged in decreasing similarity from a similarity level of 0.8676 for the first inter-OTU link to 0.6156 when all the OTUs are joined in one cluster. The diagrams which are of most use in elucidating the relationship between the taxa of *Peregrinae* and *Hypechusa* are shown in Figs 4 and 5.

Before discussing the results of the LINKAGE analysis, linkage diagrams themselves require introduction. During the analysis at various threshold levels of similarity each pair of OTUs will cluster: this is demonstrated in the linkage diagram by a line connecting the pair of OTUs. Lines connecting OTUs may be of three kinds, indicating three possible kinds of relationships between OTUs: a single line indicating a relationship established at a higher level of similarity, a double line indicating a new relationship established at that particular similarity level, and a broken line which indicates a new internal (within cluster) link at that similarity level. To

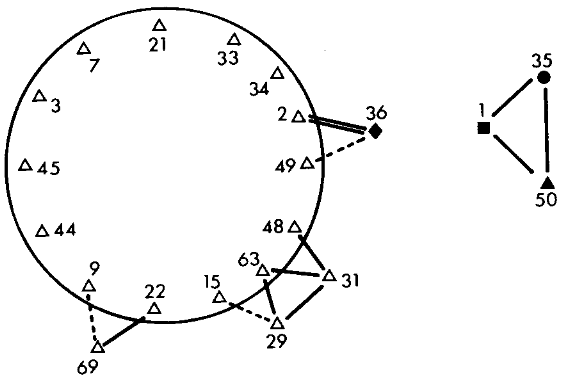

FIG. 4. Linkage diagram for sect. *Peregrinae* and sect. *Hypechusa* taxa at a threshold similarity level of 0.6286. △ , sect. *Hypechusa* taxa.

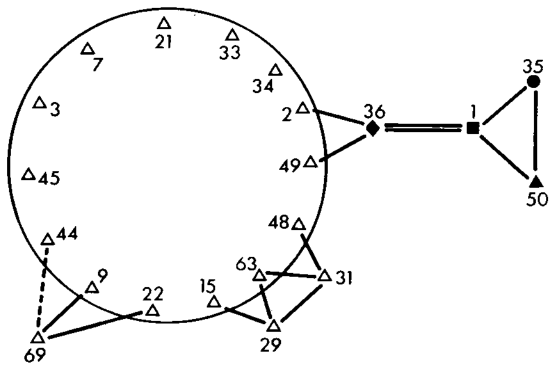

FIG. 5. Linkage diagram for sect. *Peregrinae* and sect. *Hypechusa* taxa at a threshold similarity level of 0.6156.

simplify interpretation of the diagrams, highly intra-connected clusters are encircled. The criterion for inclusion in a circle is that each OTU should have at least three links with other members of the same cluster.

At a similarity level of 0.6286 the 21 taxa included in the analysis are contained in two clusters, as is shown in Fig. 4. One contains all the sect. *Hypechusa sensu* Kupicha taxa plus *V. mollis* (36) from sect. *Peregrinae sensu* Kupicha, while the second cluster contains the remaining three sect. *Peregrinae* taxa, *V. aintabensis* (1), *V. michauxii* (35) and *V. peregrina* (50). When the similarity level is decreased to 0.6156, as is shown in Fig. 5, these two clusters form an inter-cluster link when *V. mollis* (36) forms a new link with *V. aintabensis* (1), uniting all the taxa into one cluster. It should be noted that prior to this link with its sect. *Peregrinae* allies, *V. mollis* has formed links with two sect. *Hypechusa* taxa, *V. anatolica* (2) and *V. pannonica* subsp. *pannonica* (49). The results of the analysis indicate that *V. mollis* is phenetically closer to the sect. *Hypechusa* taxa than to sect. *Peregrinae*. The new link between the two clusters, shown in Fig. 5, is made via *V. mollis*, so although this species is a natural member of sect. *Hypechusa* it is the sect. *Hypechusa* taxon most closely related to sect. *Peregrinae*.

To verify the results of the single linkage cluster analysis and to avoid any bias inherent in this method, the same dataset was re-analysed using both Ward's method and average linkage cluster analysis. The resultant dendrograms are shown in Figs 6 and 7 respectively. The results of both these different methods of analysis are similar to those of the single linkage cluster analysis. *V. mollis* (36) can be seen to be part of the sect. *Hypechusa* cluster and the three remaining taxa of sect. *Peregrinae sensu* Kupicha are clearly separated into a distinct cluster.

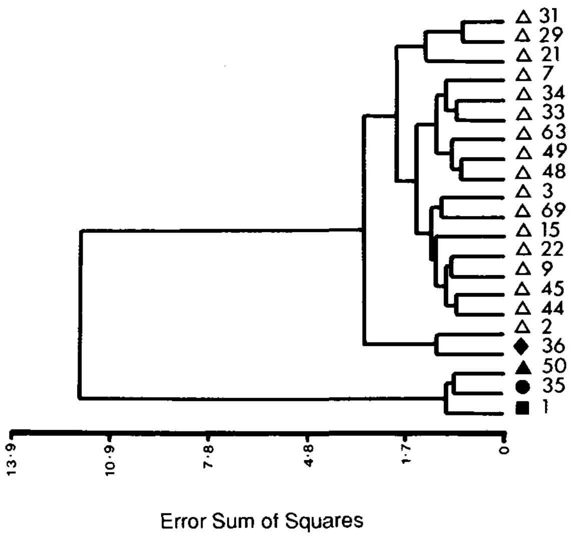

FIG. 6. Dendrogram resulting from Ward's method of cluster analysis of sect. *Peregrinae* and sect. *Hypechusa* taxa.

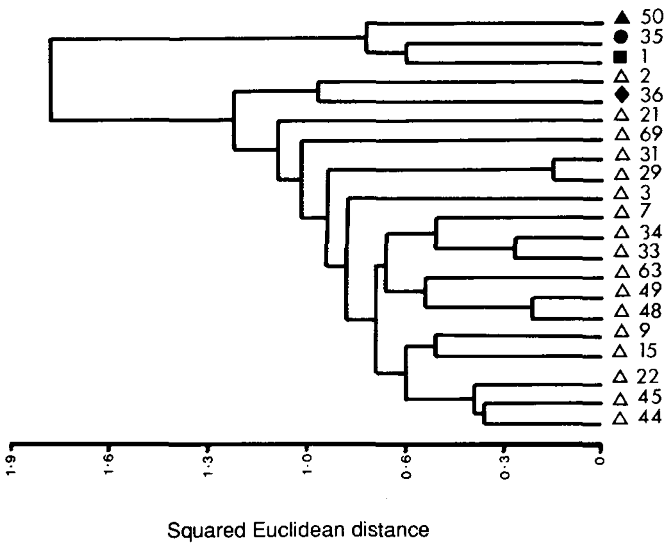

FIG. 7. Dendrogram resulting from average linkage cluster analysis of sect. *Peregrinae* and sect. *Hypechusa* taxa.

DISCUSSION

V. mollis was considered by Kupicha (1976) to be a member of *Vicia* sect. *Peregrinae*, this grouping of *V. mollis* with *V. peregrina* and its allies having been originally suggested by Boissier (1872). However, the results of the phenetic analysis consistently indicate the more natural affinity of *V. mollis* with sect. *Hypechusa*, to which it has been transferred (Maxted, 1993). It is worth stressing the degree of agreement between the results of the different methods of analysis, which strengthens the necessity for this species to be transferred to sect. *Hypechusa*.

Kupicha (1976) states that the species of her sect. *Peregrinae* have no peduncle and the seed lens is situated near the hilum. This is true for *V. aintabensis*, *V. michauxii* and *V. peregrina*, but *V. mollis* does, in fact, possess a short peduncle and the lens is found on the opposite side of the seed to the hilum. This natural alliance of *V. mollis* with sect. *Hypechusa* was noted by Townsend (1967) and the transfer of this species to sect. *Hypechusa* is supported by Plitmann (pers. comm.).

The transfer of *V. mollis* to sect. *Hypechusa* is supported by cytological data. *V. mollis* has a chromosome count of $2n = 10$ (Maxted et al., 1991). The most common diploid number for *Vicia* subgenus *Vicia* taxa, which contains sections *Hypechusa* and *Peregrinae*, is $2n = 14$, but $2n = 10$ and 12 are also common. Records of $2n = 10$ are restricted to two subgenus *Vicia* sections, *Vicia* and *Hypechusa*. Within the latter section, $2n = 10$ is recorded for *V. anatolica*, *V. ciliatula* and *V. melanops* (*V. anatolica* was shown in the phenetic analysis to be the closest morphological ally of *V. mollis*). The three members of sect. *Peregrinae* have commonly been found to have diploid numbers of $2n = 14$ and more rarely $2n = 12$, but no record of $2n = 10$ has yet been reported for these species. This suggests that *V. mollis* is cytologically more closely allied to taxa of sect. *Hypechusa* with diploid counts of $2n = 10$.

The three species of sect. *Peregrinae* are closely allied, though the existence of several constantly correlated characters that can be used to distinguish the three taxa indicates that they do warrant distinct specific status. However, as with all closely related groups of taxa, the identification of individual taxa can be seriously hampered by problems associated with missing data. If a group of taxa are closely related, by definition they are generally distinguished by a small number of correlated characters. If it is not possible to score these key diagnostic characters then they are likely to be confused, as has happened historically between *V. aintabensis* and *V. michauxii*. These two species are easily distinguished on the basis of legume and seed characters, but these characteristics are often those most difficult to score from herbarium material. During expeditions to the Middle East I have collected fruiting material of *V. peregrina*, *V. aintabensis* and *V. michauxii* (and *V. mollis*) and this has allowed me to gain a clearer understanding of the differences between these species.

Sect. *Peregrinae* as circumscribed here contains three distinct species. Plitmann (in Davis & Plitmann, 1970) refers to intermediate forms between the three species being found in northern Iraq and southern Turkey and he describes two varieties within *V. michauxii*. I have not noted specimens that show intermediacy and my interpretation of the variation pattern is that the character correlations suggest three distinct species. *V. peregrina* is more widely geographically and ecologically distributed than the other two species and possibly consequently shows a greater range of morphological variation. Plitmann (1967) recognized three varieties within *V. peregrina* (var. *gracilior*, var. *carnea* and var. *peregrina*), distinguished on the basis of leaflet dimensions, calyx teeth lengths, corolla colour and size. Field observations have shown these characters to be variable within populations and they do not appear to form distinct taxonomic units. The results of the phenetic analysis do indicate groups of specimens within the *V. peregrina* clusters shown in Figs 1 and 2. However, these groups are not consistent for the two methods of analysis used and a re-examination of the dataset failed to indicate any consistent character correlations that could have produced these groupings. Without the experience of a more detailed study in uniform garden conditions, it seems premature to accept any distinct subspecific taxa.

The distribution of all three species of sect. *Peregrinae* centres on the north-east Mediterranean, with the highest concentrations of specimens being found in Turkey, Lebanon, Syria, Iran, Iraq, the Caucasus and the Central Asian republics of the C.I.S. *V. aintabensis* and *V. michauxii* are much more restricted than *V. peregrina*, which extends throughout southern Europe, west Asia and north Africa. Of the two former species it is notable that *V. michauxii* extends further east into Afghanistan and the C.I.S. than *V. aintabensis*. All three species have very similar ecological preferences for dry, agricultural or disturbed scrubby land and rocky, limestone slopes.

KEY TO THE SPECIES

1. Flower cream; limb of standard c. equal to claw; calyx teeth shorter than tube; seed circumference to hilum length ratio up to 0.1 ____ 2

\+ Flower violet-purple; limb of standard c. twice as long as claw; calyx teeth c. as long as tube; seed circumference to hilum length ratio 0.11 to 0.3 ____ 3. ***V. peregrina***

2. Legume rounded to flat in cross-section; seed 4.0–5.5 × 4.0–5.5mm, subglobose ______ 2. ***V. aintabensis***
\+ Legume flat in cross-section; seed 5.5 × 8.0–9.5mm, transversely ellipsoid ______ 1. ***V. michauxii***

CONSPECTUS

Type specimens that have not been seen are indicated by n.v.

Vicia* sect. *Peregrinae Kupicha, Notes Roy. Bot. Gard. Edinburgh 34: 323 (1976).
Type species: *V. peregrina* L.
Syn.: *Vicia* subgen. *Alangula* Alef., Bonplandia 8: 72 (1861).
Tuamina Alef., Bonplandia 9: 102 (1861).
Vicia sect. *Subsessiles* Rouy in Rouy & Foucaud, Fl. Fr. 5: 208 (1899), pro parte excl. typ.
Vicia ser. *Peregrinae* B. Fedtsch., Fl. URSS. Komarov (ed.) 13: 466 (1948), nom. inval. (descr. ross.).
Vicia subsect. *Brevicarpa* Stank., Tr. Prikl. Bot. Genet. Sel. 43: 113 (1970), pro parte excl. typ.
Vicia subsect. *Peregrinae* Radzhi, Novosti Sist. Vyssh. Rast. 7: 238 (1971).

Annual; climbing or scrambling; stem slender. Stipules entire or semi-hastate with 1–2 teeth. Leaf apex tendrillous; leaflets 2–7 pairs per leaf, 5–40 × 1–6mm, symmetrical; margins entire. Flower solitary, sessile. Calyx mouth oblique; teeth not reflexed; lower tooth longer than upper; base gibbous. Flowers 9–24mm; corolla concolorous; all petals approximately equal length; wing marking absent. Standard cream, blue or purple, platonychioid or stenonychioid; dorsal bowing present; dorsal surface glabrous. Legume oblong, 15–47 × 5–15mm round or round to flat in cross-section; sutures curved; simple valve hairs present; septa absent. Seeds 2–7 per legume, spherical or transversely ellipsoid, 3.5–6.0mm, hilum 1–3mm, less than ¼ seed circumference; lens positioned near hilum; hilum oval; testa surface smooth; aril absent. $2n = 12, 14$.

Number of taxa: 3.

Distribution: Mediterranean Basin, Crimea, South-west Asia to Pakistan.

1. *V. michauxii* Sprengel, Mant. Fl. Halens. 48 (1807). Holo.: *Kotschy* 238 (K), collected in Iran, Persepolis ruins (isotypes G, UPS n.v., W).
Syn.: *V. persepolitana* Boiss., Diagn. ser. 1(6): 48 (1846).
Tuamina michauxii (Sprengel) Alef., Bonplandia 9: 102 (1861).
V. carnea Kotschy in Unger & Bornm., Die Insel Cypern 386 (1865).
V. michauxii var. *stenophylla* Boiss., Fl. Or. 2: 577 (1872).
V. aintabensis sensu Blakelock, Kew Bull. 3: 424 (1948) non Boiss. & Hauskn. ex Boiss.
V. peregrina subsp. *michauxii* (Sprengel) Ponert, Feddes Repert. 83(9–10): 634 (1973).

V. peregrina subsp. *persepolitana* (Boiss.) Ponert, Feddes Repert. 83(9–10): 634 (1973).

Annual, 10–75cm. Stem nodes green or purple. Stipules 1–3 × 0.5–2mm, entire or semi-hastate with 1–2 teeth, c.10 hairs per cm^2. Leaves 28–79mm; petiole 1–8mm; leaflets 6–14 per leaf, (5–)8–24(–40) × 1–6mm; narrowly linear to elliptic-ovate, 5–45 abaxial hairs per cm^2. Pedicel 3–5mm. Calyx green or with purple base; tube 3.5–5mm; lower tooth 2–3.5mm; hairs 10–35 per cm^2. Standard cream or pale yellow, occasionally with purple veins, 7–16mm. Wings cream or pale yellow, 10–14.5mm. Keel 8–11.5mm. Staminal tube 6.5–10mm; filaments 1.5–2.5mm. Style 2.5–4.5mm. Ovary 5–7mm, covered with simple hairs; 5–7 ovules per ovary. Legume oblong; (12–)23–30(–40) × 7–15(–18)mm, round to laterally flattened in cross-section; valves yellow or yellow-brown, occasionally with purple markings, hairs 10–35 per cm^2. Seeds 2–5 per legume, transversely ellipsoid, 5.5 × 8–9.5mm, red-brown or brown. Flowering March to September. $2n$ = (12), 14.

Ecology: Dry agricultural and disturbed land, 500–2650m.

Distribution: Afghanistan, Commonwealth of Independent States, Iran, Iraq, Israel, Jordan, Lebanon, Pakistan, Syria, Turkey.

2. *V. aintabensis* Boiss. & Hausskn. ex Boiss., Fl. Orient. 2: 577 (1872). Holo.: *Hausknecht* 24/4/1865 (G), collected near Gaziantep, Turkey, agricultural weed (isotypes K, W).

Syn.: *V. peregrina* subsp. *aintabensis* (Boiss. & Hauskn. ex Boiss.) Ponert, Feddes Repert. 83(9–10): 634 (1973).

Annual, 20–50(–80)cm. Stem nodes green or rarely purple. Stipules 1–3 × 1–4mm, semi-hastate with 1–2 teeth, c.10 hairs per cm^2. Leaves 32–60mm; petiole 2–6mm; leaflets 8–14 per leaf, 6–26 × 1–4mm; linear-elliptic, 5–45 abaxial hairs per cm^2. Pedicel 2–6mm. Calyx green or with purple base; tube 3–6mm; lower tooth 2–4mm; hairs 5–35 per cm^2. Standard cream (rarely pale yellow), occasionally with purple veins, 9–18mm. Wings cream, 8–16mm. Keel 6–11mm. Staminal tube 4.5–9.5mm; filaments 1–2mm. Style 2.5–4.5mm. Ovary 4–6.5mm, covered with simple hairs; 4–8 ovules per ovary. Legume oblong; 18–26(–40) × 7–10mm, round in cross-section; valves yellow, hairs 5–45 per cm^2. Seeds 2–6 per legume, spherical to cubic, 4–5.5 × 4–5.5mm, brown. Flowering April to July. $2n$ = 14.

Ecology: Dry agricultural and disturbed land, more rarely woodland edges, 170–1600m.

Distribution: Egypt, Iran, Iraq, Israel, Jordan, Lebanon, Syria, Turkey.

3. *V. peregrina* L., Sp. Pl. 2: 737 (1753).
Type: Hb. Linn. 906.28 (lecto. designated here).
This specimen is pinned together with 906.29 and 906.30 in Hb. LINN; 906.29 is not *V. peregrina* but is *V. articulata* Hornem.

Syn.: *V. megalosperma* M. Bieb., Fl. Taur.-Cauc. 2: 161 (1808).
V. leptophylla Raf., Car. Nuo. Gen. Nuo. Sp. Ani. Pl. Sicilia 71 (1810).
V. monanthos Viv., Fl. Lib. Spec. 42 (1824).

V. peregrina var. *glabrescens* Post, Fl. Syr. Pal. Sin. 1: 288 (1896).
V. peregrina var. *parviflora* Post, Fl. Syr. Pal. Sin. 1: 288 (1896).
V. peregrina var. *angustifolia* Rouy in Rouy & Foucaud, Fl. Fr. 5: 218 (1899).
V. peregrina var. *latifolia* Rouy in Rouy & Foucaud, Fl. Fr. 5: 218 (1899).
V. peregrina var. *leptophylla* (Raf.) Hal., in Consp. Fl. Graec. 1: 481 (1901).
V. peregrina var. *gracilior* Popov in Sched., Ad. Herb. Fl. As. Med. 11: 271 (1927).
V. gracilior (Popov) Popov, Fl. URSS. 13: 467 (1948).
V. peregrina var. *carnea* (Kotschy) Plitmann, Bio. Ann. *Vicia*, U.S.D.A., Rep. 10-CR-11 75 (1968).
V. peregrina subsp. *megalosperma* (M. Bieb.) Ponert, Feddes Repert. 83(9–10): 634 (1973).

Annual, 10–70(–95)cm. Stem nodes green or purple. Stipules 1–4 × 1–3.5mm, semi-hastate, c.5 hairs per cm^2. Leaves 22–57mm; petiole 1–6mm; leaflets (4–)8–14 per leaf, 6–22(–40) × 1–3 (–6)mm; narrow linear or linear-elliptic, 5–45 abaxial hairs per cm^2. Pedicel 2–9mm. Calyx green or with purple base; tube 3–6.5mm; lower tooth 2–5mm; hairs 10–60 per cm^2. Standard purple (rarely pale purple), 10–25mm. Wings purple (rarely pale purple) 7–15mm. Keel 5.5–11.5mm. Staminal tube 5–9.5mm; filaments 1.5–2.5mm. Style 2.5–3.5mm. Ovary 4–6mm, covered with simple hairs; 5–8 ovules per ovary. Legume rhomboid or oblong; (15–)17–40 × (4–)6–12mm, round in cross-section; valves yellow or yellow-brown, with occasional purple markings; hairs 5–45 per cm^2. Seeds 2–7 per legume, spherical to cubic, 3.5–6.5 × 3.5–6.5mm, yellow to red-brown. Flowering February to July. $2n$ = (12), 14.

Ecology: Scrub and rocky limestone slopes, dry agricultural and disturbed land, 10–1450m.

Distribution: Afghanistan, Albania, Algeria, Bulgaria, Commonwealth of Independent States, Cyprus, Egypt, France, Germany, Hungary, Iran, Iraq, Israel, Italy, Jordan, Lebanon, Libya, Morocco, Pakistan, Portugal, Romania, Saudi Arabia, Spain, Switzerland, Syria, Turkey, former Yugoslavia.

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APPENDIX I

SPECIMEN CITATIONS

Specimens are listed according to taxon identification, country of provenance and herbarium from which the specimen was borrowed. Individual specimen citations are displayed in the following order: collector(s), collection number, two letter ISO country code (International Standards Organisation, 1981) and herbarium abbreviations (Holmgren et al., 1990).

V. aintabensis

Liston & Lev-Ari 7-85-371/24, IL (HUJ); *Cowan & Darlington* 463, IR (K); *Samuelsson* 3671, SY (K); *Maxted, Ehrman & Khattab* 2110, SY (K); *Maxted, Ehrman & Khattab* 2148, SY (K); *Maxted, Ehrman & Khattab* 2158, SY (K); *Maxted, Ehrman & Khattab* 2182, SY (K); *Maxted, Ehrman & Khattab* 2214, SY (K); *Davis & Hedge* 27919, TR (BM); *Davis & Hedge* 28087, TR (BM, E, HUJ); *Davis* 42294, TR (E); *Haussknecht* s.n., TR (G); *Zohary* 3752, TR (HUJ); *Haussknecht* s.n., TR (K); *Maxted, Ehrman & Auricht* 4825, TR (K); *Maxted, Auricht & Ehrman* 4825, TR (K); *Maxted, Auricht & Ehrman* 4889, TR (K); *Maxted, Auricht & Ehrman* 4982, TR (K); *Maxted, Auricht & Ehrman* 5060, TR (K); *Maxted, Auricht & Ehrman* 5079, TR (K); *Maxted, Auricht & Ehrman* 5106, TR (K); *Maxted, Auricht & Ehrman* 5216, TR (K); *Maxted, Ehrman & Auricht* 5252, TR (K); *Maxted, Auricht & Ehrman* 5252, TR (K); *Haussknecht* s.n., TR (W).

V. michauxii

Ekberg W 9116, AF (E); *Hedge & Wendelbo* W3638, AF (E); *Hedge, Wendelbo & Ekberg* W8276, AF (E); *Podlech* 10364, AF (E); *Gowan* 2419, IQ (K); *Kotschy* 238, IQ (K, W); *Bornmüller* 6682, IR (E); *Koelz* 14484, IR (E); *Kotschy* 993, IR (W); *Pichler* s.n., IR (W); *Portenschlag* 1366, IR (W); *Willdenow* s.n., SU (K); *Aidarova* s.n., SU (LE); *Butkov* s.n., SU (LE); *Krivenko* s.n., SU (LE); *Linchevsky* s.n., SU (LE); *Lipsky* s.n., SU (LE); *Von Knorring* s.n., SU (LE); *Von Minkwitz* s.n., SU (LE); *Gudkova* s.n., SU (WIR); *Maxted & Potokina* 8024, SU (K); *Maxted & Potokina* 8028, SU (K); *Maxted & Potokina* 8038, SU (K); *Maxted & Sperling* 8143, SU (K); *Maxted & Sperling* 8149, SU (K); *Nikitina* s.n., SU (WIR); *Popov* 9419, SU (WIR); *Shcherbakov* s.n., SU (WIR); *Stankevich & Legotina* 1504, SU (WIR); *Stankevich & Legotina* 1525, SU (WIR); *Stankevich* 4588, SU (WIR); *Stankevich* D45, SU (WIR); *Stankevich* s.n., SU (WIR); *Davis & Hedge* 28374, TR (E).

V. mollis

Eig & Zohary s.n., IQ (HUJ); *Jacobs* 6501, IR (E); *Haussknecht* s.n., SY (G); *Maxted, Ehrman & Khattab* 2277, SY (K); *Maxted, Ehrman & Khattab* 2589, SY (K); *Maxted, Ehrman & Khattab* 2648, SY (K); *Maxted, Ehrman & Khattab* 2653, SY (K); *Maxted, Ehrman & Khattab* 2670, SY (K); *Maxted, Ehrman & Khattab* 2697, SY (K); *Maxted, Ehrman & Khattab* 2706, SY (K); *Haussknecht* s.n., SY (W); *Davis & Hedge* 28226, TR (BM, E); *Davis & Hedge* 27917, TR (BM, E, HUJ); *Davis* 42889, TR (E); *Davis & Hedge* 27696, TR (K); *Sintenis* 753, TR (K); *Maxted, Ehrman & Auricht* 4807, TR (K); *Maxted, Auricht & Ehrman* 4807, TR (K); *Maxted, Auricht & Ehrman* 4936, TR (K); *Maxted, Auricht & Ehrman* 5031, TR (K); *Maxted, Auricht & Ehrman* 5092, TR (K); *Maxted, Auricht & Ehrman* 5125, TR (K); *Maxted, Auricht & Ehrman* 5131, TR (K); *Maxted, Auricht & Ehrman* 5145, TR (K); *Maxted, Auricht & Ehrman* 5168, TR (K); *Maxted, Auricht & Ehrman* 5204, TR (K); *Maxted, Auricht & Ehrman* 5236, TR (K); *Maxted, Auricht & Ehrman* 5255, TR (K).

V. peregrina

Davis 2235, CY (E); *Kupicha* 197, ES (E); *Bourgeau* 979, ES (K); *Krendl & Krendl* s.n., ES (W); *Reverchon* s.n., FR (K); *Albaille* s.n., FR (MPU); *Blanchet* s.n., FR (MPU); *Blanchet* s.n., FR (MPU); *Foures* 983, FR (MPU); *Sauvage*

5863, FR (MPU); *Maxted & Khattab* 1033, FR (K); *Maxted & Khattab* 1042, FR (K); *Heldreich* 24/3/1895, GR (E); *Thompson* 1869, IL (E); *Baldinger* 17966, IL (HUJ); *Jaffe* 17962, IL (HUJ); *Plitmann* 17854, IL (HUJ); *Burri & Krendl* s.n., IT (W); *Sennen & Mauricio* s.n., MA (BM); *Gandoger* s.n., MA (MO); *Krendl & Krendl* s.n., RO (W); *Anon.* s.n., SU (ERE); *Gabrielian* s.n., SU (ERE); *Popov* 271, SU (E, LE, MO); *Bochantsev* 128, SU (LE); *Lipsky* s.n., SU (LE); *Mikhelson* s.n., SU (LE); *Regel* s.n., SU (LE); *Yarmolenko* 65, SU (LE); *Maxted, Ehrman & Khattab* 2031, SY (K); *Maxted, Ehrman & Khattab* 2095, SY (K); *Maxted, Ehrman & Khattab* 2147, SY (K); *Maxted, Ehrman & Khattab* 2164, SY (K); *Maxted, Ehrman & Khattab* 2370, SY (K); *Maxted, Ehrman & Khattab* 2460, SY (K); *Maxted, Ehrman & Khattab* 2503, SY (K); *Maxted, Ehrman & Khattab* 2559, SY (K); *Maxted, Ehrman & Khattab* 2607, SY (K); *Maxted, Ehrman & Khattab* 2652, SY (K); *Maxted, Ehrman & Khattab* 2735, SY (K); *Zohary & Orshan* 2718, TR (HUJ); *Maxted, Kitiki & Allkin* 4001, TR (K); *Maxted, Kitiki & Allkin* 4029, TR (K); *Maxted, Kitiki & Allkin* 4045, TR (K); *Maxted, Kitiki & Allkin* 4053, TR (K); *Maxted, Kitiki & Allkin* 4137, TR (K); *Maxted, Kitiki & Allkin* 4150, TR (K); *Maxted, Kitiki & Allkin* 4294, TR (K); *Maxted, Auricht & Ehrman* 4833, TR (K); *Maxted, Auricht & Ehrman* 4950, TR (K); *Maxted, Auricht & Ehrman* 5022, TR (K); *Maxted, Auricht & Ehrman* 5068, TR (K); *Maxted, Auricht & Ehrman* 5120, TR (K); *Maxted, Auricht & Ehrman* 5166, TR (K); *Maxted, Ehrman & Auricht* 5205, TR (K); *Maxted, Auricht & Ehrman* 5240, TR (K); *Maxted, Auricht &* Ehrman 5268, TR (K); *Maxted & Potokina* 7861, SU (K); *Maxted & Potokina* 7876, SU (K); *Maxted & Potokina* 7984, SU (K); *Maxted & Sperling* 8150, SU (K); *Maxted & Sperling* 8191, SU (K); *Smith* s.n., YU (K).

APPENDIX II

PHENETIC CHARACTER SET

The character set is displayed in the following order: character number: character name: character state if applicable. Character use is indicated by + for that character set.

		A	B	C
1	Life form: annual, perennial	–	–	–
2	Growth habit: erect, ascending, procumbent	–	–	–
3	Plant height (cm)	–	–	–
4	Stipule length (mm)	+	–	+
5	Stipule width (mm)	–	–	–
6	Stipule length–width ratio	–	–	–
7	Stipule shape: entire, semi-hastate, semi-sagittate, laciniate	–	–	–
8	Stipule apex shape: acute, obtuse, mucronate	–	–	–
9	Stipule teeth on distal edge: 0, 1–2, 3–5, > 5	–	–	–
10	Stipule teeth on proximal edge: 0, 1–2, 3–5, > 5	–	–	–
11	Stipule edge form: entire, uneven with swollen hairs	–	–	–
12	Stipule edge: translucent, not translucent	–	–	–
13	Stipule colour (upper part of plant): green, green with purple, purple	–	–	+
14	Stipule pubescence: glabrous, located edge only, < 10 hairs/cm^2, more than 9 hairs/cm^2	+	–	+
15	Leaf length (mm)	+	–	+
16	Petiole length (mm)	+	–	+
17	Average leaflet internode length (mm)	+	–	–
18	Leaflet length (mm)	+	+	+
19	Leaflet width (mm)	+	–	+
20	Tendril length (mm)	+	–	+
21	Average leaf internode length (mm)	–	–	–

22	Petiolule length (mm)	+	–	–
23	Leaf apex: mucronate, tendrillous, terminal leaflet	–	–	–
24	Tendril branching: inappropriate, not branched, 2 branches, 3 branches, > 3 branches	+	–	+
25	Leaflet symmetry: symmetric, asymmetric	–	–	–
26	Relative leaflet size: same length along leaf, smaller at leaf apex	–	–	–
27	Number of leaflets per leaf	–	–	+
28	Upper leaflet margin: entire, < 7 serrations, > 6 serrations, lobed	–	–	–
29	Lower leaflet margin: entire, crenate	–	–	–
30	Leaflet margin: undulating, level	–	–	–
31	Leaflet shape: linear, elliptic, ovate-elliptic, ovate	+	+	+
32	Leaflet apex shape: retuse, mucronate and emarginate, mucronate, acute, obtuse	+	–	+
33	Leaflet base shape: angustate, truncate to angustate, truncate	+	–	–
34	Leaflet broadest point: broadest at apex, broadest in middle, broadest at base	–	+	–
35	Leaflets distribution pattern: unpaired, paired	–	–	–
36	Leaflet adaxial hair density: absent, $< 10/cm^2$, $10–50/cm^2$, $> 50/cm^2$	+	–	–
37	Leaflet adaxial hair length: inappropriate, < 0.5mm, 0.5–1.5mm, > 1.5mm	+	–	–
38	Leaflet abaxial hair density: absent, $< 10/cm^2$, $10–50/cm^2$, $> 50/cm^2$	+	–	+
39	Leaflet abaxial hair length: inappropriate, < 0.5mm, 0.5–1.5mm, > 1.5mm	+	–	+
40	Petiole hair density: absent, $< 10/cm^2$, $10–50/cm^2$, $> 50/cm^2$	+	–	+
41	Stem node colour (upper plant): green, purple	–	–	–
42	Peduncle type: peduncle absent, obsolescent, > 2mm but shorter than flower, longer than flower	+	–	+
43	Peduncle length (mm)	+	–	+
44	Rachis length (mm)	–	–	+
45	Pedicel length (mm)	+	–	+
46	Flower length (mm)	+	–	+
47	Ratio of peduncle to rachis length	–	–	–
48	Ratio of rachis to pedicel length	–	–	–
49	Ratio of peduncle to flower length	–	–	–
50	Peduncular cusp: inapplicable, absent, present and < 2.1mm, present and > 2.0mm	+	–	–
51	Number of flowers/inflorescence: one, two, three or four, > four	–	–	+
52	Pedicel hair density: absent, $< 10/cm^2$, $10–50/cm^2$, $> 50/cm^2$	+	–	–
53	Pedicel hair length: inappropriate, < 0.5mm, 0.5–1.5mm, > 1.5mm	+	–	–
54	Calyx lower tooth length (mm)	–	–	+
55	Calyx lateral teeth length (mm)	–	–	–
56	Calyx upper teeth length (mm)	–	–	–
57	Calyx tube length (mm)	+	–	+
58	Ratio of lower tooth to tube length	+	–	+
59	Calyx base shape: not gibbous, slightly gibbous, strongly gibbous	+	+	+

60	Calyx tube mouth shape: truncate, slightly oblique, strongly oblique	–	–	+
61	Calyx teeth reflexing: absent, present	–	–	–
62	Calyx tooth curvature: absent, present	+	–	–
63	Calyx exterior nectaries: absent, present on lateral teeth, present on all teeth	–	–	+
64	Calyx hair distribution: absent, calyx teeth only, general coverage	–	–	+
65	Calyx exterior hair density: absent, $< 10\ /cm^2$, $10–50/cm^2$, $> 50/cm^2$	+	–	+
66	Calyx exterior hair length: inappropriate, < 0.5mm, 0.5–1.5mm, > 1.5mm	+	–	+
67	Calyx hair elevation: inapplicable, hairs adpressed, hairs erect	–	–	–
68	Calyx colour: green, purple base, purple calyx teeth, purple	–	–	+
69	Standard length (mm)	+	–	+
70	Standard limb length (mm)	+	–	–
71	Standard claw length (mm)	+	–	–
72	Standard limb width (mm)	+	–	+
73	Standard claw width (mm)	+	–	+
74	Ratio of standard length to standard limb width	+	+	–
75	Ratio of limb length to claw length	+	+	–
76	Ratio of limb width to claw width	+	–	–
77	Corolla petal colour: concolorous, not concolorous	–	–	+
78	Standard face colour: cream, yellow, yellow-pink, yellow-green, lilac, violet, purple	+	–	+
79	Standard back colour: cream, yellow, yellow-brown, violet, lilac, purple	+	–	+
80	Standard face-vein colour: concolorous, not concolorous	+	+	+
81	Standard shape: platonychioid, stenonychioid	+	–	+
82	Standard shape apex: strongly emarginate, emarginate, emarginate with mucro, obtuse	+	–	+
83	Standard dorsal bowing: absent, present	+	–	+
84	Standard back pubescence: glabrous, pubescent	–	–	+
85	Standard vein number: absent, 3–5 veins, > 5 veins	+	+	+
86	Wing length (mm)	+	–	+
87	Wing limb length (mm)	–	–	–
88	Wing claw length (mm)	–	–	–
89	Wing limb width (mm)	–	–	+
90	Ratio of wing length to limb width	–	–	–
91	Ratio of limb length to claw length	–	–	–
92	Wing colour: cream, yellow, yellow-pink, yellow-green, lilac, violet, purple	+	–	+
93	Wing markings: absent, round spot, entire tip coloured	–	–	+
94	Wing spot colour: inappropriate, brown/black, purple	–	–	+
95	Wing shape: see Fig. 8	+	–	+
96	Wing spur shape: see Fig. 9	+	–	+
97	Wing limb base kinking: absent, weak kinking, strong kinking	–	–	+
98	Wing limb pouching: absent, present	+	–	–
99	Wing-keel attachment adhesion: weak, strong	–	–	–

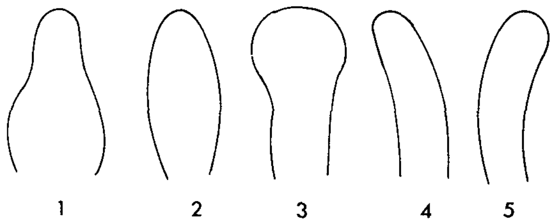

FIG. 8. Wing shape, character 95.

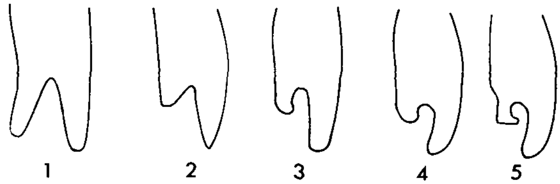

FIG. 9. Wing spur shape, character 96.

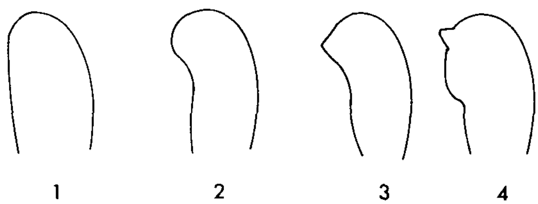

FIG. 10. Keel shape, character 108.

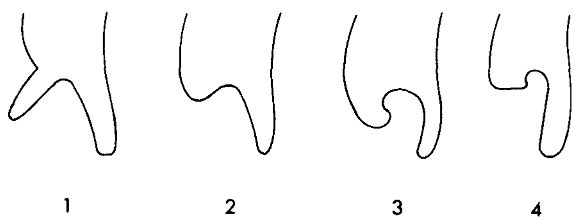

FIG. 11. Keel claw shape, character 109.

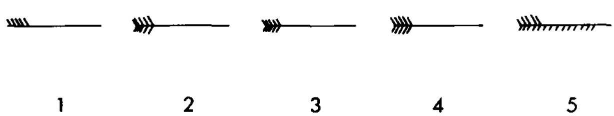

FIG. 12. Style apex pubescence, character 124.

100	Keel length (mm)	+	–	+
101	Keel hood length (mm)	–	–	–
102	Keel claw length (mm)	–	–	–
103	Keel hood width (mm)	–	–	–
104	Ratio of hood length to claw length	–	–	–
105	Ratio of hood length to hood width	+	–	–
106	Keel colour: white, purple/brown	+	–	–
107	Keel hood tip colouring: absent, present	–	–	+
108	Keel shape: see Fig. 10	+	–	+
109	Keel claw shape: see Fig. 11	–	–	+
110	Keel pouch: absent, present	–	–	+
111	Staminal tube length (mm)	–	–	+
112	Staminal filament length (mm)	–	–	+
113	Ratio of tube to filament length	–	–	–
114	Comparative filament length: equal length, 5th stamen extended	–	–	+
115	Staminal tube vein colouring: absent, present	–	–	–
116	Ovary length (mm)	–	–	+
117	Style length (mm)	+	–	+
118	Supra-ovary extension (mm)	–	–	+
119	Ovary shape: linear, intermediate, oblong	–	–	+
120	Style apex cross-sectional shape: round, dorsiventrally flat	–	–	+
121	Stigma shape: globose, conical, discoid	–	–	–
122	Supra-ovary curvature: absent, present	–	–	+
123	Ovary pubescence: glabrous, sutures only, entire coverage, suture only with swollen base, entire coverage with swollen base	–	–	+
124	Style apex pubescence: see Fig. 12	+	–	+
125	Number of ovules per ovary	–	–	+
126	Legume length (mm)	+	–	+
127	Legume width (mm)	+	+	+
128	Legume depth (mm)	+	–	+
129	Ratio of legume length to width	+	–	+
130	Ratio of legume width to depth	+	–	–
131	Amphicarpous legumes: absent, present	–	–	–
132	Legume colour: yellow, yellow-brown, brown, black	+	–	+
133	Legume coloration: uniform over legume, brown/black veins, purple patches	+	–	+
134	Legume shape: linear, rectangular, rhomboid, oblong	+	–	+
135	Legume cross-sectional shape: rounded, intermediate, laterally flat	–	–	+
136	Legume curvature: absent, falcate	–	–	–
137	Legume suture curvature: sutures unparallel, sutures parallel	–	–	–
138	Legume distal end shape: unbeaked, beaked	–	–	+
139	Legume valve surface: not torulose, torulose	–	–	–
140	Legume surface: smooth, ridged with veins, strong vein ridging	–	–	–

141	Legume venation: absent, reticulate, fish-bone, longitudinal	–	–	–
142	Legume partition type: absent, present	–	–	–
143	Legume hair density: glabrous, < 10/cm^2, 10–50/cm^2, > 50/cm^2	+	–	+
144	Legume hair length: inappropriate, < 0.5mm, 0.5–1.5mm, > 1.5mm	+	–	+
145	Legume hair position: inappropriate, sutures only, entire coverage	–	–	+
146	Suture surface: smooth, rough, denticulate, ciliate < 1mm, ciliate > 1mm, ciliate with tubercular foot	–	–	–
147	Hair tubercle length: absent, short, long	–	–	+
148	Legume twisting once dehisced: loose, medium, tight, very tight	–	–	–
149	Number of seeds per legume	–	+	+
150	Seed length (mm)	+	+	+
151	Seed width (mm)	–	+	+
152	Seed depth (mm)	+	–	–
153	Seed circumference (mm)	+	+	+
154	Hilum length (mm)	–	–	+
155	Distance from hilum to lens (mm)	+	–	+
156	Ratio of seed length to width	+	–	+
157	Ratio of seed length to depth	–	–	–
158	Ratio of seed circumference to hilum length	+	–	+
159	Seed shape: spherical, cubical, transversely ellipsoid	+	+	+
160	Seed shape in side view: not laterally compressed, laterally compressed	+	–	+
161	Seed colour: yellow, red-brown, brown, black	+	–	+
162	Seed colour mottling: absent, present	+	–	+
163	Seed finish: shiny, variable, matt	–	–	–
164	Seed surface: smooth, wrinkled, tuberculate, pitted	+	–	–
165	Hilum shape: round, oval, elongated < third circumference, very elongated > third circumference	–	–	+
166	Hilum position in lateral view: level, sunken	–	–	–
167	Hilum surface profile: convex, level, concave	–	–	–
168	Hilum colour: yellow, red-brown, brown, black	–	–	+
169	Hilum groove colour: yellow-orange, same as hilum, red-brown	–	–	+
170	Hilum position: end, corner, side	–	–	–
171	Hilum surface excess tissue: absent, present	–	–	–
172	Lens position: confluent to hilum, < 16mm from hilum, > 15mm from hilum, opposite hilum	+	–	+
173	Lens prominence: prominent, not prominent	+	–	–
174	Aril presence and orientation: absent, protruding	–	–	–

APPENDIX III

TAXA INCLUDED IN SECTION *HYPECHUSA* AND *PEREGRINAE* ANALYSIS
Taxa are listed alphabetically. Taxon codes are those used by Maxted (1991).

Taxon code	Taxon name	Authority	Section *sensu* Kupicha
1	*V. aintabensis*	Boiss. & Hauskn. ex Boiss.	*Peregrinae*
2	*V. anatolica*	Turrill	*Hypechusa*
3	*V. assyriaca*	Boiss.	*Hypechusa*
7	*V. ciliatula*	Lipsky	*Hypechusa*
9	*V. esdraelonensis*	O. Warb. & Eig	*Hypechusa*
15	*V. galeata*	Boiss.	*Hypechusa*
21	*V. hybrida*	L.	*Hypechusa*
22	*V. hyrcanica*	Fischer & C.A. Mey.	*Hypechusa*
29	*V. lutea* subsp. *lutea*	L.	*Hypechusa*
31	*V. lutea* subsp. *vestita*	(Boiss.) Rouy	*Hypechusa*
34	*V. melanops* var. *loiseaui*	Alleiz.	*Hypechusa*
33	*V. melanops* var. *melanops*	Sibth. & Smith	*Hypechusa*
35	*V. michauxii*	Sprengel	*Peregrinae*
36	*V. mollis*	Boiss. & Hauskn. ex Boiss.	*Peregrinae*
45	*V. noeana* subsp. *megalodonta*	Rech. f.	*Hypechusa*
44	*V. noeana* subsp. *noeana*	(Reut. in Boiss.) Boiss.	*Hypechusa*
48	*V. pannonica* subsp. *pannonica*	Crantz	*Hypechusa*
49	*V. pannonica* subsp. *striata*	(M. Bieb.) Nymen	*Hypechusa*
50	*V. peregrina*	L.	*Peregrinae*
63	*V. sericocarpa*	Fenzl	*Hypechusa*
69	*V. tigridis*	Mouterde	–