

The genus *Heliotropium* L. (Boraginaceae) in Flora Iranica Area

by

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Abstract:

AKHANI, H. & FÖRTHNER, H.: The genus *Heliotropium* L. (Boraginaceae) in Flora Iranica Area. Sendtnera 2: 187-276. 1994. ISSN 0944-0178.

A revision of the genus *Heliotropium* L. (Boraginaceae) in Flora Iranica Area based on examination of rich herbarium material and intensive field studies in Iran is presented. Taxonomic characters, an identification key for all accepted taxa, descriptions of species including reference to synonyms and types, enumeration of studied material, notes on taxonomy and variability in morphology, and in most cases illustrations of the flowers and partly entire plants are given. Altogether 37 species with 4 subspecies are accepted for that area. Two new combinations [*H. aucheri* DC. subsp. *carmanicum* (Bunge) Akhani & Förthner and *H. dasycarpum* Ledeb. subsp. *transoxanum* (Bunge) Akhani & Förthner] are established. Most of the taxa are typified. In spite of two recently published new species the total number of species is reduced to about half of the formerly reported within Flora Iranica.

Zusammenfassung:

Eine Revision der Gattung *Heliotropium* L. (Boraginaceae), basierend auf der Untersuchung umfangreichen Herbarmaterials und auf Feldstudien im Iran, wird für das Flora Iranica-Gebiet vorgelegt. Taxonomische Merkmale, ein Bestimmungsschlüssel für alle akzeptierten Sippen, Beschreibungen der Taxa mit Angabe von Synonymie und Typen, eine Auflistung des untersuchten Materials, Anmerkungen zur Taxonomie und morphologischen Variabilität, zum Teil Zeichnungen von Blütendetails und vom Habitus der Arten werden präsentiert. Insgesamt werden 37 Arten mit 4 Unterarten für das Gebiet unterschieden. Zwei neue Kombinationen [*H. aucheri* DC. subsp. *carmanicum* (Bunge) Akhani & Förthner, *H. dasycarpum* Ledeb. subsp. *transoxanum* (Bunge) Akhani & Förthner] werden erstellt. Die meisten Taxa werden typifiziert. Obwohl erst vor kurzem zwei neu beschriebene Arten hinzukamen, konnte die Gesamtzahl auf etwa die Hälfte der bisher in der Flora Iranica genannten Arten reduziert werden.

1. Introduction

The genus *Heliotropium* is the largest and most complex genus of *Boraginaceae* in Flora Iranica Area. Most of the species are growing in arid and semi-arid habitats. The treatment of this genus in Flora Iranica (RIEDL 1967) has not sufficiently solved the difficult taxonomic situation. Some of the species dealt there were reported only on base of literature and misidentified herbarium specimens. Most of the previously described species were uncritically accepted without consideration of their correct taxonomical position. Therefore the reported number of 74 *Heliotropium* species from Flora Iranica Area is highly exaggerated. Since publication of Flora Iranica more than 12 additional species were described or shown from that area (RIEDL 1968; KAZMI 1970; PONERT 1973; RECHINGER 1976; RIEDL & ESFANDIARI 1976;

ESFANDIARI 1977; KUNKEL 1977; RECHINGER & WENDELBO 1977; RIEDL 1977; LÉONARD 1984; RECHINGER & WENDELBO 1985; NASIR 1987; AKHANI 1991a; AKHANI & RIEDL 1991).

The presented study is based on intensive field studies in Iran and examination of a large amount of herbarium and type material from various European and Iranian herbaria. In order to typify the genus and its sections most of the original type material has been examined. Consulted herbaria are abbreviated according the 8th edition of Index Herbariorum (HOLMGREN & al. 1990): B, BM, BP, BR, FR, G, GOET, H, HAL, HOH, IRAN, JE, K, KAS, L, LE, M, MEL, P, PR, PRC, STU, TARI, TEH, TUB, TUH, W, WAG, WU, *MMTT (Natural History Museum of Iran), *MUH (Mashahd University Herbarium), *SBUH (Shahid Beheshti University Herbarium), and private Herbarium of Prof. PODLECH (München) and AKHANI. Those Iranian herbaria which are not yet included in Index Herbariorum are marked above with an asterisk (*). Additional information by the authors to the cited herbarium material is given in brackets [...].

Working in the fields many of the complex groups were studied in their natural habitats, in some very critical cases additionally at the original type localities. According to this investigation a lot of species are recognized only as synonyms for others or reduced in rank of infra-specific taxa. This account is presenting the taxonomic characters, a new identification key of all accepted taxa, descriptions including declaration of type specimens. Additionally a list of synonyms, a selection of studied material, notes on taxonomy, typification and the habitats of the species, and many detailed illustrations of flowers and partly plant habits are given.

2. Taxonomic characters

One of the biggest problems in taxonomy of the genus *Heliotropium* is the large variability in morphological characters. Many of them are strongly influenced by ecological conditions as well as by individual life cycles of the plants. The presented analysis led the authors to the conclusion that a lot of taxonomic characters formerly used by the two main works on this genus in Flora Iranica Area (BUNGE 1869; RIEDL 1967) seem to have much less importance in distinguishing of species and infrageneric classification of the genus. A good example of morphological variabilities inside this genus has been given by BRUMMITT (1971) for the few European species. The mainly used taxonomic characters of this work result from examination of rich herbarium material and intensive field experiences. Their importance, variability and applicability is subsequently discussed.

2.1. Life cycle and life forms

The *Heliotropium* species of the presented area are either annuals or perennials (hemicryptophytes and chaemphytes). Distinction of life forms is sometimes only possible with presence of root stock or existence of last year remainings in herbarium specimens. There are three species that may occur as well in an annual, a biennial or perennial form, *H. bianmulatum*, *H. noeanum* and *H. remotiflorum*. The first one is growing in East Afghanistan and in the adjacent area of Pakistan. It is usually a perennial, but sometimes annual specimens were observed. *H. dicricophorum* was separated only based on that special variability of habit. *H. noeanum* is a common annual in Zagros foothills extending in Southwest of Iran, but it is becoming biennial to perennial in its more southern populations of southern Fars. *H. remotiflorum* is found in Southeast of Iran as far as Baluchestan part of Pakistan and South Afghanistan. Clearly annual and perennial forms exist next to each other without geographical separation. Such a variability in life forms is probably a result of favourable climate and a long life cycle.

Normally *Heliotropium* species have a long flowering period which is in most parts of Iran disrupted by the cold winter. In southern parts of Fars province as well as in Baluchestan due to its warmer climate there is no rigorous climatic disruption of growing and flowering season. Therefore some individuals of basically annuals may continue their life cycle under those optimal conditions for more than one season as biennial or even perennial forms.

2.2. Branching and habit

Most species are erect, ascending with divaricately branches or sometimes branched from the base. Due to variability of habits and branching modi there are no taxonomically important differences between species. Worthy to remark seems the always prostrate habit of *H. supinum* and *H. curassavicum*. *H. marifolium* may be prostrate, ascending or erect.

2.3. Indument

The quite common double indument of many species consists of short and long hairs. The dominant shorter ones are dense and mixed with scattered long hairs of about 1.5-2 times the length of the short ones. Hairs subtending by a tuberculate base varying in size and density. Usually there is a direct relation between tubercle size, thickness and length of hairs. With respect to general view of indument the species could be categorized as following:

- villose indument is common in many species (e.g. *H. europaeum* s.l., *H. bovei*, *H. noeianum*, etc.),
- densely tomentose species (e.g. *H. biannulatum*, *H. brevilimbe*, *H. crassifolium* and *H. kaserunense*),
- perennial species with long scabrous hairs on large tubercles (e.g. *H. bacciferum* s.l. and psammophytic populations of *H. dasycarpum* subsp. *transoxanum*), and
- glandulose hairs mixed with simple ones appear in the two related species *H. agdense* and *H. suaveolens* as well as *H. biannulatum*, *H. fragillimum*, *H. macrolimbe* and *H. zeylanicum*.
- Multicellular hairs were found in two related species *H. griffithii* and *H. bucharicum*.
- Furtheron *H. bucharicum* has pannose-floccose whitish hairs which are unique for *Heliotropium* in this area.
- *H. curassavicum* is the only glabrous species.

Usually there is a relationship between altitude of location and indument: at lower places with warmer climate plants have patent hairs, in contrast to that are appressed hairs at plants of higher altitudes growing under colder conditions more common.

2.4. Leaves

Shape and size of leaves are very variable in nearly all species. Two main types of leaves can be found in our species:

- nearly all annual species and many perennial species have broad leaves, from ovate, elliptic, elliptic-ovate to suborbicular.
- Narrow leaves (linear, linear-lanceolate to linear-oblong in outline) are characteristic for *H. bacciferum* s.l., *H. curassavicum*, *H. marifolium*, *H. ophioglossum*, *H. rariflorum* and *H. zeylanicum*.

In most cases are the nerves on upper side impressed, on lower side prominent.

2.5. Inflorescence

Inflorescences generally are scorpioide cymes at the end of stem and branches or leaveless lateral cymes. They are simple, simply or dichotomously branched in two or more branches. Taxonomical characters of importance in inflorescences are:

- Existence of bracts, e.g. in *H. marifolium* and *H. rariflorum*.
- Loosely branched inflorescences of pseudopaniculate form with long flower pedicels in *H. micranthum* and $\pm$ *H. fragillimum*.

- Flowers densely arranged in dichotomously branched, sometimes head-like looking inflorescences of *H. chorassanicum*.
- In most of the species flowers insert on the direct line of the inflorescence axis. In the case of very dense inflorescences flowers appear in two lines at cyme axis until time of fructification. This is a good character to distinguish *H. europaeum* s.l. and *H. suaveolens* from other species.
- Persistence of calyx after dropping of corolla and nutlets or total dropping of calyx are good characters to separate e.g. *H. europaeum* s.l. from other annual species like *H. bovei*, *H. noeanum*, *H. chorassanicum* and *H. crassifolium*.

2.6. Calyx

Taxonomic importance of calyx is confined to the degree of calyx division. In many species the calyx lobes are usually free near to base (more than 3/4 of length); but in *H. supinum* they are connate more than 3/4, in *H. arguzioides* up to 1/2 and in *H. bacciferum* s.l. from 1/4-1/2 of calyx' length. To compare the relation in length between calyx and corolla is useful to distinguish species, e.g. in *H. dasycarpum* corolla is more in *H. aucheri* less than twice as long as calyx.

2.7. Corolla

Length, shape, form and size of lobes, intercalary lobes and presence or absence of hairs inside the throat are the most useful characters of corolla despite their wide range of variation.

2.7.1. Corolla shape

Generally four kinds of corolla shape can be distinguished in *Heliotropium* species:

- Campanulate: this form is only characteristic of *H. rariflorum*.
- Hypocrateriform: the species *H. agdense*, *H. cabulicum*, *H. chorassanicum*, *H. crassifolium*, *H. denticulatum*, *H. esfandiarii*, *H. fragillimum*, *H. noeanum* and *H. ulophyllum* have typical hypocrateriform flowers; *H. europaeum* s.l. and *H. suaveolens* are basically hypocrateriform with constriction of throat and widening at corolla base.
- Infundibular: for example in *H. bovei*, *H. circinatum*, *H. macrolimbe*, *H. marifolium* and *H. szovitsii*. This is a good character to separate the latter from *H. esfandiarii* and *H. marifolium* from *H. rariflorum*.
- Tubular: all other species have this kind of corolla.

There occur rarely intermediate forms of above mentioned groups.

2.7.2. Corolla length

Corolla length is a very variable character and ranges from 1.5-13 mm according to the different species. Although there is no clear cut between each group in all cases possible species may be classified into three categories on the whole:

- Large flowers (6-13 mm), e.g. *H. agdense*, *H. bucharicum*, *H. cabulicum*, *H. circinatum*, *H. chorassanicum*, *H. crassifolium*, *H. esfandiarii*, *H. fragillimum*, *H. griffithii*, *H. macrolimbe* and *H. szovitsii*.
- Medium sized flowers ([3-] 4-9 mm): *H. biannulatum*, *H. bovei*, *H. dasycarpum*, *H. gypsaceum*, *H. kaserunense*, *H. ophioglossum*, *H. samoliflorum* and *H. ulophyllum*.
- Small flowers (1.5-4 [-5] mm): all other species belong to this group.

2.7.3. Corolla lobes

Corolla lobes may be obtuse or acute. *H. aucheri*, *H. bovei*, *H. circinatum*, *H. digynum*, *H. dasycarpum*, *H. remotiflorum* and *H. zeylanicum* have acute ones; all the other species have obtuse ones with the exception of *H. dissitiflorum*, *H. samoliflorum* and *H. szovitsii* where both forms have been observed.

2.7.4. Intercalary lobes

Long intercalary lobes, half as long or longer as the main lobes, are found in *H. arguzioides*, *H. denticulatum*, *H. dissitiflorum*, *H. samoliflorum*, and sometimes in *H. noeianum*.

All other species have no intercalary lobes or only little intercalary teeth. Care must be taken at teeth appearing in herbarium material which are very often only a result of a longitudinally folding of flowers.

In *H. szovitsii* flowers with or without intercalary lobes have been observed even in the same specimen. The flowers of *H. bovei* are usually without intercalary teeth, but few cases with a kind of teeth have been found.

2.7.5. Hairs inside of corolla

Presence or absence of hairs inside the corolla as an important character have been widely used to distinguish species (BUNGE 1869; POPOV 1953; RIEDL 1967; NASIR 1989) or for infrageneric classification (JOHNSTON 1928). In Flora Iranica (RIEDL 1967) it was considered as important to be used as a chief character for the identification key. In spite of its constancy in many species there is some variability observed in several cases. Therefore the authors believe this character as an absolute constant one may not be overvalued. Twelve taxa have been always observed with hairy corolla inside (*H. biannulatum*, *H. bucharicum*, *H. cabulicum*, *H. chorassanicum*, *H. crassifolium*, *H. dasycarpum* subsp. *transoxanum*, *H. fragillimum*, *H. griffithii*, *H. kaserunense*, *H. macrolimbe*, *H. marifolium* and *H. rariflorum*). *H. biannulatum* is peculiar with its two rings of hairs inside the corolla.

Field studies in several populations of *H. transoxanum* and *H. dasycarpum* revealed that there are not any other constant differences between both than the presence or absence of hairs at the inside of corolla. On base of this perception they are taken for one species with two subspecies within the scope of this paper.

Other species of *Heliotropium* in the treated area are basically glabrous inside of corolla, but exceptionally flowers with hairs inside were found, e.g. in *H. aucheri*, *H. dissitiflorum*, and *H. esfandiarii*. Previously the species *H. kumense* (syn. of *H. aucheri* subsp. *aucheri*) and *H. trichostomum* (syn. of *H. aucheri* subsp. *carmanicum*) have been described only with hairs present inside the corolla. In progress of trying to rediscover these species in their type localities and checking a lot of herbarium material it was impossible to keep them further on as acceptable species.

Regarding this problem one interesting example of confusion is found in *H. remotiflorum*: it has been originally described in Flora Iranica (RIEDL 1967: 35) from Pakistan, Makran, Suntsar with hairs inside of corolla and accordingly placed in the key (l.c.: 12, no. 45 b) under "corolla intus pilosa". The examination of its holotype, some isotypes and other material revealed its corolla glabrous inside. Surprisingly NASIR (1987) has distinguished *H. alii* with glabrous inside of corolla from *H. remotiflorum* although both type localities are neighbouring!

2.7.6. Corolla appendages

H. crassifolium and *H. kaserunense* are the only species of Flora Iranica *Heliotropium* with longitudinally appendages in throat (see notes under these species).

2.8. Anthers

Length, shape and position of anthers are distinguishing characters of some species. *H. crassifolium* has relatively long anthers of about 3 mm. *H. bovei* is a very polymorphic species, but its beaked anthers are always very specific. The emarginate anthers of *H. remotiflorum* are also helpful for determination. Anthers' position of *H. digynum* is a useful differentiation character to its close affinity, *H. aucheri*.

2.9. Stigma

According to stigma shape the species may be categorized as following:

- Capitate: this form is unique in *H. rariflorum*.
- Disk-like and pillow-shaped: it is peculiar in *H. agdense* and *H. disciforme*.
- Intermediate between pillow-shaped and shortly conical, e.g. in *H. bianmulatum*, *H. buchari-cum*, *H. cabulicum*, *H. curassavicum*, *H. griffithii*, *H. marifolium* and *H. suaveolens*.
- Elongate-subulate, bifid and recurved at apex is the stigma of *H. ophioglossum*. This form is unique within presented species.
- Conical and subulate conical: all other species belong to this group.

2.10. Style

The style is in most species not of distinguishing importance due to its variability in length.

2.11. Nutlets

No remarkable taxonomically importance of nutlets' shape and length has been established. They are subglobose, ovoide, ellipsoide or have combinations of those forms.

The indument of nutlets was sometimes used as a relevant character, but it is not very constant. This you may observe at young nutlets of *H. aucheri*, *H. arguzioides* and *H. dasycarpum* with its primary long, silky hairs which are falling during process of ripening.

H. europaeum s.l. was formerly divided into different species (see note under *H. europaeum* s.l.) in order to the presence or absence of hairs on nutlets. The existence of intermediate forms with any kind of transitions seems to make its splitting very questionable. More studies are necessary to prove its applicability.

There are relationships between nutlets' indument and climate. Under desertic conditions hairy nutlets are found more often, under moderate and shore conditions they are generally more glabrous.

Usually 4 nutlets are produced in *Heliotropium* species except *H. supinum* where only one of the nutlets develops (HILGER 1987).

3. Typification and infrageneric classification

The genus *Heliotropium* was typified by FÖRTHNER in JARVIS' "list of Linnean generic names" (1993: 53). Like in other large genera where a modern revision is missing most of the more than 2000 taxa described worldwide under the genus are not yet typified.

For Flora Iranica Area there are a lot of old names burdening the *Heliotropium* taxonomy. Troubles about the value and acceptance of some species were unavoidable because in former times it was not necessary to mention explicitly the holo- or lectotype with reference to its depository; e.g. from all taxa mentioned in this work only five ones were typified before (VERDCOURT 1987 & 1991; GUBANOV 1993; FÖRTHNER in JARVIS 1993). For removing this deficiency most of the relevant type specimen were reviewed in progress of this work and many of the taxa cited here are typified for the first time.

The main classification of the genus *Heliotropium* and its species occurring in the treated area has essentially been propounded by BUNGE (1869) and RIEDL (1967). BUNGE in his work "Über die Heliotropien der mittelländisch-orientalischen Flor" divided the genus into 11 sections and RIEDL created in his treatment for "Flora Iranica" a classification system of 3 sub-genera including 10 sections. It is rather difficult to accept especially the latter system due to the fact that the importance of used taxonomic characters seemed to have been misinterpreted; e.g. *H. bacciferum* and *H. ramosissimum* which are in our opinion closely related to each other or perhaps only different forms of one species are placed in two different sections and the same case with *H. brevilimbe* and *H. calcareum* which are even identical.

Although Flora Iranica Area with its mass of *Heliotropium* species is a "hot spot" for origin of the genus, a regional revision cannot be the place to present a new classification for the

whole genus with its enormous distribution over the Old and New World. Therefore all the species treated in this account are arranged without regard to their relationships in alphabetical order.

4. Ecology

In Flora Iranica Area most species of *Heliotropium* are growing under arid and semi-arid conditions. They are mainly concentrated in central, eastern and western Iran and southern and eastern Afghanistan in following habitats: inland and littoral sand dunes, dry sandy steppes at soils covered by scree or gravels (shingle), serpentine soils, calcareous and gypsum hills, slightly salty and dry soils, ruderal places, cultivated and waste land, margin of roads, oases, rarely in rocky slopes and clay-alluvial soils at the margin of rivers. *Heliotropium* species prefer mostly unstable and sandy soils. Due to their peculiar ecological adaptations they have a very important role in intermediate stages of succession specially as pioneers of degraded area. Dominant communities have been only observed under such conditions. By that reason they are rarely found in climax communities.

Some characteristic habitats of *Heliotropium* in Flora Iranica Area are:

- *H. arguzioides*, *H. digynum*, *H. micranthum* and *H. remotiflorum* are only found on inland sand dunes. The last species was also once collected on salty soil according to the information of a herbarium label.
- *H. dasycarpum* subsp. *transoxanum* is a frequent species in central Iranian sand deserts. In eastern Iran it is found together with subsp. *dasycarpum* on different soils including dry steppes, serpentine, sandy, saline soils and around cultivated land.
- *H. aucheri* subsp. *aucheri* is growing on very different soils, e.g. sand, shingels, gypsum, calcareous and even dry saline soils. Some pure formations were observed on sand dunes in central Iran.
- Ecologically *H. denticulatum* is restricted to gypsum hills in southwestern Iran.
- Coastal forms of *H. bacciferum* play an important role in the vegetation of coastal dunes and saline soils along Persian Gulf and Oman Sea.
- *H. curassavicum* is a typical halophyte and was collected in Flora Iranica Area only in the extreme southeastern part, at the coasts of Pakistan.
- *H. disciforme* is known from black shingels and soils probably rich in iron.
- *H. bovei* and *H. noeatum* are dominant in wastelands and ruderal land of western Iran associated with other species typical for that special niche.
- *H. supinum* is found in alluvial river beds on clay and sandy soils as well.
- One interesting halophytic ecotype of *H. dissitiflorum* grows in a special zone around Uromieh Lake (NW Iran) on salty and sandy soil.
- *H. europaeum* s.l. is a typical common weed.

Annual and perennial species are different in their Iranian distribution (AKHANI 1993). The low lands of southern and southeastern Iran are preferred by mostly perennial species; in north-western Iran and high altitudes of central Iran all species are annual.

5. Taxonomic enumeration

5.1. Description of the genus

Heliotropium L., Sp. pl.: 130 (1753). **Type:** *H. europaeum* L.

= *Beruniella* Zakirov & Nabiev, Conspectus fl. asiae mediae 8: 169. (1986). **Type:** *Onosma micranthos* Pallas.

= *Piptoclaina* G.Don, Gen. syst. 4: 364. 1837. **Type:** *Heliotropium supinum* L.

Annual or perennial, prostrate to erect herbs or subshrubs usually with villous, tomentose to scabrid indument. Leaves alternate. Inflorescence usually terminal or axillary scorpioid cymes. Flowers white or more rarely yellow, usually ebracteate. Calyx mostly 5-partite into linear or lanceolate lobes; lobes often nearly free to base, rarely connate up to the middle or more. Corolla 5 lobed, tubular, infundibuliform to hypocrateriform, hairy at the outside or sometimes inside, lobes obtuse to linear, with or without intercalary lobes. Stamens as much as corolla lobes, subsessile, attached to the corolla tube, anthers sometimes apiculate or beaked. Stigma often shortly to elongated conical, more rarely pillow-shaped. Style erect, sometimes hidden by stigmatic disc. Ovary 4-locular or incompletely 2-locular. Fruit comprising 1-4 nutlets.

5.2. Key of species and subspecific taxa

- | | |
|---|----------------------------|
| 1 Plant glabrous, glaucous | 13. <i>H. curassavicum</i> |
| - Plant variously hairy | 2 |
| 2 Annuals | 3 |
| - Perennials | 28 |
| 3 Cymes bracteate | 21. <i>H. marifolium</i> |
| - Cymes ebracteate | 4 |
| 4 Calyx shallowly 5-lobed, completely enclosing the fruit, only one of the nutlets developing (ovary monosperme), habit prostrate | 34. <i>H. supinum</i> |
| - Calyx lobes nearly free to base, mostly 4 nutlets developing, habit rarely prostrate | 5 |
| 5 Flowers borne on long pedicels equal or longer than calyx; inflorescence lax, paniculate | 27. <i>H. micranthum</i> |
| - Flowers sessile or lower ones with short pedicel not longer than 2.5 mm, upper flowers always sessile; inflorescence not paniculate | 6 |
| 6 Corolla inside with two rings of hairs | 5. <i>H. biannulatum</i> |
| - Corolla inside glabrous or hairy, but without two rings of hairs | 7 |
| 7 Stigma pillow-shape, disc-like or slightly conical | 8 |
| - Stigma elongate to subulate-conical | 12 |
| 8 Corolla tubular, longer than 4mm, inside pilose | 9 |
| - Corolla hypocrateriform or if tubular less than 4 mm long, inside glabrous | 10 |
| 9 Robust plants up to 70 cm tall, densely woolly-tomentose | 8. <i>H. bucharicum</i> |
| - Smaller plants up to 30 cm tall, villose, not tomentose | 22. <i>H. griffithii</i> |
| 10 Corolla 2.5-3 mm long, expanded in lower part; corolla lobes ovate-triangular, 0.2-0.3 mm broad; corolla outside with eglandulose hairs; stigma disc-like | 17. <i>H. disciforme</i> |
| - Corolla 4-9 mm long; corolla lobes rotundate, more than 1.5 mm broad; corolla outside sometimes with glandulose hairs; stigma cape-shaped or slightly conical | 11 |
| 11 Corolla 4-7 mm long, outside with tuberculate long hairs; stigma pilose, cape-shaped to slightly conical, bilobed | 33. <i>H. suaveolens</i> |
| - Corolla 7-9 mm long, outside often glandulose pubescent, almost without tubercles at the base; stigma glabrous, pillow-shaped | 1. <i>H. agdense</i> |
| 12 Corolla with intercalary lobes or teeth | 14 |
| - Corolla without intercalary lobes | 19 |
| 13 Intercalary lobes as long or longer than corolla lobes | 32. <i>H. samoliflorum</i> |
| - Intercalary lobes shorter than corolla lobes | 14 |
| 14 Corolla inside pilose; lobes folded inwards | 24. <i>H. kaserunense</i> |
| - Corolla inside glabrous; lobes not folded inwards | 15 |
| 15 Corolla shorter than 5 mm | 16 |
| - Corolla longer than 5 mm | 17 |

- 16 Calyx easily dropping, nutlets rugose, corolla hypocrateriform (NE-Iraq, W-Iran) 28. *H. noe anum*
 - Calyx $\pm$ persistent, nutlets smooth, corolla tubular (Iran & Turkmenistan) 18. *H. dissitiflorum*
- 17 Corolla lobes coiled at tips (circinate); inflorescence usually with more than 30 flowers; nutlets rugose (Turkey, Iraq) 11. *H. circinatum*
 - Corolla lobes not coiled at tips; inflorescence usually with less than 30 flowers; nutlets smooth or lineolate 18
- 18 Leaves on surface villose; corolla hypocrateriform (endemic in north-central Iran) 19. *H. esfandiarrii*
 - Leaves on surface sparsely pilose to subglabrous; corolla infundibula 35. *H. szovitsii*
- 19 Inflorescence biseriate 20
 - Inflorescence uniseriate 22
- 20 Calyx longer than 3.5 mm, deciduous 10. *H. chorassanicum*
 - Calyx shorter than 3.5 mm, persistent 21
- 21 Stigma slightly conical; hairs outside of corolla simple or sometimes glandulose and tuberculate at base 33. *H. suaveolens*
 - Stigma elongate-conical; hairs outside of corolla never tuberculate nor glandulose 20. *H. europaeum* s.l.
- 22 Flowers yellow; corolla always with longitudinal ridges (only Afghanistan) 23
 - Flowers white; corolla usually without longitudinal ridges (except. *H. remotiflorum*) 24
- 23 Corolla tubular, lobes smaller than 1 mm; stigma shortly conical, glabrous 22. *H. griffithii*
 - Corolla infundibular, lobes broader than 1 mm; stigma elongate-conical, pilose 25. *H. macrolimbe*
- 24 Stigma longer than 1.5 mm; nutlets rugose 25
 - Stigma shorter than 1.5 mm; nutlets smooth 26
- 25 Plant taller than 50 cm; corolla hypocrateriform, lobes $\pm$ rounded (endemic in SE-Iraq & SW-Iran) 12. *H. crassifolium*
 - Plant smaller than 50 cm; corolla infundibular, lobes $\pm$ acute (from Palestine to Iran) 6. *H. bovei*
- 26 Basal leaves petiolate; corolla longer than 6 mm 35. *H. szovitsii*
 - Basal leaves sessile or with petiole shorter than 1 cm; corolla shorter than 5 mm 27
- 27 Leaves more than 1 cm broad; corolla shorter than 4 mm, lobes linear (Iran, Afghanistan, Pakistan) 31. *H. remotiflorum*
 - Leaves less than 1 cm broad; corolla longer than 4 mm, lobes rotundate (endemic in NW-Iran) 23. *H. gypsaceum*
- 28 Stigma exserted, deeply bifid, recurved (endemic in S-Pakistan) 29. *H. ophioglossum*
 - Stigma included, minutely bifid, not recurved 29
- 29 Cymes bracteate 30
 - Cymes ebracteate 31
- 30 Corolla campanulate, corolla lobes rotundate, at margins incurved. Stigma clavate. Anthers not crowded at apex. 36. *H. rariflorum*
 - Corolla $\pm$ infundibular, corolla lobes triangular to ovate, margins not curved inside. Stigma shortly conical. Anthers crowded at apex. 26. *H. marifolium*
- 31 Flowers inside with 5 longitudinally appendage-like ridges (endemic in SW-Iran) 24. *H. kaserunense*
 - Flowers inside without appendages 32
- 32 Flowers inside with two ring of hairs (Afghanistan, Pakistan) 5. *H. biannulatum*
 - Flowers inside glabrous or hairy without two ring of hairs 33
- 33 Corolla lobes obtuse 34
 - Corolla lobes acute or acuminate 41

- 34 Corolla lobes oblong, intercalary lobes linear subulate, longer than lobes (endemic in SW-Iran) . 15. *H. denticulatum*
 - Corolla lobes rotundate, intercalary lobes missing or if present not linear-subulate 35
 35 Calyx lobes connate to 1/3-1/2 of length 36
 - Calyx lobes free nearly to base 37
 36 Corolla lobes extremely folded lengthwise, plicate; intercalary lobes similar to main lobes, emarginate; rhizomes cord-like 2. *H. arguzioides*
 - Corolla lobes not folded lengthwise; without intercalary lobes; no cord-like rhizome 4. *H. bacciferum*
 37 Inflorescence laxe, rarely up to 10 (-12) flowers. Plants of greenish colour, sparsely hairy (E & SE Afghanistan; N Pakistan) 38
 - Inflorescence dense, more than 10 and up to 50 flowers. Plants greyish, densely covered by villose or tomentose hairs (S & W Iran, S Pakistan) 40
 38 Corolla 3-4 mm long, inside glabrous (endemic in Pakistan) 36. *H. ulophyllum*
 - Corolla more than 7 mm long, inside pilose 39
 39 Leaves $\pm$ sessile, rarely lower ones with short petiole, thick, margin distinctly undulate. Indument sparse, scabrous, subappressed. Stigma usually glabrous (Afghanistan, Pakistan) 9. *H. cabulicum*
 - Leaves with distinct petiole, papery, margin not undulate. Indument patent villose. Stigma pilose (endemic in Afghanistan) 21. *H. fragillimum*
 40 Nutlets whitish tomentose; corolla lobes 0.3-0.75 mm long, 0.2-0.5 mm broad, indument tomentose, plants always perennial (Arabia, Iran, Pakistan) 7. *H. breviliimbe*
 - Nutlets subglabrous to sparsely pilose; corolla lobes (0.4-) 0.7-2 mm long, (0.3-) 0.5-1 mm broad, indument whitish villose, very rarely perennial (NE-Iraq, Iran) 28. *H. noeanum*
 41 Style very short, inconspicuous (Iran, Afghanistan, Pakistan) 31. *H. remotiflorum*
 - Style long, conspicuous 42
 42 Leaves narrow, lanceolate. Nutlets tuberculate-rugose (S Pakistan) 37. *H. zeylanicum*
 - Leaves ovate, elliptic-ovate, rarely lanceolate. Nutlets $\pm$ smooth (Afghanistan, Iran, N Pakistan) 43
 43 Inflorescence compact; corolla 3-5 mm long; calyx mostly shorter than half of the corolla length; stigma 0.6-0.9 (-1) mm long 44
 - Inflorescence laxe; corolla (2.5-) 4.5-8 mm long; calyx mostly longer than half of the corolla length; stigma (0.8-) 1-1.5 mm long 46
 44 Style two times longer than stigma (sand dunes of Khuzestan) 16. *H. digynum*
 - Style two times shorter than stigma (central Iranian deserts, W. Pakistan) 45
 45 Corolla lobes triangular, acute, often recurved 3a. *H. aucheri* subsp. *aucheri*
 - Corolla lobes anguste-triangular or linear triangular, caudate-acuminate, often curved inwards the tube 3b. *H. aucheri* subsp. *carmanicum*
 46 Corolla inside glabrous 14a. *H. dasycarpum* subsp. *dasycarpum*
 - Corolla inside pilose 14b. *H. dasycarpum* subsp. *transoxanum*

5.3. Enumeration of *Heliotropium* taxa in alphabetical order

1. *Heliotropium agdense* Bunge, Bull. Soc. Imp. Naturalistes Moscou 42: 297. 1869. **Syn-types:** In margine deserti salsi magni Persiae, prope Agda [Aghda], 1859, Bunge (G-BOIS!); Schurab, 13.10.1858, Bunge & Bienert (P!). **Lectotypus** (hoc loco designatus): Schurab, 13.10.1858, Bunge & Bienert (P!).

Fig.: plate 1 a, page 197.

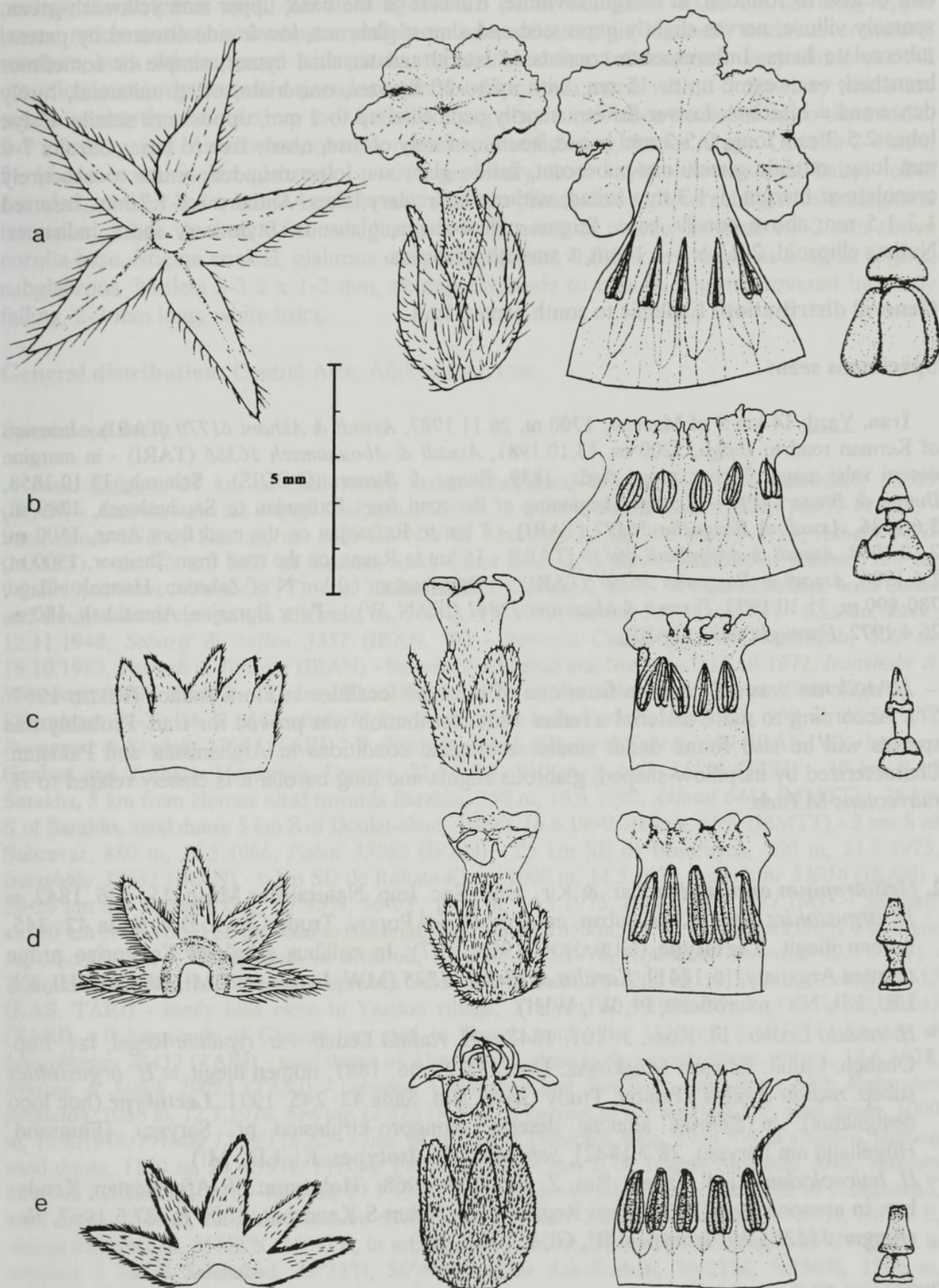


Plate 1: a) *H. agdense* Bunge (Assadi & Akhani 61770); b) *H. arguzioides* Kar. & Kir. (Akhani 5771); c) *H. bacciferum* Forssk. (Akhani 6725); d) *H. brevilimbe* Boiss. (Mozaffarian 49774); e) *H. denticulatum* Boiss. & Hausskn. (Akhani 5435).

cm, obtuse to rounded, at margin revolute, truncate at the base; upper side yellowish-green, sparsely villose, nerves slightly impressed and almost glabrous; lower side covered by patent, tuberculate hairs. Inflorescence consists of lateral and terminal cymes, simple or sometimes branched; each cyme up to 15 cm, with up to 30 flowers, uniseriate, often unilateral, rarely dense and $\pm$ biseriate. Lower flowers shortly pedicelled up to 1 mm, upper ones sessile. Calyx lobes 2.5-3 mm long, 0.5-2 mm broad, acute or rarely obtuse, nearly free to base. Corolla 7-9 mm long, outside glandulose-pubescent, inside glabrous; lobes rounded, entire to obscurely crenulate at margin, 1-1.3 mm broad, without intercalary lobes. Anthers 1.5-1.7 mm, inserted 1.3-1.5 mm above corolla base. Stigma pillow-shape, glabrous. Style very short, indistinct. Nutlets ellipsoid, 2-2.3 x 1-1.1 mm, $\pm$ smooth, glabrous.

General distribution: Endemic to south-central Iran.

Specimens seen:

Iran. Yazd: 14 km S of Marvast, 1700 m, 26.11.1987, *Assadi & Akhani 61770* (TARI) - Junction of Kerman road to Bafgh, 1200 m, 13.10.1981, *Assadi & Abouhamzeh 36386* (TARI) - in margine deserti salsi magni Persiae prope Agda, 1859, *Bunge & Bienert* (G-BOIS) - Schurab, 13.10.1858, *Bunge & Bienert* (P). -- Kerman: beginning of the road from Rafsanjan to Sarcheshmeh, 1700 m, 3.6.1986, *Assadi & Bazgosha 56397* (TARI) - 7 km to Rafsanjan on the road from Anar, 1500 m, 2.10.1988, *Assadi & Amirabadi 66439* (TARI) - 15 km to Ravar, on the road from Sheitoor, 1300 m, 1.6.1988, *Assadi & Bazgosha 56297* (TARI). -- Baluchestan: 60 km N of Zahedan, Harmak village, 780-890 m, 31.10.1975, *Termeh & Moussavi 33841* (IRAN, W). -- Fars: Borazjan, Abmakhak, 180 m, 26.4.1972, *Foroughi 3593* (TARI).

H. agdense was only known from one of the type localities in Flora Iranica (RIEDL 1967: 51). According to more material a rather wide distribution was proved for Iran. Probably this species will be also found under similar ecological conditions in Afghanistan and Pakistan. Characterized by its pillow-shaped, glabrous stigma and long corolla it is closely related to *H. suaveolens* M.Bieb.

2. *Heliotropium arguzioides* Kar. & Kir., Bull. Soc. Imp. Naturalistes Mosc. 15: 406. 1842. $\equiv$ *H. arguzioides* Kar. & Kir. subsp. *eu-arguzioides* Popov, Trudy Glavn. Bot. Sada 42: 245, nomen illegit. **Lectotype** (GUBANOV 1993: 107): In collibus sabulosis Songoriae prope montes Arganaty, [6.1841], *Karelin & Kirilov 1725* (MW; **Isotypes**: BM!, BR!, G!, H!, K!, LE!, M!, NY! microfiche, P!, W!, WU!).
- = *H. radula* Ledeb., Fl. Ross. 3: 101. 1847 $\equiv$ *H. radula* Ledeb. var. *typicum* Regel, Izv. Imp. Obshch. Ljubit. Estestv. Moskovsk. Univ. 34(2): 56. 1881, nomen illegit. $\equiv$ *H. arguzioides* subsp. *radula* (Ledeb.) Popov, Trudy Glavn. Bot. Sada 42: 245. 1931. **Lectotype** (hoc loco designatus): in Sibiriae altaicae deserto soongoro-kirghisico pr. Saryssu, [Flugsand, Hügelland am Saryssu, 28.7.1842], *Schrenk* (LE!; **Isotypes**: K!, LE!, M!).
- = *H. leucocladum* Riedl, Österr. Bot. Z. 115: 101. 1968. **Holotype**: SE-Afghanistan, Kandahar: in arenosis mobilibus deserti Registan, 25-30 km S Kandahar, 1000 m, 27.5.1967, *Reichinger 35328* (W!; **Isotypes**: B!, G!, K!, LE!, M!).

Fig.: plate 1 b, page 197.

Psammophytic perennial, erect, ascending to rarely prostrate, with long cord-like rhizomes; stems white, patent villose, becoming $\pm$ glabrous in lower parts. Leaves ovate to elliptic-lanceolate; lower leaves up to 2.5 cm long and 1.5 cm broad, petiol up to 1.5 cm long, upper leaves much smaller, with shorter petiole or subsessile; margin distinctly undulate-crenulate,

ceolate; lower leaves up to 2.5 cm long and 1.5 cm broad, petiol up to 1.5 cm long, upper leaves much smaller, with shorter petiole or sessile; margin distinctly undulate-crenulate, revolute; both sides covered with patent, tuberculate hairs. Inflorescence very short, ca. 1-2 cm, dichotomously branched pseudocorymbose-like; each cyme with 1-3 flowers, which are sessile or shortly pedicelled up to 0.5 mm. Calyx persistent; 5 lobes connate up to the middle, 2-3 mm long, ca. 1 mm broad, obtuse, outside pilose, inside glabrous, shiny. Corolla 2-4 mm, 5- (6-) merous, inside glabrous, outside especially from middle downwards hairy; lobes rounded, at their bases 0.3-0.4 mm broad, strongly plicate-folded, alternately with emarginate intercalary lobes. Anthers 0.6-1 mm, linear-oblong, acute or obtuse, inserted 1.7-2 mm above corolla base. Stigma conical, glabrous or sparsely pilose, 0.6-0.8 mm. Style as long as stigma, subglabrous. Nutlets 2-3.2 x 1-2 mm, oblong-ellipsoide to ovoide, rugose, covered by easily falling, 2-3 mm long, white hairs.

General distribution: Central Asia, Afghanistan, Iran.

Specimens seen:

Iran. Esfahan: 37 km de Chah-Malek versus Chupanan, 840 m, 16.5.1975, *Iranshahr* 33057 (IRAN) - Anarak, near the village Chupanan, 950 m, 5.6.1986, *Assadi & Bazgosha* 56532 (TARI) - Sand dunes ESE of Kashan, ca. 8-10 km NW of Abu-Zeid Abad, 900 m, 9.9.1989, *Akhani* 5765 (MMTT) - ca. 15 km ESE of Kashan, sand dunes near sand dunes stabilization station, 900 m, 9.9.1989, *Akhani* 5756 (MMTT) - ca. 30 km ESE of Kashan, 2 km N of Abu-Zeidabad, sand dunes and sandy soils at the margin of fields, ca. 900 m, 9.9.1989, *Akhani* 5771 (MMTT) - Kashan, kavir, 12.11.1948, *Scharif & Aellen* 5357 (IRAN, W) - between Chahartaghi and Maranjab, 800 m, 16.10.1982, *Termeh & Tehrani* (IRAN) - between Fakhrabad and Nushabad, 15.10.1972, *Iranshahr & Moussavi* 16239 (IRAN) - 23 km NE of Kashan, 780 m, *Babakhanlou & Amin* 17809 (TARI). -- Khorassan: 20-30 km N of Gonbad, 70 km on the road from Torbate-Heydarieh, 990 m, 30.5.1977, *Runemark & Sardabi* 23644 (TARI) - Torbate-Heydarieh, *Gaub & Sabeti* 1000 (IRAN, W) - between Gonbad and Torbate- Heydarieh, Omrani, 21.5.1984, 910 m, *s. coll.* 11136 (TUH) - 30 km S of Sarakhs, 5 km from Norouz-abad towards Sarakhs, 350 m, 16.6.1990, *Akhani* 6485 (MMTT) - 26 km S of Sarakhs, sand dunes 5 km S of Doulat-abad, 350 m, 16.6.1990, *Akhani* 6469 (MMTT) - 2 km S of Sabzevar, 880 m, 16.5.1966, *Pabot* 35060 (IRAN) - 25 km SE de Boshruh, 900 m, 11.5.1975, *Iranshahr* 33081 (IRAN) - 6 km SO de Robate-Khan, 1000 m, 14.5.1975, *Iranshahr* 33056 (IRAN) - 20-30 km SW Robat-e Gur, 33°45'N, 56°03', 1000 m, 14.5.1975, *Rechinger* 51781 (M). -- Semnan: ca. 50 km N of Torud on the road to Shahrud, sand dunes, 1050 m, 19.9.1975, *Wendelbo & Foroughi* 18718-a (TARI) - Torud, south of Shahrud, 1350 m, 9.10.1976, *Rejamand & Arazm* 32573 (W) - Touran Protected Area: dune ridge between Salehabad & Talkhab, 1200 m, 13.7.1976, *Freitag* 13652 (KAS, TARI) - sandy hills close to Yazdoo village, 1150 m, 10.5.1978, *Freitag & Jadidi* 28963 (TARI) - 9 km south of Chajam, on road to Torud, sand hills, 1120 m, 24.4.1978, *Freitag & Mozaffarian* 28452 (TARI) - sand dunes of Ahmadabad, close to destroyed village, 960 m, 13.5.1978, *Freitag & Jadidi* 29015 (TARI) - between Ahmadabad and Towchah, sand dunes with *Haloxylon persicum*, 1030 m, 12.7.1976, *Freitag* 13/615 (KAS) - 6 km east of the way to Khor, sand dunes, 1000 m, 13.5.1978, *Freitag* 15/333 (KAS) - Just W of Touran Protected Area, 9 km SW of Chajam, shifting sand dunes, 1160 m, 24.4.1978, *Freitag* 14/729 (KAS) - Just E of Touran Protected Area, between Sabri & Zamanabad, 1150-1250 m, 17.5.1978, *Freitag* 15/487 (B, KAS) - 6 km NE of Zamanabad, sand dunes, 1100 m, 13.6.1990, *Akhani* 6448 (MMTT) - 5-10 km S Ahmadabad, 35°46' N, 56°36' E, versus Zamanabad, 35°46'N, 56°47'E, in arenosis, 900-950 m, 30.4.1975, *Rechinger* 50714 (W) - in arenosis 7 km E Salehabad, 35°33'N, 56°48'E, versus Asb-Keshan, 35°21'N, 56°56'E, 1100 m, 2.5.1975, *Rechinger* 50963 (W). -- Tehran: Kavir Protected Area, 17.4.1974, *Karimi* 7121 (MMTT) - SE of Siahkuh, sand dunes, 850 m, 21.4.1975, *Wendelbo & Assadi* 16076 (TARI).

Afghanistan. Herat: 40 km nordöstlich von Khusan, an der Straße nach Gulran bei Bara Koh, 950 m, 9.5.1968, *Freitag* 5492 (Herb. PODL.). -- Badghis: Sanddünen bei Yaka Tut, 20 km südlich Toraghundi an der Straße nach Herat, 800 m, 62/18-35/07, 29.4.1977, *Podlech & Jarmal* 29496 (M, Herb. PODL.). -- Faryab: 26 km E Andkhoy an der Straße nach Sheberghan, 310 m, 7.10.1969, *Podlech*

1.6.1962, *Rechinger* 16128 (M, W). -- *Jowzjan*: 60 km NW Balkh, 8 km S Islam Chomgar, Saxaul-Sandwüste, zwischen Sanddünen, 280 m, 27.8.1976, *Breckle* 4672 (M, W, Herb. PODL.). -- *Qunduz*: 15 km westlich des Kotal-e-Erganak an der Straße von Qunduz nach Tashqurghan 530 m, 27.9.1968, *Freitag* 3845 (Herb. PODL.). -- *Kandahar*: 40 km südöstlich Kandahar bei Takhta Pul am Dori-Fluß, Sandwüste, 22.4.1960, *Freitag* 2578 (Herb. PODL.) - Cagray Cala, 40 km SE Kandahar, Sand, 1050 m, 18.9.1976, *Breckle* 4821 (Herb. PODL.) - in arenosis mobilibus deserti Registan, 25-30 km S Kandahar, 1000 m, 27.5.1967, *Rechinger* 35328 (B, G, K, LE, M, W).

Turkmenistan. Ad marginem boreo-orientalem oppidi Ashabad, 300 m, 6.9.1976, *Vasák* (M) - Regio Transcaspica, Asshabad, in collibus arenosis inter Annaju & Gjaurs, 5.6.1900, *Bornmüller* 334 (M) - prope Ashabad, in arenosis, 30.4.1897, *Litwinow* (W) - in arenis prope Farab ad fl. Amu-Darja, 19.5.1904, *Androssov & Kelov* 3552 (M, Herb. PODL.).

H. arguzioides was only recorded from very few localities in Flora Iranica (RIEDL 1967: 31). It is a typical psammophytic species growing only on relatively deep sand dunes. In Touran Protected Area it was found associated with "*Haloxylon*" and "*Calligonum*" community and in Kashan additionally on bare sand dunes. Also along Tajan river (Harir-rud, South of Sarakhs in northeast of Khorassan) it is a very dominant species on dunes. Unusually it seems that plants are sometimes grazed.

Morphologically it is characterized by its short, dichotomously branched inflorescence, presence of well developed intercalary lobes, extremely plicate corolla and intercalary lobes, up to the middle connate calyx and whitish stem.

3. *Heliotropium aucheri* DC., Prodr. 9: 533. 1845. Type: ? in Turcorum Asia pr. Mossul, [1836], *Aucher* (G-BOIS!; photo Herb. AKHANI!, P!). ¹⁾

= *H. halame* Boiss. & Buhse, Nouv. Mém. Soc. Imp. Naturalistes Moscou 12: 150. 1860.

Syntypes: in der großen Salzwüste bei Dschendak, 5.4.1849, *Buhse* 1261; bei Jesd in der Ebene und im Gebirge, 23.4.1849, *Buhse* 1311 (LE!); Derreh-goum bei Jesd, [1849], s. coll. probably *Buhse* (LE!). **Lectotype** (hoc loco designatus): In der großen Salzwüste bei Dschendak [Jandagh], 5.4.1849, *Buhse* 1261 (LE!; **Isotype:** K!).

= *H. sericocarpum* Bunge, Bull. Soc. Imp. Naturalistes Moscou 42: 322. 1869. **Lectotype** (hoc loco designatus): In sterilibus aridis prope Schurab inter Kaschau [Kashan] & Kum [Qom], 17.5.1859, *Bunge s.n.* (P!).

= *H. kumense* Bunge, l.c. 320. **Lectotype** (hoc loco designatus): In deserto ad septentrionem urbis Kum, prope Pul-i-dallak, *Bunge & Bienert* (P!; **Isotype:** G-BOIS!).

= *A. eremobium* Bunge, l.c. 321. **Syntypes:** Ad septentrionem et occidentem deserti magni salsi Persiae, inter Bedescht [Behdasht] et Maiomai [Mayamey], [4.6.1858], *Bunge & Bienert*; inter urbem Kum & Pul-i-dallak, 1859, *Bunge & Bienert*. **Lectotype** (hoc loco designatus): Ad septentrionem et occidentem deserti magni salsi Persiae, inter Bedescht et Maiomai, [4.6.1858], *Bunge & Bienert* P!; **Isotype:** G-BOIS!).

= *H. minutiflorum* Bunge, l.c. 324. **Lectotype** (hoc loco designatus): pr. Safar-chodshe [Safarkhojeh, 3.6.1859], *Bienert s.n.* (P!).

= *H. minutiflorum* Bunge var. *rudbaricum* Bornm., Bull. Herb. Boissier, sér. 2, 7: 780. 1907.

≡ *H. rudbaricum* (Bornm.) Riedl in Rech. f., Fl. Iranica 48: 24. 1967. **Lectotype** (hoc loco designatus): in arenosis ad fluvium Sefidrud, inter Rudbar et Mendschil [Manjil], 350 m, 10.5. 1902, *Bornmüller* 7655 (B!; **Isotypes:** BM!, BP!, G!, K!, LE!, M!, P!, PR!, STU!, W!, WU!).

1) The type locality of *H. aucheri* DC. is very doubtful. Just DECANDOLLE mentioned the locality with questionmark in his original diagnose "? in Turcorum Asia pr. Mossul". BOISSIER (1879) correctly stated that it must have been collected from Iran. According to rich herbarium material studied by us it was neither found in Turkey nor Iraq; it is limited in its distribution to central Iran and adjacent parts of Pakistan.

- = *H. lamondiae* Kazmi, J. Arn. Arb. 51 (2): 168. 1970. **Holotype:** Pakistan: S. Makran: 20-30 km E of Mirjaveh, desert, 28.3.1965, *Lamond 134* (E!).
- = *H. ruhanyi* Riedl & Esfand., Bot. Abteil. Pl. Pests Diseases Res. Inst. 8: 1. 1976. **Holotype:** Kashan, 38 km NO de Natanz, 1280 m, 19.5.1975, *Iranshahr 33072* (W!; **Isotype:** IRAN!).

Perennial, herbaceous, 10-40 cm high, branched from base and in stem, erect, ascending or subprostrate; stems whitish by indument of villose to tomentose, appressed or spreading hairs. Leaves elliptic-ovate to suborbicular, 9-40 mm long, 6-30 mm broad, acute or obtuse on top, attenuate, rounded or subtruncate at base, revolute at margin; upper side dark green, appressed villose hairs mixed with long, slightly scabrous, patent ones; lower side greyish-green, tomentose; petiole up to 1.3 cm, upper leaves often subsessile. Inflorescence terminal, frequently branched in two, uni- or obscurely biseriate, unilateral cymes; cymes 1-8 (-10) cm long, densely with 8-15 (-25) flowers, without pedicel or shortly up to 0.5 mm pedicelled. Calyx lobes nearly free to base, linear-lanceolate, (1.2-) 1.5-3.5 long, 0.5-1 mm broad, acute or obtuse. Corolla tubular, 3-5 mm long; corolla lobes vary from triangular-ovate, triangular to linear-triangular, acute to subulate acuminate, 0.3-1.2 mm long, their margin entire, rarely slightly crenulate; without distinct intercalary teeth; outside downwards appressed pilose; inside basically glabrous (very rarely pilose). Anthers 1-1.5 mm, apex subemarginate, sometimes hooked-apiculated inwards, inserted 1-2 mm above corolla base. Stigma 0.6-0.9 (-1) mm, conical, pilose. Style 0.4-1.1 (-1.2) mm, pilose. Nutlets ellipsoid-ovoid, smooth, 2.5-2.8 x ca. 1 mm, in early state densely covered by long silky hairs, later glabrous.

3a. *H. aucheri* subsp. *aucheri*

Fig.: plate 2 a + b, page 203.

Corolla lobes triangular, often recurved, subacute or acute.

General distribution: Endemic in Central Iran and adjacent parts of Pakistan.

Specimens seen:

Iran. Gilan: in arenosis ad fluvium Sefidrud, inter Rudbar et Mendschil [Manjil], 350 m, 10.5.1902, *Bornmüller 7655* (B, BM, BP, G, K, LE, M, P, PR, STU, W, WU) - 7 km NE of Rudbar, sloping sandy areas above Sefidrud river, ca. 150 m, 25.8.1989, *Akhani & Lari 5660* (MMTT) - Near Manjil (UA3), 300 m, 3.5.1987, *Assadi & Shah-Mohammadi 60035* (TARI) - East of Rudbar, 200 m, 13.7.1975, *Wendelbo & Assadi 18301-b* (TARI, W). -- **Zanjan:** Safar-chodshe [Safarkhojeh, 3.6.1859], *Bienert s.n.* (P) - ca. 12 km SW of Abe-yek, ca. 2 km after Gharpoz-abad, near Safarkhojeh, 1100 m, 24.8.1989, *Akhani & Lari 5610* (MMTT) - ca. 36 km W of Abe-yek, in the road towards Ghazvin, 1130 m, 24.8. 1989, *Akhani & Lari 5617* (MMTT). -- **Lorestan:** Bisheh, *Rechinger & Manuchehri 5800* (IRAN). -- **Arak:** 30 km road of Saveh towards Tehran, Zarand, 2.5.1985, *Akhani 215* (SBUH). -- **Esfahan:** in ruderalis lapidosis ab Esfahan 7 km occidentem versus prope institutum phytopathologicum, 1600 m, 28.5.1974, *Rechinger 46659* (M, W) - Kashan, 38 km NO de Natanz, 1280 m, 19.5.1975, *Iranshahr 33072* (IRAN, W) - dto., *Rechinger 52082* (W) - ca. 20 km SE of Kashan, on road to Natanz, 1200 m, 13.5.1974, *Wendelbo & Foroughi 11417* (TARI, W) - Kashan to Natanz, Pole-Hanjan, 1500 m, 30.10. 1973, *Foroughi 10546* (TARI, W) - ca. 18-20 km ESE of Kashan, ca. 900 m, 9.9.1989, *Akhani 5762* (MMTT, TUH) - ca. 35 km N of Natanz, near Dehabad village, 8 km NW of Bad, 1050 m, 10.9.1989, *Akhani 5794* (MMTT) - ca. 20 km N of Natanz, 5 km E of Hanjan village, 1350 m, 10.9.1989, *Akhani 5789* (MMTT) - Road of Khur to Robate-Poshte-Badam, 1000 m, 8.5.1978, *Dini & Bazargan 33084* (TARI) - Road from Natanz to Ardestan, near Emamzade Abyaran, 1380 m, 15.5.1974, *Wendelbo & Foroughi 11475* (TARI, W) - ca. 20 km N of Natanz, near Sarasiab village, 1050 m, 10.9.1989, *Akhani 5791* (MMTT) - ca. 15 km ESE of Kashan,

Emamzade Abyaran, 1380 m, 15.5.1974, *Wendelbo & Foroughi 11475* (TARI, W) - ca. 20 km N of Natanz, near Sarasiab village, 1050 m, 10.9.1989, *Akhani 5791* (MMTT) - ca. 15 km ESE of Kashan, sand dunes near sand dune stabilization station, 900 m, 9.9.1989, *Akhani 5758* (MMTT) - 15 km S of Kashan, in the road towards Ghamsar, 1300 m, 10.9.1989, *Akhani 5780* (MMTT) - Khur-Biabanak to Tashtab, 20-30 km from Khur, 3.11.1974, *Termeh & Moussavi* (IRAN) - inter Varamin et Ardestan, 34 km S of Sefidab versus Agha-Ali-Abbas, 26.5.1974, *Iranshahr* (IRAN) - Kavire-Namak, Sefidab to Kushkuh, 13.10.1972, *Iranshahr & Moussavi* (IRAN) - Südrand des Darya-Yi Namak: Ebene von Kadich, salzige Kiessteppe, 800 m, 9.11.1948, *Charif & Aellen 1334* (W). -- Yazd: 22 km NO de Robat-e Posht Badam, 880 m, 15.5.1975, *Iranshahr* (IRAN) - dto., *Rechinger 51827* (W) - Abiazeh, 33°19'N, 55°03'E, 15.5.1975, *Rechinger 51839* (W) - bei Jesd in der Ebene und im Gebirge, 23.4.1849, *Buhse 1311* (LE) - Derreh-goum bei Jesd, [1849], s. coll. probably *Buhse* (LE) - 58 km NW Yazd, 1060 m, 11.5.1961, *Pabot* (IRAN) - 14 km N de Mehrjan, 900 m, 18.5.1975, *Iranshahr* (IRAN) - dto., *Rechinger 51841* (W). -- Khorassan: 40-43 km NW Tabas versus Robat-e Gur, 600 m, 14.5.1975, *Rechinger 51775* (M, W) - 20-30 km SW Robat-e Gur, 33°45'N, 56°30'E, versus Robat-e Khan, 33°21'N, 56°03'E, 1000 m, 14.5.1975, *Rechinger 51780* (W) - 87 km from Neyshabur to Kashmar (FE2), 1850-2000 m, 11.6.1981, *Assadi & Mozaffarian 35523* (TARI) - Tabas, 23-26 km O de Jowkhash versus Robate-Gour, 14.5.1975, *Iranshahr 33065* (IRAN). -- Semnan: ad septentrionem et occidentem deserti salsi Persiae, inter Bedesht (Behdasht) et Maiomai (Maymay), [4.6.1858], *Bunge & Bienert* (G-BOIS, P) - between Mayamay & Davarzan, 64 km after Mayamay towards Sabzevar, Abbasabad, 900 m, 13.6.1990, *Akhani 6421* (MMTT) - ca. 30 km SW of Semnan, 950-1000 m, 12.6.1990, *Akhani 6382 & 6443* (MMTT) - Shahrud, ESE de Delbar to Ahmadabad, 1000 m, 28.4.1875, *Iranshahr 35062* (IRAN) - in deserto gypsaceo 2-7 km supra Sorkheh prope Semnan, 29.5.1975, *Rechinger 52150 & 52211* (W) - dto., 24.4.1975, *Rechinger 50204* (W) - 31 km W Semnan, Sorkheh, Momenabad, 1200-1350 m, 19.5.1982, *Termeh & Zargani* (IRAN) - near Semnan, on road to Firuzkuh, 1600 m, 19.7.1974, *Wendelbo & Gobham 13679* (TARI) - ca. 10 km NW of Semnan, 1650 m, 26.7.1982, *Assadi & Mozaffarian 40356* (TARI) - ca. 20 km N of Semnan, 1400-1500 m, 20.5.1978, *Wendelbo & Assadi 29743* (TARI) - Semnan to Firuzkuh, 7 km NW of Semnan, 1180 m, 24.6.1974, *Wendelbo & Foroughi 12996* (TARI) - 3 km S Sangsar, 1600-1700 m, 8.7.74, *Renz & Iranshahr 16578* (W) - Touran Protected Area: 7 km WSW of Majerad, in the plain, 950 m, 5.5.1978, *Freitag & Mozaffarian 28867* (TARI) - west side of pass between Ahmadabad and Delbar, 1070 m, 25.7.1976, *Freitag 13907* (TARI) - in alveo exsiccato 18 km ESE Delbar versus Ahmadabad, 35°46'N, 56°36'E, 820 m, 28.4.1975, *Rechinger 50524* (W) - 85 km from Shahrud to Sabzevar, 1100 m, 10.6.1981, *Assadi & Mozaffarian 35374* (TARI) - 98 km from Shahrud on the road to Sabzevar, 1400 m, 14.7.1976, *Assadi & Maassoumi 21216* (TARI) - ca. 50 km N of Torud, on road to Shahrud, 1050 m, 19.9.1975, *Wendelbo & Foroughi 18718-b* (TARI) - Hosseinabad to Jandagh, 800-1000 m, 29.10.1974, *Termeh & Moussavi 16839* (IRAN) - in der großen Salzwüste bei Dschendak [Jandagh], 5.4.1849, *Buhse 1261* (K, LE) - 13 km E Eyvanakey, gypsum and salted hills, 1100 m, 8.7.1974, *Renz & Iranshahr 16577* (IRAN, W) - inter Simindasht et Kabutar-darreh, 3-4.9.1948, *Aellen & Manuchehri 5354* (IRAN, W) - dto., 1177 (W) - inter Garmsar, 35°15'N, 52°20'E et Semnan, 900 m, 28.5.1975, *Rechinger 52143* (W) - Garmsar to Semnan, 54 km from Garmsar, 1.5.1974, *Iranshahr & Riedl 15825* (IRAN, W) - 40 miles east of Garmsar, 900 m, 7.7.1972, *Alava & Iranshahr 10819* (W) - inter Abbasabad et Miamay, *Rechinger et al. 5345* (IRAN, M, W) - 8 km NE of Momenabad, 1400-1500 m, 20.2.1980, *Moussavi & Karavar 35065* (IRAN) - Semnan, Sorkheh, 1000 m, 29.6.1937, *Gaub 998* (IRAN, W) - 37 mile Garmsar, versus Semnan, 900 m, 7.7.1972, *Iranshahr 16263* (IRAN) - inter Firuzkuh et Semnan, 1600 m, 14.8.1936, *Gaub 1660* (IRAN) - 37 km from Garmsar on road to Semnan, near Sorkhehnow, 940 m, 20.4.1978, *Freitag & Mozaffarian 28256* (TARI) - S of Sorkheh, 1400-1500 m, 15.5.1978, *Wendelbo & Assadi 29418* (TARI) - 36 km Garmsar, Tochal village, 22.5.1974, 1400 m, *Amin & Bazargan 18469* (TARI). -- Tehran: Kiessteppe beim Flugplatz Tehran, 1135 m, 8.9.1948, *Aellen 1331* (W) - prope Schurab inter Kaschau [Kashan] & Kum [Qom, 17.5.1859], *Bunge s.n.* (P) - in deserto ad septentrionem urbis Kum, prope Puli-dallak, *Bunge & Bienert* (G-BOIS, P) - 7 km NE of Qom, in the road towards Kuh-Sefid, 850 m, 11.9.1989, *Akhani 5807* (MMTT) - Salzige Steppenbühl beim Bahnhof Rud Shur, 60 km südwestlich Tehran, ca. 950 m, 2.11. and 21.9.1948, *Aellen 1333 & 1325* (W) - ca. 23 km NE of Qom, near Asgarabad, near Ghara-Chay river, ca. 850 m, 11.9.1989, *Akhani 5812* (MMTT, TUH) - SE of Houze-Soltan lake, ca. 800 m, 18.9.1987, *Akhani 4763* (MMTT) - SW of Houze-Soltan lake, ca. 800 m, 5.6.1987, *Ghorbanli et al. 4710* (MMTT) - N of Houze-Soltan lake, ca. 800 m, 18.9.1987, *Akhani 4748* (MMTT) - ca. 25 km NE



Plate 2: *H. aucheri* DC. subsp. *aucheri*: a) habit (Akhani 6348), b) flower (Wendelbo & Assadi 16005); c) *H. aucheri* DC. subsp. *carmanicum* (Bunge) Akhani & Förther: flower (Assadi & Amirabadi 66409).

of Qom, between Ain-abad and Kaj, 11.9.1989, *Akhani 5814* (MMTT) - SE of Houze-Soltan lake, near Sadr-abad Carvanserai, ca. 800 m, 5.6.1987, *Ghorbanli et al. 4714* (MMTT) - 32 km NW of Kashan, in the road towards Qom, 1000 m, 11.9.1989, *Akhani 5799* (MMTT) - ad stationem viae ferrae Anjilavand inter Qom et Tehren, 16.7.1948, *Rechinger 5800* (W) - ca. 40 km SE of Qom road to Kashan, 1200 m, 13.5.1974, *Wendelbo & Foroughi 11401* (W) - 50 km SE Qom, an der Straße nach Kashan, 13.4.1977, *Manuchehri 923* (Herb. PODL.) - 33 km E of Eshtahard towards Karaj, 1200 m, 27.8.1989, *Akhani & Lari 5741* (MMTT) - Salzsteppe 70 km SW Karaj, ca. 1000 m, 21.9. 1948, *Aellen 1356* (W) - Bijin, about 44 km from Tehran on road to Qom, 1050 m, 20.5.1974, *Shirdelpour & Amini 11581* (TARI, W) - 13 km Qom to Arak, 965 m, 13.6.1973, *Babakhanlu & Amin 30317* (TARI) - ca. 40 km SE of Qom, road to Kashan, 1200 m, 13.5.1974, *Wendelbo & Foroughi 11404* (TARI) - 20 km Qom to Arak, 11.6.1974, 1000 m, *Bazargan & Dini 18864* (TARI) - 66 km Qom to Kashan, 24.5.1972, 870 m, *Moussavi & Amin 1273* (TARI) - 26 km S Tehran to Qom, 22.4.1973, 1000 m, *Babakhanlou & Amin 30325* (TARI) - Qom, Hossein-abad to Janat-abad, 1200-1350 m, 19.5.1982, *Termeh & Zargani* (IRAN) - 64 km N of Qom, in the road to Tehran, ca. 1000 m, 5.6.1987, *Ghorbanli et al. 4693* (MMTT) - 28 km SE of Qom, in the road towards Kashan, 950-1000 m, 11.9.1989, *Akhani 5802* (MMTT) - Lehmwüste beim Bahnhof von Bahram, 20 km östlich Tehran, ca. 1100 m, 7.8.1948, *Aellen 1339* (W) - Kiessteppe bei Shahabad, 20 km westlich Tehran, 1200 m, 4.8.1948, *Aellen 1260* (W) - 100 km SW of Tehran, 1250 m, 22.5.1961, *Pabot 16868* (IRAN) - Kavir Protected Area: Mobarakieh, 40 km a Varamin meridiem versus, 900 m, 22.5.1974, *Rechinger 46110* (M, TARI, W) - in deserto lapidoso prope stationem viae ferreae Bad Rud, 1080 m, 26.5.1974, *Rechinger 46490* (W) - ca. 24 km on road from Mobarakieh to Caravanserai, 950 m, 20.4.1975, *Wendelbo & Assadi 16005* (TARI) - 3 km S Mobarakieh, plain N of Nare-Khar Kuh, 820 m, 2.8.1976, *Freitag 13982* (TARI) - East of Siakuh, 800 m, 10.9.1974, *Wendelbo & Foroughi 14656* (TARI) - in deserto usque ad 18 km a Chashmeh-ye Safidab, 34°19'N, 52°20'E, septentriones versus, 900 m, 25.5.1974, *Rechinger 46411* (M, TARI, W) - in deserto lapidoso 34 km a Chashmeh-ye Safidab versus Haji-Ali-Abbas, 1100 m, *Rechinger 46458* (M, TARI, W) - in montibus aridissimus in ditone Chashmeh-ye Safid Ab, 34°19'N, 52°20'E, 1000 m, 25.5.1974, *Rechinger 46415* (W) - ca. 25 km SE of Mobarakieh, 2.9.1986, *Akhani 1332* (SBUH) - 12-30 km SE of Mobarakieh versus Siah-kuh, 22.5.1974, *Iranshahr* (IRAN) - 7 km W of Ayvanakey, in the road of Tehran, 850 m, 11.6.1990, *Akhani 6352* (MMTT) - Steppenhügel zwischen Rudhen und dem Fluss Delidjai, 40-60 km östlich Tehran, 1800 m, 14.7.1948, *Aellen 1248* (W) - 15-20 km from Rude-Hen towards Tehran, around Khorramdasht, 1600 m, 24.8.1982, *Zehzad 82/1074* (SBUH) - Eshtahard, Abbas-abad, 22.5.1968, *Termeh 16837* (IRAN) - 93 km after Mamazan towards Ayvanakey, 1000 m, 11.6.1990, *Akhani 6348* (MMTT) - Chitgar, 30 km a Tehran occidentem versus, 1300 m, 17.5.1977, *Rechinger 55329* (W) - Chitgar, 1260 m, 24.11.1970, *Foroughi 952* (TARI) - Chitgar, 1320 m, 15.7.1972, *Sabeti, 5988*, 16.6.1974, *Wendelbo & Sanii 12516* (TARI) - Chitgar, Botanical Garden of Iran, *Mohamadi 1896* (TARI) - dto., *Afzal-Rafii & Zehzad 182* (SBUH) - dto., 24.6.1975, *Rechinger 53792* (W) - 15 km E of Boin-Zahra towards Eshtahard, ca. 1200 m, 27.8.1989, *Akhani & Lari 5740* (MMTT) - between Tehran & Karaj, near Tchitgar, 25.5.1982, *Zehzad 82/1112 & 82/1113* (SBUH) - Mardabad prope Karaj, *Gaubu 997* (W) - Salzsteppenhügel bei Mardabad, südwestlich Karaj, ca. 1300 m, 21.9. 1948, *Aellen 1244* (W) - in collibus Halkedar ad Mardabad prope Karaj, ca. 1200 m, 31.8.1948, *Rechinger 6795* (M, W) - near Mardabad, S of Karaj, 1250 m, 18.6.1975, *Wendelbo & Assadi 18131* (TARI) - 12 km Karaj-Chalus road, 1.6.1973, 1560 m, *Babakhanlu & Amin 30323* (TARI) - Karaj valley, Aliabad, 1480 m, 5.6.1974, *Foroughi et al. 12327* (TARI, W) - Rudhen, 2 km of Firuzkuh road, 1860 m, 23.8.1972, *Foroughi 5958* (TARI) - 31 km SW of Karaj, above the Shah-dasht, 1250 m, 17.6.1973, *Babakhanlu & Amin 30315* (TARI). -- Not exactly to localize: Mossul, [1836], *Aucher* (G-BOIS, P).

Pakistan. Makran: 20-30 km E of Mirjaveh, 28.3.1965, *Lamond 134* (E). - Chagai: 20-30 km E Mirjaveh, 29°01'N, 61°30'E, in deserto, 28.3.1965, *Rechinger 27254* (W) - dto., *Rechinger 27255* {mixed with *H. dasycarpum* subsp. *dasycarpum*} (W).

H. aucheri is found in different desertic habitats, e.g. sandy dunes, gravelly soils, gypsum hills, moderately saline beds and in waste lands around oases and cities. In many cases it is associated with *Artemisia sieberi*. Only in very few cases it was found in young dunes as a ± dominant community. Compared with other species of *Heliotropium* it plays a trifling role in succession of desert plant-communities.

rescence are influenced by ecological factors and growing period. For example the plants in gypsum and calcareous beds have smaller leaves, white stems and dense indument, in sand dunes they are more branched with higher growth, in gravelly steppes larger leaves on shorter stems connected with semiprostrate habit are common. Presence or absence of hairs on nutlets is dependent on the collection date. Usually younger nutlets have long silky hairs, older ones become glabrous.

Nearly all of the synonyms cited for the first time were studied at their type localities and original type material. Their minor differences represent the variability of this species only and demonstrate different ecological forms.

The shape of corolla lobes is correlated with geographical provenance of specimens: based on this character two subspecies, *H. aucheri* subsp. *aucheri* and subsp. *carmanicum*, are accepted in this account.

H. kumense and *H. trichostomum* of which the first is cited here as synonym of *H. aucheri* subsp. *aucheri* and the second as synonym of *H. aucheri* subsp. *carmanicum* have been distinguished by their pilose corolla inside. As discussed under taxonomic characters (see p. 191) such rare forms are only a variation like in other species with usually glabrous inside of corolla.

The relationship of *H. aucheri* and *H. digynum* is discussed under *H. digynum* (see p. 234).

3b. *H. aucheri* subsp. *carmanicum* (Bunge) Akhani & Förther comb. nov. $\equiv$ *H. carmanicum* Bunge, Bull. Soc. Imp. Naturalistes Moscou 42: 324. 1869. **Syntypes: in Persiae austro-orientalis provincia Carmania: prope Kuh-i-bachtun; Chabbis; Feisabad; Diracht-nishau ad orientem; et inter Bejas et Anar ad occidentem urbis Kerman, *Bunge & Bienert*. **Lectotype** (hoc loco designatus): Prope Kerman, [23.4.1859], *Bunge* (P!; **Isotypes:** LE!, P!).**

= *H. trichostomum* Bunge, l.c.: 319. **Holotype: In margine australiori deserti salsi magni Persiae inter Kerman et Jesd [Jazd] pr. Kermanschahi [Kermanschah], [29.4.?], *Bunge & Bienert* (P!).**

Fig.: plate 2 c, page 203.

Corolla lobes narrowly triangular or linear triangular, caudate-acuminate, often curved inwards the tube.

General distribution: Endemic in South-Central Iran.

Specimens seen:

Iran. Esfahan: 10 km from Morchehkhort to Natanz, 28.10.1987, *Termeh et al.* (IRAN) - 32 km from Ardestan to Nain, 830 m, 11.8.1981, *Assadi & Abouhamzeh* 36354 (TARI) - inter Ardestan et Murcheh-khort, 24 km from Murchehkhort, 27.5.1975, *Iranshahr* (IRAN) - 45-55 km S Esfahan, prope Mahyar, 1800 m, 2.6.1974, *Iranshahr* 16840 (IRAN) - in lapidosis aridis prope Mahyar, 45-60 km ab Esfahan versus Shahreza, 1800 m, 2.6.1974, *Rechinger* 46998 (M, W). -- **Yazd:** Junction of Kerman road to Bafgh, 1200 m, 13.10.1981, *Assadi & Abouhamzeh* 36390 (TARI) - between Mehriz and Marvast, 18 km after Aliabad, 2200 m, 24.11.1987, *Assadi & Akhani* 61739 (TARI) - 63 km to Bafgh, on the road from Yazd, 1400 m, 28.5.1986, *Assadi & Bazgosha* 55977 (TARI) - 37 km to Anar, on road from Yazd, 1400 m, 2.10.1988, *Assadi & Amirabadi* 66409 (TARI) - near Kharanagh, 1600 m, 14.10.1981, *Assadi & Abouhamzeh* 36450 (TARI) - 21 km from Ardestan to Yazd, 1100 m, 12.10.1981, *Assadi & Abouhamzeh* 36377 (TARI) - between Surmagh and Abarkuh, 32 km W of Abarkuh, 1700 m, 7.11.1990, *Kavousi* 6883 (MMTT) - between Yazd and Anar, 83 km after Yazd, 1530 m, 7.11.1990, *Kavousi* 6903 (MMTT). -- **Kerman:** Kerman, 7.5.1956, *Bobek* 150 (W) - prope Kerman, [23.4.1859], *Bunge* (LE, P) - inter Kerman and Jazd, prope Kermanschah Ali, *Bunge & Bienert* (P) - inter Kerman et Saidabad (Sirjan), inter Mashir et jugum Khane Sorkheh, 2000 m, 27.4.1948, *Rechinger* 3042 (W) - inter Baghin, 1670 m et jugum Sangpur (Gudare-e-Dokhtar), ca. 2200 m, 27.4.1948, *Rechinger* 2987 (W) - Tarud, inter Kerman et Bam, ca. 1500 m, 6.5.1948,

Rechinger 3607 (W) - inter Anar et Bahramabad (Rafsan-jan), 22-23.4.1948, *Rechinger et al. 2922* (M, W) - in planitie ad Baghin, 1900 m, 19.4.1892, *Bornmüller 3937* (P) - between Bam and Kerman, 13.6.1960, *Pabot 25559* (TARI) - 15 km SE Anar, road between Yazd and Rafsanjan, 1460 m, 9.5.1961, *Pabot 25549* (TARI) - 22 km NE of Anar, 1460 m, 9.5.1961, *Pabot 25550* (TARI) - inter Kerman et Mahan, 1800 m, 6.5.1948, *Rechinger 3547* (W) - dto., ca. 1900 m, 6.5.1977, *Assadi 23280* (TARI) - in arenosis prope Mahan, 30°05'N, 57°18'E, 1800 m, 6.5.1977, *Rechinger 55238* (M, W) - ca. 20 km from Kerman, road to Bandar Abbas, 2100 m, 5.6.1977, *Assadi & Miller 25045* (TARI) - Darzin, 2 km on road to Jiroft, 1380 m, 14.4.1975, *Foroughi 15901* (TARI, W) - Mahan, 6.5.1948, *Rechinger et al. 3542* (IRAN) - Kerman to Bardsir, 1680 m, 13.5.1981, *Sabouhi et al.* (IRAN) - inter Yazd et Kerman, 24.4.1955, *Alexandrov* (IRAN) - 22 km E of Rafsanjan, 1670 m, 5.11.1975, *Termeh & Moussavi 33836* (IRAN, W) - beginning of the road from Rafsanjan to Sarcheshmeh, 1700 m, 3.6.1986, *Assadi & Bazgosha 56382* (TARI). -- Fars: 35 km from Izadkhist towards Abadeh, 1950 m, 29.6.1989, *Zehzad & Taheri 66894* (TARI) - S of Izad-i-Kdast, between Abadeh and Esfahan, 2100 m, 30.7.1966, *Archibald 2945* (W).

4. *Heliotropium bacciferum* Forssk., Fl. Aegypt.-Arab. 38. 1775. sensu lato. **Holotype**: Arabia Felix: Lohaja [Al Luhayyah, 1.1763], *Forsskål 1329* (C.; microfiche 53: II.1,2).

= *H. tuberosum* (Boiss.) Boiss., Fl. Or. 4: 147. 1879 = *H. undulatum* Vahl var. *tuberosum* Boiss., Diagn. pl. orient., 1. ser., 11: 89. 1849 = *H. bacciferum* subsp. *tuberosum* (Boiss.) Riedl, Österr. Bot. Z. 113: 167. 1966 = *H. bacciferum* Forssk. subsp. *bacciferum* var. *tuberosum* (Boiss.) Kazmi, J. Arnold Arbor. 51(2): 162. 1970. **Syntypes**: In insula Korgo [Khark] Persiae australis, 7.1.1842, *Kotschy 22*; in Persia australi, Apr., *Aucher 5002* (BM!, G-BOIS!, LE!, P!). **Lectotypus** (hoc loco designatus): In insula Korgo [Khark] Persiae australis, 7.1.1842, *Kotschy 22* (G-BOIS!; **Isotypes**: BM!, BP!, BR!, GOET!, H 1611510!, HAL!, JE!, K!, L!, LE!, M!, P!, PR!, PRC!, REG 62159!, W!, WAG!, WU!).

= *H. ramosissimum* (Lehm.) DC., Prodr. 9: 536. 1845 = *H. undulatum* Vahl var. *ramosissimum* Lehm., Icon. descr. nov. stirp. 4: 24, tab. 40. 1831 = *H. bacciferum* Forssk. subsp. *bacciferum* var. *crispum* (Desf.) Sauvage & Vindt f. *ramosissimum* (Lehm.) Sauvage & Vindt, Trav. Inst. Sci. Chérifien, Sér. Bot. 3: 72. 1954. **Lectotype** (hoc loco designatus): Herb. Aegypt. [Wadi Gamuhs], *Sieber s.n.* (MEL 233321!; **Isotypes**: B!, BM!, BP!, BR!, G-DC!, GOET!, HAL!, JE!, K!, L!, LE!, M!, MEL 233322!, P!, PR!, PRC!, REG 62160! & 62208!, W!, WU!).

= *H. ramosissimum* DC. var. *trichocarpum* DC., Prodr. 9: 537. 1845. **Syntypes**: in deserto Sinaico, *Schimper*; inter Suez et Gaza, VI.1832, *Bové 86* (G-DC!, K!); inter Bagdad et Mossul, 1822, *Olivier* (G-DC!, M!, P!); *H. eriocarpum*, 22.8.1835, *Schimper* pl. exs. arab. 726. **Lectotype** (hoc loco designatus): *H. eriocarpum*, 22.8.1835, *Schimper* pl. exs. arab. 726 (G-DC!; **Isotypes**: BM!, K!, LE!, P!, REG 62184!, TUB!, W!).

= *H. affghanum* Boiss., Fl. Or. 4: 143. 1879. **Holotype**: in Affghania, *Griffith* distr. nr. 5936 (G-BOIS!; **Isotypes**: K!, LE!, M!, P!, W!).

= *H. turcomanicum* Popov & Korovin, Trudy Glavn. Bot. Sada 42: 246. 1931. **Syntypes**: in montibus Kopet-dagh Turcomaniae, ad confinium Rosso-persicum, pr. vigilias Tschat, 29.6.1916, *Korovin 1137* (TASH); dto., *Korovin 1138* (LE!, TASH).

= *H. sarothroclados* Bornm., Beih. Bot. Centralbl. 61 (2): 89. 1941. **Syntypes**: Prov. Kerman, am Kuh-tagħ-ali, 2.6.1892, 2000 m, *Bornmüller 3941* (B!, BM!, BP!, BR!, JE!, K!, LE!, M!, P!, PR!, PRC!, W!, WU!); am Kuh-i-Dschupar, 2200 m, VI.1892, *Bornmüller 3942* (B!, K!); Prov. Kerman, Kerman in monte Kuh-i-tachne [am Turm der Parsen], ca. 2000 m, 15.5.1892, *Bornmüller 3943*. **Lectotype** (hoc loco designatus): Prov. Kerman, Kerman in monte Kuh-i-tachne [am Turm der Parsen], ca. 2000 m, 15.5.1892, *Bornmüller 3943* (B!; **Isotypes**: B!, BM!, BP!, BR!, G!, GOET!, JE!, K!, LE!, M!, P!, PR!, PRC!, W!, WU!).

- = *H. persicum* (Burm.f.) Lam. f. *erosulum* Parsa, Kew Bull. 1948: 212. **Lectotype** (hoc loco designatus): Persia australis, (Farsistan) in segetibus ad Buschir, 12.3.1893, *Bornmüller* 532 (B!; **Isotypes**: B!, BRNM!, JE!, K!, LE!, M!, P!, PRC!, STU!, WU!).
- *H. kotschy* Bunge, Bull. Soc. Imp. Naturalistes Moscou 42: 331. 1869, nomen nudum.
 - *H. persicum* auct.: Boiss., Fl. Or. 4: 147. 1879, non Lam. 1789.
 - *H. lignosum* Bornm., Repert. Spec. Nov. Regni Veg. 41: 323. 1937, nomen nudum.

Fig.: plate 1 c, page 197.

Suffrutescent perennial to subshrub with erect, ascending or prostrate branches from a woody base up to 3 cm diameter, covered by strigose tuberculate hairs. Leaves 5-60 mm long, 2-16 mm broad, linear, linear-lanceolate, acute, crenulate-undulate and revolute at margin; young leaves flat, mature ones somewhat fleshy, sometimes semiterete. Inflorescence usually terminal, often in two branches, up to 7 cm long, in beginning of flowering time short, elongating during fruiting time; cymes with few, sessile flowers. Calyx persistent; calyx lobes 1.75-3 mm long, linear, acute, connate up to 1/3-1/2 of length, outside hairy, inside subglabrous. Corolla, 2.5-4 mm long, tubular, slightly constricted at throat, outside pilose, inside glabrous; corolla lobes 0.6-0.7 mm long, ovate, oblong or rounded, at margin entire or slightly crenulate-sinuate, $\pm$ imbricate. Anthers 0.8-1.25 mm long, inserted ca. 1 mm above corolla base. Stigma ca. 1 mm long, conical, acute, pilose or glabrous. Style up to 0.7 mm. Fruit subglobose, ca. 2 mm in diameter; nutlets 4, $\pm$ connate, sometimes slightly winged at edges, rugulate, shiny, glabrous or pilose.

General distribution: North Africa, Arabian peninsula, Iraq, Iran, Afghanistan, Pakistan, Turkmenistan.

H. bacciferum is a frequent species especially in coastal parts of Persian Gulf and Oman Sea. The habitats are varying from litoral sand dunes, salt marshes, saline flats to dry gravelly areas. In form of leaves, nutlets and indument the species is extremely variable. Therefore some authors (RIEDL 1967; KAZMI 1970; LÉONARD 1985) have divided it into several species and infraspecific taxa.

The distinction between *H. bacciferum* and other separately described taxa of this very complex group is not exactly clear. It is hardly possible to sort such extreme variations into welldefined, different species or infraspecific taxa. All taxa of Flora Iranica Area which seem to belong to *H. bacciferum* s.l. in the opinion of the authors are listed therefore provisionally as synonymys of this species.

The fact that many intermediate forms can be found does not allow an exact separation between *H. bacciferum* s.str. (as a bushy species with narrow, somewhat fleshy and semiterete leaves and glabrous, winged nutlets) and *H. ramosissimum* (dominating in inland deserts and mainly characterized by broad leaves, pilose and entire nutlets) like LÉONARD (1985: 27/28) did. It is more likely that such differences are perhaps more ecologically than genetically. As long as a biosystematic study of this complex over its whole distribution range is missing and for avoiding additionally troubles in nomenclature of *H. bacciferum* s.l., all examined specimens are listed here only as two groups differentiated by the kind of indument on ripe nutlets:

Specimens seen:

a) specimens with glabrous nutlets:

Iraq. Basra: Desertum meridionale, 5 km SW of Al Busayyah, 7.11.1956, *Rechinger* 8229 (W) - S of Al Busayyah, ca. 300 m, 7.11.1956, *Rechinger* 8209 (M, W). -- Diwaniya: Desertum meridionale, 10-15 km E As-Salman, 22.4.1957, *Rechinger* 9284 (M, W) - 8-15 km NW Aidaha (Al-Aida), ca. 90-95 km SW As-Salman, 410 m, 25.4.1957, *Rechinger* 9400 (M, W) - ca. 30°30'N, 44°30'E, 12 km WNW Ansab (143 km S As Salman), 340 m, 24.4.1957, *Rechinger* 9361 (W). -- Diyala: ad confines Persiae, in collibus conglomeraticis ab oppido Mandali, ca. 10 km orientem versus, ca. 33°40'N, 45°40'E, ad ripam dextram fluvii, 2.6.1957, *Rechinger* 12787 (W). -- Kut al-Imara: ad confines Persiae in ditone opiidi Badra, in collibus arenaceis, ca. 33°N, 46°E, 30 km SE Badra, 12.-13.4.1957, *Rechinger* 14022 (W). -- Karbala: Desertum occidentale, desert 17 km W Ramadi, 110 m, 18.-20.11.1956, *Rechinger* 8367 (W). -- Desertum occidentale: 31 km W Ramadi, 8.-9.6.1957, *Rechinger* 9763 (M, W).

Iran. Bushehr: 21 km to Genaveh on the road from Bandare-Deilam, 10.12.1989, *Assadi & Angoshti* 67496 (TARI) - 70 km on the road from Bandare-Bushehr to Ameri, 3-10 m, 3.3.1978, *Runemark & Mozaffarian* 27064 (TARI) - 5 km S of Bandare-Bushehr, 0-10 m, 2.3.1978, *Runemark & Mozaffarian* 26965 (TARI) - 42 km on road from Bandare-Bushehr to Ameri, 30-40 m, 2.3.1978, *Runemark & Mozaffarian* 27016 (TARI) - between Borazjan & Genaveh, Darvahi, near Daleki River, 50 m, 4.10.1974, *Bokhari et al.* 14793 (TARI) - Bushehr, 70 m, 24.4.1972, *Foroughi* 3600 (TARI) - Chahkhani, 25.4.1972, 70 m, *Foroughi* 3580 (TARI) - between Khormouj & Kangan, 20.1.1977, *Termeh & Moussavi s.n.* (IRAN). -- Hormozgan: Bandar Abbas, 14.2.1949, *Behboudi* 526 (IRAN) - dto., *Rechinger et al.* 3471 (IRAN) - on the road from Bandare-Moghireh to Bandare-Lengeh, 10 km to Lengeh, sea level, 3.8.1983, *Sardabi & Lotfian* 43213 (TARI) - between Bandare-Lengeh & Bandare-Charak, after Bandare-Shenas, sea level, 1.12.1987, *Assadi & Akhiani* 61978 (TARI) - Nakhle-Nakhoda, ca. 10 m, 21.11.1983, *Mozaffarian* 45043 (TARI) - 50 km from Minab to Jask, 40 m, 28.2.1982, *Mozaffarian et al.* 37992 (TARI) - Bandare-Charak, ca. 10 m, 26.11.1983, *Mozaffarian* 45231 (TARI) - Bastak, 1.3.1971, *Foroughi* 1163 (TARI) - Bandare-Jask, 26.1.1965, ca. 10 m, *Pabot* 25563 (TARI) - Minab, 29 m, 29.3.1986, *Mozaffarian* 63688 (TARI) - 100 km from Jask to Minab, 50 m, 5.5.1983, *Mozaffarian et al.* 44169 (TARI) - ca. 25 km from Bandare-Lengeh to Bastak, Bavard region, 30 m, 25.11.1983, *Mozaffarian* 45182 (TARI) - ca. 10 km S Gavbandi, Bandare-Javad-ol-Aemmeh, sea level, 8.2.1986, *Zehzad* 86/089 (SBUH) - between Asalouyeh & Nakhle-Taghi towards northern mountains, 10.2.1986, *Zehzad* 86/133 (SBUH) - between Bandar Lengeh and Bushehr, 4 km W of Bostaneh, 15 m, 28.2.1984, *Termeh et al. s.n.* (IRAN) - 15 km north of Lengeh, 3.3.1971, *Iranshahr & Termeh s.n.* (IRAN) - Aboumusa Island, sea level, 8.3.1984, *Assadi & Mozaffarian* 47167 (TARI) - Tonbe-Bozorg Island, ca. 0 m, 28.4.1984, *Assadi & Mozaffarian* 47300 (TARI) - Siri Island, 30.4.1984, *Assadi & Mozaffarian* 47358 (TARI) - Qeshm Island, SE Dargahan, Mousen, 30 m, 6.4.1975, *Wendelbo & Foroughi* 15573 & 15565 (TARI) - in insula Korgo [Khark] Persiae australis, 7.1.1842, *Kotschy* 22 (BM, BP, BR, G-BOIS, GOET, H 1611510, HAL, JE, K, L, LE, M, P, PR, PRC, REG 62159, W, WAG, WU) - in arenosis insula Karek in Sinu Persico, 7.1.1842, *Kotschy* 17 (BM, K, LE, M, P, W) - Hormoz Island, 10.-11.2.1976, *Termeh & Moussavi* (IRAN) - Qeshm Island, 25-27.2.1976, *Termeh & Moussavi* (IRAN) - Lavan Island, 6-12.7.1976, *Termeh s.n.* (IRAN). -- Baluchestan: ca. 20 km NE of Chahbahar towards Rask, ca. 20 m, 19.11.1990, *Akhiani* 6725 (MMTT) - ca. 7 km north of Negor, ca. 30 m, 19.11.1990, *Akhiani* 6720 (MMTT) - Goatr, sea level, 18.11.1990, *Akhiani* 6702 (MMTT) - ca. 10 km W of Konarak, shores near Pozm-Tiab, 19.11.1990, *Akhiani* 7653 (MMTT) - 7 km from Negor towards Kollani, saline soils, ca. 20 m, 18.11.1990, *Akhiani* 6662 (MMTT) - Bandare-Chahbahar, near sea shore, 9.8.1983, *Sardabi & Lotfian* 43239 (TARI) - Chahbahar, Beris, 21 km Pasabandar road, 10 m, 5.3.1974, *Shirdelpour* 10695 (TARI) - 135 km on road from Rask to Chahbahar, 220 m, 8.3.1977, *Runemark et al.* 22487 (TARI) - 70 km N Chahbahar, 50 m, 2.3.1974, *Iranshahr & Ershad s.n.* (IRAN) - Chahbahar towards Jask, between Ghattan and Bandinii, 155 km W of Tis, 50 m, 14.11.1976, *Ershad et al. s.n.* (IRAN) - Jask, 21.2.1949, *Behboudi* 527 (IRAN). -- Not exactly to localize: in Persia australi, Apr., *Aucher* 5002 (BM, G-BOIS, LE, P).

Afghanistan. Farah: 60 km NW Farah Rod an der Straße nach Herat, 1250 m, 3.8.1970, *Podlech 19200 a* (Herb. PODL.) - bei Kurmalik, ca. 35 km E Farah an der Straße nach Dilaram, 680 m, 26.8.1968, *Freitag 3779* (Herb. PODL.).

Pakistan. Quetta: in alveo 8 km NW Harnai, 30°05'N, 68°00'E, 900-1200 m, *Rechinger 29558* (W). -- **Baluchistan**: Makran, inter Kappar, 25°18'N, 62°42'E, et Gwadar, 25°09'N, 62°21'E, 14.4.1965, *Rechinger 27898* (M, W) - between Kappar and Gawadez, 14.4.1965, *Kazmi 1031* (M) - Ras Nuh prope Gwadar, 25°09'N, 62°21'E, 50-150 m, 15.4.1965, *Rechinger 27923* (W) - inter Pasni 25°13'N, 63°30'E, et Kappar, 25°18'N, 62°42'E, 14.4.1965, *Rechinger 27867* (M, W) - Neli Nut prope Kappar inter Pasni 25°13'N, 63°30'E et Kappar 25°18'N, 62°42'E, 14.4.1965, *Rechinger 27892* (M, W) - between Pasni and Kappar, 14.4.1965, *Kazmi 1026* (M) - Suntsar, 25°31'N, 62°02'E, versus Kikki 25°42'N, 62°36'E, 17.4.1965, *Rechinger 27979* (W) - Bela, inter Uthal 25°48'N, 66°40'E, et Naka Kharai, 3.4.1965, *Rechinger 27474* (M, W) - inter Sonmiani, 25°25'N, 66°40'E, et Uthal, 25°48'N, 66°40'E, 8.4.1965, *Rechinger 27553* (W) - circa Hab Chauki, 25°05'N, 66°55'E, ad viam versus Sonmiani, 25°25'N, 66°40'E, 30.4.1965, *Rechinger 28574* (W) - dto., *Rechinger 28578* (W) - 10-20 km N Hab Chauki, 25°05'N, 66°55'E, in agris incultis, 30.4.1965, *Rechinger 28613* (W) - 20-30 km S Panjgur, 26°58'N, 64°06'E, 20.4.1965, *Rechinger 30120* (W) - Kalat, 30-50 km W Bela, 26°12'N, 66°20'E, 300 m, *Rechinger 27622* (W) - dto., *Rechinger 27640* (M, W) - 20 miles from Ushab on Ushab Punjgur road, 20.4.1965, *Kazmi 1158* (M). -- **Karachi**: Cape Monze W Karachi, 6.4.1965, *Rechinger 27501* (W) - inter Damloti et Khadeji, 29.4.1965, *Rechinger 28511* (M, W).

b) specimens with ± pilose nutlets:

Iraq. Karbala: Desertum occidentale, between Fallujah and S shore of Lake Habbaniya, 18.-20.11.1956, *Rechinger 8288* (M, W) - sandy gypsum soil at ruins of Ukaidre, 15.3.1963, *Underwood & Barkley 4335* (W). -- Kut al-Imara: 30 km SE Badra, 12.4.1957, *Rechinger 9143* (M, W). -- Amara: in collibus arenaceis argillosis conglomeraticis ad stationem munitam Shatt at-Tib, ab Amara ca. 70 km septentrionem versus, 50-200 m, 32°30'N, 47°10'E, Jabal Ruhaila, 27.-28.3.1957, *Rechinger 14146* (W). -- Basra: Jabal Sanam, ca. 30°10'N, 47°30'E, 18.3.1957, *Rechinger 8577* (W) - Zubair, ca. 30°20'N, 47°40'E, 18.3.1957, *Rechinger 15412* (W) - prope Safai al Maghif (NE Ghazlani), 100 km WSW Basra, in arenosis lapidosis, 130 m, 24.3.1957, *Rechinger 14336* (W). -- Baghdad: Desert E of Fallujah, gypsiferous sand, 31.10.1956, *Rechinger 8128* (M, W) - Iskanderiya, S of Baghdad, 16.11.1956, *Rechinger 8268* (W) - sandy desert 2 km S Iskanderia, Hilla liwa, 19.9.1964, *Barkley & Hikmat Abbas Al-Ani 8865* (W). -- Diwaniya: Desertum meridionale, 30 km E As-Salman, in arenoso-lapidosus, 190 m, 22.4.1957, *Rechinger 13895* (W) - 80 km SW Karbala, 26.4.1957, *Rechinger 9493* (W). -- Dulaim: Al-Jazira inter Al-Falluja et Wadi Tharthar (Thirthar), 3.5.1957, *Rechinger 9511* (W).

Iran. Ilam: 15 km W of Dehloran, in the road towards Mehran, margin of Meymeh River, 200 m, 5.8.1989, *Akhani 5515* (MMTT) - Mehran, Gari, 1.5.1968, *Iranshahr 16231* (IRAN). -- Esfahan: 4 km from Anarak to Naein, 1400 m, 6.6.1986, *Assadi & Bazgosha 56550* (TARI) - Ghom, 80 km Kashan road, 960 m, 9.10.1972, *Riazi 6374* (TARI) - ca. 10 km WNW of Abuzeidabad towards Kashan, margin of fields, ca. 900 m, 9.9.1989, *Akhani 5778* (MMTT) - 18 km SO de Farrokhi versus Chahmalek, 800 m, 16.5.1975, *Iranshahr 33060* (IRAN) - 14 km N de Mehrjan, 900 m, 15.5.1975, *Iranshahr* (IRAN) - Hosseynian towards Jandagh, 20-30 km Jandagh, 800-1000 m, 29.10.1974, *Termeh & Moussavi* (IRAN) - between Khour and Biabanak, Tashtab, 20-30 km from Khour, 3.11.1974, *Termeh & Moussavi* (IRAN). -- Yazd: 22 km SO de Robate-Poshte Badam, 880 m, 15.5.1975, *Iranshahr 33059* (IRAN). -- Khuzestan: 31 km on road from Ramshir to Ahvaz, 120 m, 7.3.1978, *Runemark & Mozaffarian 31902* (TARI) - 5 km W Behbahan, 15.4.1959, *Pabot 25573* (TARI) - 12 km E of Ahvaz, 13.3.1959, *Pabot 25572* (TARI) - Sousangerd, Houyayzeh, 110 m, 14.3.1972, *Foroughi 3316* (TARI) - ca. 30 km to Ramhormoz from Ahvaz road, 80 m, 13.5.1986, *Mozaffarian 63214* (TARI) - Hendijan, 50 m, 13.3.1986, *Mozaffarian 62397* (TARI) - ca. 20 km from Gachsaran to Genaveh, 350 m, 5.3.1987, *Mozaffarian 63356* (TARI) - 40 km ESE Andimeshk, ca. 10 km N Chananeh, sandy soils, 150 m, 4.8.1989, *Akhani 5477* (MMTT, Herb. PODL.) - 20 km from Andimeshk to Ahvaz, 150 m, 14.11.1985, *Mozaffarian 58462* (TARI) - NE of Bostan, around Kuh-e Mish-Dagh, 50-200 m, 16.4.1985, *Mozaffarian 53716* (TARI) - Fakeh, *Ensaf 52* (SBUH) - Hamidieh, 24.3.1948, *Esfandiari 50* (IRAN). -- Bushehr: Dalaki to Borazjan, 12 km on the road to Borazjan, 50 m, 17.3.1985, *Maassoumi & Abouhamzeh 51878* (TARI) - between Bushehr and Bandar Lengeh, ca.

11 km SE of Khormouj, ca. 40 m, *Bokhari & Wendelbo* 42 (TARI) - 61 km on road from Kazeroun to Dalaki, 250-300 m, 28.2.1978, *Runemark & Mozaffarian* 26821 (TARI) - Mountains NE of Dalaki, 200-600 m, 1.3.1978, *Runemark & Mozaffarian* 26900 (TARI) - in arenosis prope Dalechi [Dalaki], 3.1842, *Kotschy* 134 (BM, K, LE, M, P, W) - 63 km on road from Borazjan to Genaveh, 40 m, 5.3.1978, *Runemark & Mozaffarian* 27210 (TARI). -- Fars: ca. 30 km S of Jahrum, near the village Harm, ca. 800 m, 28.11.1987, *Assadi & Akhani* 61849 (TARI) - 91 km SE Shiraz, 3.4.1961, *Pabot* 25570 (TARI) - ca. 60 km S of Jahrum, between Koureh and Evaz, 800 m, 29.11.1987, *Assadi & Akhani* 61885 (TARI). -- Hormozgan: Sirjan, Hajiabad, Dadashzadeh 25568 (TARI) - ca. 100 km SE of Lar, near the village Sartang, 300 m, 19.4.1983, *Assadi & Sardabi* 41944 (TARI) - 4 km N of Ghotbabad on the road to Sirjan, 730 m, 9.4.1975, *Wendelbo & Foroughi* 15766 (TARI) - 80 km from Minab to Kahnuj, 300-350 m, 6.5.1983, *Mozaffarian et al.* 44218 (TARI) - 5 km from Bandar Abbas to Sareghan village, 1100 m, 14.5.1983, *Mozaffarian* 44887 (TARI). -- Kerman: Hammune Jazmurian, Zehkalat, Hosseinabad, 300 m, 24.10.1983, *Mozaffarian* 45626 (TARI) - ca. 20 km from Khabr to Keht, 2200 m, 7.6.1977, *Assadi & Miller* 25145 (TARI) - 64 km SE of Sirjan, 1700 m, 6.5.1961, *Pabot* 25569 (TARI) - Shahdad to Birjand, Kavire-Lut, Khur to Jafrud, 20-40 km SE of Khur, 28.10.1975, 1150-1320 m, *Termeh & Moussavi* 33843 (IRAN) - am Kuh-tagh-ali, 2.6.1892, 2000 m, *Bornmüller* 3941 (B, BM, BP, BR, JE, K, LE, M, P, PR, PRC, W, WU) - am Kuh-i-Dschupar, 2200 m, 6.1892, *Bornmüller* 3942 (B, K) - Kerman in monte Kuh-i-tachne [am Turm der Parsen], ca. 2000 m, 15.5.1892, *Bornmüller* 3943 (B, BM, BP, BR, G, GOET, JE, K, LE, M, P, PR, PRC, W, WU). -- Baluchestan: 35 km from Iranshahr on road to Bazman, 570 m, 10.3.1977, *Runemark et al.* 22573 (TARI) - 25 km from Iranshahr to Khash, Baluchekan, 950 m, 4.6.1985, *Mozaffarian* 53360 (TARI) - Sarbaz, Rask, 18.3.1949, *Salavatian* 511 (IRAN) - Bazman, 11.5.1950, *Manuchehri* (IRAN). -- Khorassan: Tabas, 20 km SO de Robate Gur versus Robat-e Khan, 1000 m, 14.5.1975, *Iranshahr* (IRAN). -- Semnan: 55 km SW of Semnan, 19.5.1966, *Pabot* 25574 (TARI) - ca. 100 km ESE of Semnan in the road to Torud, 28.10.1987, *Akhani* 4076 (MMTT) - Touran Protected Area, 30 km E of Razeh, at Piste towards Kavir, 2.5.1978, *Freitag* 14/999 (KAS) - Hable-rud Tal, Bone Kuh, 1.9.1948, *Aellen & Manuchehri* (IRAN). -- Tehran: SE of Houze-Soltan Lake, near Sadrabad Carvansaraei, ca. 800 m, 5.6.1987, *Akhani et al.* 4716 (MMTT).

Afghanistan. Nangahar: 14 km SE von Jalalabad, Ufer des Kabulflusses, 540 m, 70/35 - 34/22, 17.4.1977, *Podlech* 28652 a (M, Herb. PODL.) - 20 km E Jalalabad, 34°26'N, 70°25'E, versus Tor Khama, 34°08'N, 71°10'E, 700 m, 25.7.1967, *Rechinger* 37433 (M, W) - 50 km W Tor Khama, 34°08'N, 71°10'E, versus Jalalabad, 34°26'N, 70°25'E, 600 m, 17.6.1965, *Rechinger* 31023 (M, W) - bei Mian Ali Sahab, zwischen Jalalabad und dem Khyber-Pass, Straßenrand, 14.4.1965, *Podlech* 10169 (M, Herb. PODL.) -- Paktia: 1 km N Yaqubi, 1150 m, 33°28'N, 70°00'E, *Anders* 3583 (Herb. PODL.). -- Not exactly to localize: Affghania, *Griffith* distr. nr. 5936 (G-BOIS, K, LE, M, P, W).

Pakistan. S. Waziristan: Sarwaki, 14.5.1973, *Kazmi* 4427, 4480 (M). -- Sind: in collibus calc. 10-15 km S Sehwan, 26°26'N, 67°52'E, 5.5.1965, *Rechinger* 28739 (M, W) - dto., *Rechinger* 28719 (M, W). -- Dera Ismail Khan: In arenosis mobilibus 50 km N Dera Ismail Khan, 31°51'N, 70°56'E, 250 m, 24.5.1965, *Rechinger* 30025 (M, W). -- Dera Ghazi Khan: Montes Sulaiman, Fort Munro, 29°51'N, 70°00'E, 1600-1800 m, 18.5.1965, *Rechinger* 29740 (W). -- Karachi: Karachi University Campus, 21.4.1974, *Kazmi* 5462 (M) - inter Damloti et Khadeji, 29.4.1965, *Rechinger* 28500 (W). -- Mian wah: Near Divisional Forest Office, 25.3.1974, *Kazmi* 5369 (M) - dto., *Kazmi* 5382 (M). -- Baluchistan: Chagai, 100-150 km E Nok Kundi, 28°49'N, 62°50'E, in deserto arenoso, 29.3.1965, *Rechinger* 27271 (M, W) - Kalat, 10 km S Khuzdar, 27°49'N, 66°39'E, 2.4.1965, *Rechinger* 27392 (M, W) - 16 km W Bela, 26°12'N, 66°20'E, in jugo Jan, 100 m, 9.4.1965, *Rechinger* 27600 (M, W) - 60 km S Panjgur, 26°58'N, 64°06'E, 800-850 m, 19.4.1965, *Rechinger* 28119 (W). -- Quetta: In valle 12 km N Murgha Kibzai, Tonschiefer, 1600 m, 19.5.1965, *Rechinger* 29806 (M, W).

Turkmenistan. in montibus Kopet-dagh Turcomaniae, ad confinium Rosso-persicum, pr. vigiliis Tschat, 29.6.1916, *Korovin* 1138 (LE).

5. *Heliotropium biannulatum* Bunge, Bull. Soc. Imp. Naturalistes Moscou 42: 300. 1869.

Lectotypus (hoc loco designatus): in regno Cabulico, *Griffith* distr. nr. 5933 (P!; **Isotypes**: B+, K!, L!, LE!, M!, W!).

- = *H. dicricophorum* Rech.f. & Riedl, Biol. Skr. 13(4): 186, fig. 142. 1963. **Holotype:** Sarobi, Darunta, 12.5.1951, *Volk* 1973 (W!; **Isotype:** M!).
- = *H. khyberianum* Rech.f. & Riedl, Fl. Iranica 48: 35. 1967. **Holotype:** NW-Pakistan, Peshawar: in jugo Khyber, ca. 34°08'N - 70°52'E, 900 m, *Rechinger* 19368 (W!; **Isotypes:** G!, LE!, M!).
- = *H. baluchistanicum* Kazmi, J. Arnold Arbor. 51(2): 172. 1970. **Type:** West Pakistan, Baluchistan: Mir Ali Khel, 3600' [1200 m], 17.5.1896, *Duthie* 18922 (2x K!; **Isotype:** RAW).

Fig.: NASIR, Fl. Pakistan 191: 33, fig. 10 H-M.

Perennial (very rarely annual), slightly branched from woody base and stem; stems sometimes up to 2 cm in diameter at base, indument densely tomentose, sometimes mixed with glandulose hairs. Leaves 1-6.5 cm long, 1-4.5 cm broad, broadly ovate to suborbicular, rarely elliptic-ovate, obtuse, with a distinct petiole of 0.2-4.5 cm, subacute or sometimes emarginate at top, subtruncate, rarely subcordate or rotundate at base, margin simple or little undulate, ± thick; upper side subappressed tomentose, distinctly impressed in nerves; lower side patent tomentose, distinctly prominent in nerves. Inflorescence terminal and lateral, terminal ones mostly with two branches; cymes 1-15 cm long, unilateral, usually biseriate, rarely uniseriate, densely with 10-100, sessile or very rarely up to 1.5 mm pedicelled flowers. Calyx dropping easily; calyx lobes 3-5.5 mm long, 0.4-1 mm broad, linear-oblong, ± obtuse to subacute, free to base, inside in upper 3/4 upwards sericous, base subglabrous, outside tomentose. Corolla 4.5-9 (-10.5) mm long, tubular or rarely infundibular, inside with two rings of hairs above the top of anthers and throat, between hairy rings glabrous or sparsely pilose, outside patent to downwards villose to tomentose; corolla lobes 0.3-2 mm long and broad, oblong-semirotundate to subovate, obtuse, ± crenulate at margin, valvate, without intercalary lobes. Anthers 1-1.8 mm long, acute, inserted 1-2 mm above corolla base. Stigma 0.5-1 mm long, shortly conical or pillow-shaped, glabrous. Style 0.3-0.8 mm long, glabrous. Nutlets 1.7-1.8 x 0.8-1 mm large, ovoid, rugose, glabrous.

General distribution: Probably endemic in Afghanistan and Pakistan.

Specimens seen:

Afghanistan. Kabul: Sarobi-Tagao, Wegränder, Brachen, 21.8.50, *Volk* 1202 (M, W). -- **Laghman:** Sarobi, Darunta, 12.5.1951, *Volk* 1973 (M, W) - Darunta-Brücke, 17.8.1951, *Neubauer* 848 (W) - Alishang-Tal, 2 km südlich Rayn, 1030 m, 10.4.1970, *Podlech* 17582 (M, Herb. PODL.). -- **Nangahar:** 5 km SW Memla bei Araban, 1150-1250 m, 70/05-34/17, 17.6.1973, *Anders* 10375 (Herb. PODL.) - Tor Khama, 34°08'N, 71°10'E, ad confines Afghanistan, 700 m, 29.5.1965, *Rechinger* 30352 (M, W) - dto., 600 m, 17.6.1965, *Rechinger* 31006 (M, Herb. PODL., W) - dto., 2.9.1965, *Ahemad* 21 (M) - 5 km westlich Torkham am Khyberpass an der Straße nach Jalalabad, ca. 1000 m, 14.4.1965, *Podlech* 10180a (Herb. PODL.) - 12 km W Torkham, 29.9.1976, 600 m, *Breckle* 4952 (Herb. PODL.) - 50 km W Tor Khama, 34°08'N, 71°10'E, versus Jalalabad, 34°26'N, 70°25'E, 699 m, 17.6.1965, *Rechinger* 31024 (M, W) - 3 km N der Kunarbrücke, 13 km NE Jalalabad, 570 m, 70/33-34/30, 28.7.1978, *Podlech* 32132 (Herb. PODL.) - 13 km SE von Jalalabad nahe der Straße nach Torkham, 550 m, 70/34-34/22, 17.4.1977, *Podlech* 28648a (Herb. PODL.) - 20 km E Jalalabad, 34°26'N, 70°25'E, versus Tor khama, 34°08'N, 71°10'E, 700 m, 25.7.1967, *Rechinger* 37428 (M, W) - Ghnikhel, ca. 30 km SSO von Jalalabad, 580 m, Kalkfelsen, 8.10.1969, *Freitag* 7326 (Herb. PODL.) - Ghariabad (an der Straße Jalalabd-Torkham), 500 m, 24.10.1970, *Podlech* 19934 (M, Herb. PODL.) - Farm bei Ghariabad, 25 km SO von Jalalabad, 750 m, 27.10.1969, *Rassoul* 558 (M, Herb. PODL.) - 8 km SW Ghariabad an der Straße von Jalalabad nach Tor Kham, 550 m, 24.10.1970, *Podlech* 19976 (Herb. PODL.) - 14 km SO Jalalabad, Kabulufer, 540 m, 70/35-34/22, 17.4.1977, *Podlech* 28659 (M, Herb. PODL.) - in parte inferiore vallis Kunar, 40-60 km NE Jalalabad, 16.7.1965, *Rechinger* 32400

(M, W) - Darrah-i-Nur bei Badyalay, 675 m, 3.4.1970, *Podlech 17416* (M, Herb. PODL.) - dto., oberhalb Qala-Shahi, 1000 m, 70/35-34/40, 4.10.1972, *Anders 9458* (Herb. PODL.). -- Kunar: Bashgal Tal bei Bargematal, 2000 m, 4.6.1964, *Neubauer 4551* (W, Herb. PODL.). -- Not exactly to localize: in regno Cabulico, *Griffith 5933* (K, L, LE, M, P, W).

Pakistan. Peshawar: in jugo Khyber, ca. 34°08'N - 70°52'E, 900 m, *Rechinger 19368* (G, LE, M, W) - Khyber Agency, Turkham, 7.10.1972, *Kazmi 4356* (M) - in jugo Landi Kotal (Khyber Pass), 34°07'N, 71°15'E, 700-1000 m, 29.5.1965, *Rechinger 30329* (M, W) - Lauch Kotal, 15.5.1974, *Kazmi 5534* (M).

H. biannulatum is easily to recognize by its peculiar vegetative characters, being a perennial with a distinct woody base, the thick leaves, the densely tomentose indument, and the corolla inside with two rings of hairs between the top of anthers and throat (also evident in type material *Griffith 5933*). Between these two hairy zones there is a glabrous or sparsely hairy zone. Only in small and young flowers it is sometimes difficult to recognize this glabrous zone.

According to studied material only two collections with really annual forms were found, e.g. *Anders 10375* and *Rechinger 37428*. In the latter specimen both annual and perennial plants are mounted on the same sheet. In Flora Iranica (RIEDL 1967) *H. biannulatum* is placed in the identification key and in sectional classification as annual. In contrast to this RIEDL (1963: 183) distinguished *H. dicricophorum* from *H. biannulatum* by its perennial habit, but as mentioned above perennial habit is characteristic of *H. biannulatum*. Therefore both are only synonyms.

H. flavum was validly described from Jallalabad and Khybar Valley by GRIFFITH (Itin. Pl. Khasyah mts.: 322. 1848) 21 years before *H. biannulatum* and seems to be overlooked by all former authors. Unfortunately we were not able to find a type specimen yet. But based on the short original description "Planta ramosa 1-3 pedalis canescens, floribus flavis, infundibuliformi compresse disticho secundis" and its locality it is very probable that *H. flavum* is the correct name of *H. biannulatum*.

6. *Heliotropium bovei* Boiss., Diagn. pl. orient. 11: 87. 1849. **Holotype**: in Arabia felici, 1839, *Bové* (G-BOIS!; photo Hb. AKHANI!; **Isotype**: P). [According to BOISSIER 1875 the type locality is in Syria).

= *H. mamamense* Bunge, Bull. Soc. Imp. Naturalistes Moscou 42: 308. 1869. **Lectotype** (hoc loco designatus): Ad salinas Maman Persiae boreali-occidentalis, *Seidlitz s.n.* (P! [cum diagn.]; **Isotypes**: G-BOIS!, LE!, P!).

= *H. teheranicum* Bunge, Bull. Soc. Imp. Naturalistes Moscou 42: 309. 1869. **Lectotype** (hoc loco designatus): In apricis siccis pr. Sergendeh [Zargandeh] in vicinitate urbis Teheran, 27.5.1859, *Bunge & Bienert* (P!; **Isotype**: G-BOIS!). [2 little pieces without locality and date are in Herb. Bunge LE!]

= *H. kotschyanum* Bunge, Bull. Soc. Imp. Naturalistes Moscou 42: 312. 1869. **Holotype**: in Tauri cilicici alpinis Butgar-dagh, 24.8.1853, *Kotschy* it. cil. 277 (P!; fragm.).²⁾

Fig.: plate 3 a + b, page 213.

Annual, 10-50 cm high, branched from base, greyish, indument whitish-villose of patent or subappressed hairs. Leaves 1-3.5 cm long, 0.5-2.5 cm broad, ovate, elliptic to suborbicular, with petiole up to 2.5 cm, sometimes sessile, at top obtuse to subacute, at margin somewhat thickened, attenuate or rounded at base; upper side appressed-villose, nerves slightly impressed; lower side patent-villose, nerves prominent. Inflorescence terminal or lateral, rarely

2) There is only a fragment of a specimen under *H. kotschyanum* in the BUNGE herbarium at Paris without declaration of any locality. BUNGE himself mentions *Kotschy 277* as type, but all examined specimens of the KOTSCHY exsiccatum distributed with the remark "263 cum 277 mixtum" belong to *H. suaveolens*.

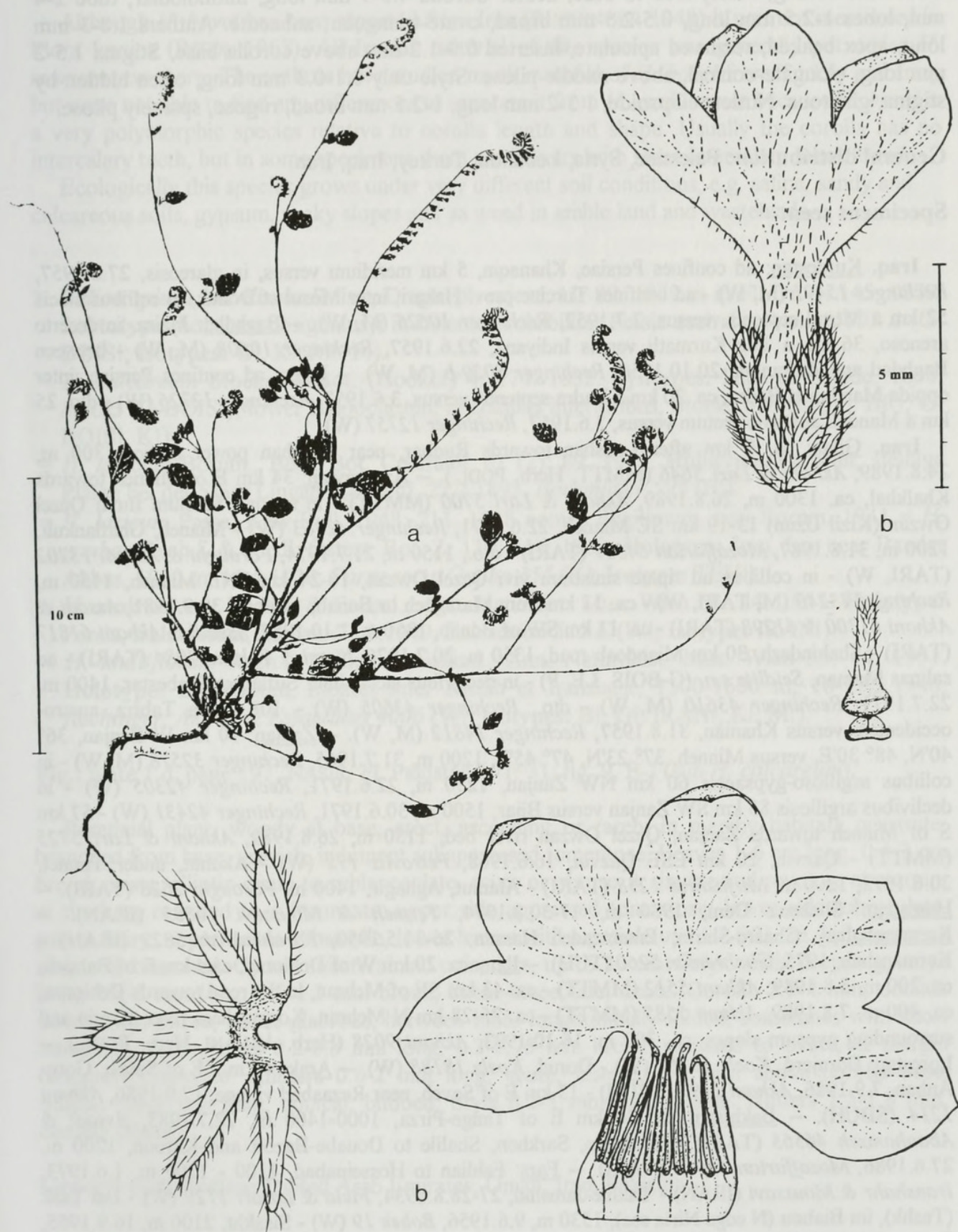


Plate 3: *H. bovei* Boiss.: a) habit (Akhani & Lari 5725), b) flower (Mozaffarian 54917).

branched. Cymes elongate, up to 35 cm, with 10-100 flowers, unilateral and uniseriate. Flowers usually without pedicel, lower ones sometimes shortly pedicelled up to 1 mm. Calyx easily dropping together with nutlets; calyx lobes 2.5-3.5 mm long, 0.5-1 mm broad, lanceolate-oblong, nearly free to base, acute. Corolla 4.5-9 mm long, infundibular; tube 2-4 mm; lobes 1-2.5 mm long, 0.5-2.5 mm broad, ovate-triangular, subacute. Anthers 1.8-3 mm long, apex beaked, recurved apiculate, inserted 0.9-1.2 mm above corolla base. Stigma 1.5-2 mm long, elongate-conical, above middle pilose. Style only 0.1-0.3 mm long, often hidden by stigma, glabrous. Nutlets ellipsoide, 1.3-2 mm long, 1-2.5 mm broad, rugose, sparsely pilose.

General distribution: Palestine, Syria, Lebanon, Turkey, Iraq, Iran.

Specimens seen:

Iraq. Kurdestan: ad confines Persiae, Khanaqin, 5 km meridium versus, in glareosis, 27.8.1957, *Rechinger 15491* (M, W) - ad confines Turciae prov. Hakari, inter Mosul et Dohuk, in collibus siccis 52 km a Mosul septentr. versus, 2.7.1957, *Rechinger 10626* (M, W). -- Baghdad: Jazira, in deserto arenoso, 36 km a Tuz Kurmatli versus Indiyana, 22.6.1957, *Rechinger 10608* (M, W) - between Baghdad and Zafraniya, 20.10.1956, *Rechinger 8029-b* (M, W). -- Diala: ad confines Persiae, inter oppida Mandali et Badra, ca. 20 km a Badra septentr. versus, 3.6.1957, *Rechinger 12726* (W) - dto. 25 km a Mandali austro-orientum versus, 3.6.1957, *Rechinger 12757* (W).

Iran. Gilan: ca. 9 km after Loushan towards Rudbar, near Loushan power station, 300 m, 24.8.1989, *Akhani & Lari 5646* (MMTT, Herb. PODL.). -- Azərbaycan: 34 km E of Mianeh towards Khalkhal, ca. 1300 m, 26.8.1989, *Akhani & Lari 5700* (MMTT) - in saxosis faucium fluvii Qezel Owzan (Kizil Uzun) 13-19 km SE Mianeh, 22.6.1971, *Rechinger 42263* (W) - Mianeh, Ghaflankuh, 1200 m, 31.8.1987, *Mozaffarian 64337* (TARI) - dto., 1150 m, 21.7.1974, *Foroughi & Assadi 13702* (TARI, W) - in collibus ad ripam sinistram vivi Qezel Owzan, 10-24 km ENE Mianeh, 1150 m, *Rechinger 43240* (M, TARI, W) - ca. 11 km from Maragheh to Bonab, 1450 m, 30.9.1981, *Assadi & Akhane 61300 & 61298* (TARI) - ca. 11 km SW of Bonab, 1350 m, 1.10.1987, *Assadi & Akhane 61317* (TARI) - Shahindezh, 30 km Miandoab road, 1350 m, 20.7.1976, *Siami & Zehzad 7084* (TARI) - ad salinas Maman, *Seidlitz s.n.* (G-BOIS, LE, P) - in declivibus siccis inter Sufian et Shabestar, 1400 m, 22.7.1971, *Rechinger 43610* (M, W) - dto., *Rechinger 43605* (W) - 108 km a Tabriz, austro-occidentem versus Khanian, 31.8.1957, *Rechinger 14812* (M, W). -- Zanjan: 10 km W Zanjan, 36° 40'N, 48° 30'E, versus Mianeh, 37° 23'N, 47° 45'E, 1200 m, 31.7.1965, *Rechinger 32578* (M, W) - in collibus argilloso-gypsaceis 60 km NW Zanjan, 1250 m, 22.6.1971, *Rechinger 42305* (W) - in declivibus argillosis 85 km SW Zanjan versus Bijar, 1500 m, 30.6.1971, *Rechinger 42431* (W) - 57 km S of Mianeh towards Zanjan, Qezel Owzan river bed, 1150 m, 26.8.1989, *Akhani & Lari 5725* (MMTT) - Qazvin, 20 km ESE Qazvin, 16.6.1968, *Petrovitz 172* (W) - Alamut, under Tunnel, 20.6.1972, 1200 m, *Mirfakhrai 1258* (TARI) - Alamut, Aghagir, 1400 m, *Foroughi 2628* (TARI). -- Hamadan: Shahnaz Dam, 1930 m, 17-30.8.1974, *Termeh & Moussavi 16835* (IRAN). -- Kermanshahan: Ghasre-Shirin, Emamzadeh Hassan, 26-31.5.1950, *Farahbakhsh 5822* (IRAN) - Kermanshah, 1975, *Ghahreman 5260* (TUH). -- Ilam: ca. 20 km W of Dehloran, ca. 4 km E of Barzieh, ca. 200 m, 5.8.1989, *Akhani 5512* (MMTT) - ca. 43 km SE of Mehran, in the road towards Dehloran, ca. 400 m, 7.8.1989, *Akhani 5585* (MMTT) - ca. 25-28 km N Mehran, Konjancham river margin and surrounding gypsum slopes, ca. 300 m, 16.10.1993, *Akhani 9028* (Herb. AKHANI, Herb. PODL.). -- Lorestan: Borujerd, *Koelz 18561* (W) - Dorud, *Koelz 18188* (W). -- Arak: 4 km NE of Saveh, Gorg-Anban, 7.9.1986, *Akhani 1196* (SBUH) - 13 km E of Saveh, near Rezaabad village, 17.9.1986, *Akhani 1214* (SBUH). -- Bakhtiari: ca. 30 km E of Tange-Pirza, 1000-1400 m, 22.7.1983, *Assadi & Abouhamzeh 46563* (TARI) - Lordegan, Sarkhon, Shalile to Douabe-Bazoft and Karoun, 1200 m, 27.6.1986, *Mozaffarian 54917* (TARI). -- Fars: Fahlian to Hosseinabad, 1100 - 1200 m, 1.6.1973, *Iranshahr & Moussavi* (IRAN) - Takhte-Jamshid, 27-28.8.1934, *Field & Lazari 1129* (W) - Bei Task (Tashk), im Biabou (N edge Niriz see), 1530 m, 9.6.1956, *Bobek 19* (W) - Sisakht, 2100 m, 16.9.1955, *Remaudiere 74* (W). -- Khuzestan: Khairabad river, 20 km E of Behbahan, boulder flood plain, 400 m, 30.6.1964, *Grant 15/893* (W) - Gachsaran, 920 m, s. coll. (IRAN). -- Tehran: Jajrud, Mount. Tala, 6.6.1972, 1700 m, *Dini & Arazm 1259* (TARI) - in ditone oppidi Karaj, in collibus prope Khur et Pashand, 3.6.1937, *Rechinger 680* (W) - prope Sergendeh in vicinitate urbis Tehran, 27.5.1859, *Bunge*

& Bienert (G-BOIS, P) - Verlassene Schweinezucht Tehran, bei Mahmoudiyeh, 15 km N Tehran, 1250 m, 24.8.1948, *Aellen* 1275 & 1270 & 1280 & 1281 & 1262 (W) - Kiessteppe beim Flugplatz Tehran, 1135 m, 8.9.1948, *Aellen* 1258 & 1330 (W) - Varamin, *Alavi* (IRAN).

Although *H. bovei* has been reported from Iran (RECHINGER 1948) it was not mentioned in Flora Iranica (RIEDL 1967). All Iranian material of this species was generally put under *H. mamamense* there. The authors have studied much material of *H. bovei* from Turkey and Iraq, but were not able to find any differences to separate it from *H. mamamense* because *H. bovei* is a very polymorphic species relative to corolla length and shape. Usually the corolla has no intercalary teeth, but in some specimens there are flowers with short intercalary lobes found.

Ecologically this species grows under very different soil conditions, e.g. saline, sandy and calcareous soils, gypsum, rocky slopes and as weed in arable land and wastelands.

7. *Heliotropium brevilimbe* Boiss., Diagn. pl. orient. 11: 89. 1849 et in Fl. Or. 4: 145. 1879.

Lectotype (hoc loco designatus): in Oriente probabiliter Persia australi, *Aucher* 5005 A (G-BOIS!; **Isotypes**: G!, K!, M!, P!).

= *H. calcareum* Stocks, J. Bot. (Hooker) 4: 174. 1852. **Syntypes**: Hills of Scinde, 1850, *Stocks* (G-BOIS!); lower Beloochistan, in collibus inferioribus, *Stocks* 630 (fragm. BR!, G-BOIS!, K!).

= *H. laricum* Bornm., Beih. Bot. Centralbl. 61 (2): 89. 1941. **Holotype**: Laristan, steinige Plätze bei der Stadt Lingae [Lengeh], 27.2.1893, *Bornmüller* 593 (B!).

= *H. laricum* Parsa, Kew Bull. 1948: 211. 1948 nomen illegitimum, non Bornm. 1941 = *H. gaubae* Rech.f. & Riedl, Österr. Bot. Z. 110: 516. 1963. **Holotype**: Iran, Lar near Bandar Abbas, 1000 m, 14.4.1939, *Parsa* recte *Gaubae* 355 (K!; **Isotype**: TEH!).

= *H. makranicum* Rech.f. & Esfand., Ann. Naturhist. Mus. Wien 58: 44. 1951. **Holotype**: Persia, Baluchistan, Sarbaz, 23.3.1949, *Salavatian* 512 E (W!; **Isotype**: IRAN!).

= *H. multiflorum* Rech.f., *Aellen* & Esfand., Ann. Naturhist. Mus. Wien 58: 44. 1951. **Holotype**: Baluchistan, montes inter Khash et Iranshahr, 1500-1600 m, 16-17.5.1948, *Rechinger*, *Aellen* & *Esfandiari* 4006 (W!; **Isotypes**: B!, G!, IRAN!, K!, M!).

Fig.: plate 1 d, page 197; NASIR, Fl. Pakistan 191: 31, fig. 9, E-J (sub *H. calcareum*).

Perennial plant, woody at base, erect, ascending or rarely in marshy habitats prostrate; branched from base, greyish, indument subappressed tomentose. Leaves 1-6 cm long, 0.4-3 cm broad, ovate, elliptic-ovate to sub lanceolate, acute or obtuse, $\pm$ sinuate and revolute at margin, at the base rounded to subtruncate; upper side appressed tomentose; lower side tuberculate, patent hairy; upper leaves subsessile, lower leaves with a petiole up to 1 (-2) cm. Inflorescence simple or branched. Cymes unilateral and uniseriate, up to 30 cm. Calyx easily dropping; calyx lobes 1.8-3 mm long, 0.5-1.3 mm broad, linear-lanceolate, acute. Corolla 2.5-4 mm, outside downwards pilose, inside glabrous, between lobes longitudinally folded, sometimes with short intercalary teeth; lobes 0.2-0.5 mm long, 0.3-0.75 mm broad, rounded to ovate, at margin obscurely crenulate. Anthers 0.8-2 mm long, acute, inserted 1-2 mm above corolla base. Stigma 0.6-1 mm long, conical, bilobed. Style 0.2-1 mm long, pilose. Nutlets 1.5-1.8 mm, densely pilose.

General distribution: United Arab Emirates, Oman, Iran, Pakistan.

Specimens seen:

Iran. Fars: 33 km from Lar to Bastak, mountains SE of the village Homrud, 500-1100 m, 17.4.1983, *Assadi* & *Sardabi* 41789 (TARI) - 18 km from Lar to Bastak, 1000 m, 16.4.1983, *Assadi* &

Sardabi 41772 (TARI). -- Hormozgan: S side of Kuh-e Genou, 700-800 m, 2.4.1975, *Wendelbo & Foroughi 15343* (TARI) - near Genou mount., 6.3.1983, *Lotfian 43151* (TARI) - 20 km E of Bandar Abbas to Bandar Lengeh, sea level, 5.3.1990, *Akhiani et al. 68009* (TARI) - 33 km N of Bandar Abbas, 5.5.1961, 200 m, *Pabot 25545* (TARI) - Hajiabad to Genou, 29.4.1948, *Rechinger et al. 3269* (IRAN, W) - Hajiabad to Bandar Abbas, 29.4.1948, *Rechinger et al. 3347* (IRAN, W) - 17-19 mile O d'Isin, 14.2.1975, *Iranshahr & Termeh 35063* (IRAN) - 15 mile S de Kahurestan, dans les terrains sales, 15.2.1975, *Iranshahr & Termeh 33061* (IRAN) - Sarkhoune, 18.4.1949, *Behboudi 524* (IRAN) - Bandar Abbas to Sirjan, Sarzeh, 700 m, 8.3.1971, *Iranshahr & Termeh* (IRAN) - 20 mile O de Kashar-e Olia, 14.2.1975, *Iranshahr & Termeh 33064* (IRAN) - inter Hajiabad et Bandar Abbas, 29.4.1948, *Rechinger et al. 3241* (IRAN, W) - Hajiabad, 1.5.1948, *Rechinger et al. 3489* (IRAN, W) - Bandar Abbas to Hajiabad, 55 km from Bandar Abbas, 18.4.1977, *Riedl & Ershad 37154* (IRAN) - ca. 25 km from Kahurestan to Bastak, 200 m, 25.4.1985, *Mozaffarian 49701* (TARI) - ca. 100 km SE of Lar, above the village Sartang, Kuh-e Shah, 500-900 m, 19.4.1983, *Assadi & Sardabi 42034* (TARI) - Siahou region, 500-700 m, 3.3.1982, *Mozaffarian et al. 38212* (TARI) - 5 km to Siahu from main road, 500 m, 8.5.1982, *Mozaffarian et al. 39634* (TARI) - 83 km from Lar to Bastak, 500 m, 17.4.1983, *Assadi & Sardabi 41871* (TARI) - ca. 50 km from Bastak to Bandar Lengeh, 250 m, 26.4.1985, *Mozaffarian 49774* (TARI) - 55 km from Bandar Lengeh to Bastak, between Garestaneh and Chah-Mosallam, 30 m, *Mozaffarian 45200* (TARI) - 66 km N Bandar Abbas, on road to Sirjan, 400 m, 8.4.1975, *Wendelbo & Foroughi 15697* (TARI, W) - Ghotbabad, Baghestan, Damtang village, Baz mount., 500-2000 m, 28.4.1985, *Mozaffarian 50033* (TARI) - 8 km from Bastak to Bandar Lengeh, 800 m, 30.11.1987, *Assadi & Akhani 61935* (TARI) - 70 km N of Bandar Abbas, on road to Sirjan, 430 m, 9.4.1975, *Wendelbo & Foroughi 15747 & 15745* (TARI, W) - 58 km N of Bandar Abbas, on road to Sirjan, 330 m, *Wendelbo & Foroughi 15683* (TARI) - Bashagerd, 22 km from Senderk to Darpahn, 550 m, 3.5.1982, *Mozaffarian et al. 39254* (TARI) - 42 km from Minab to Senderk, 160 m, 2.5.1982, *Mozaffarian et al. 39162* (TARI) - 80 km from Minab to Kahnouj, 300-350 m, 6.5.1983, *Mozaffarian et al. 44219* (TARI) - Bashagerd, 11 km from Senderk to Darpahn, after Arangeh, 450 m, 3.5.1982, *Mozaffarian et al. 39182 & 39174* (TARI) - Entre Bandar-e Charak et Gavbandi, 13 mile O de Bolasgar, 19.2.1975, *Iranshahr & Termeh 33066* (IRAN) - E de Bandar Lengeh, pres de Bandar-e Moallem, 16.2.1972, *Iranshahr & Termeh 33062* (IRAN) - Entre Bandar-e Khamir et Bandar-e Lengeh, pres de Dejgan, 15.2.1975, *Iranshahr & Termeh* (IRAN) - Biaban, Bahmedi towards Kuh Mobarak, 26.2.1973, *Iranshahr & Moussavi* (IRAN) - Minab, 20.3.1949, *Behboudi 514* (IRAN, W) - Jask to Bahmedi, 2.4.1973, *Iranshahr & Mousavi* (IRAN) - Minab, Jardin d'agriculture, 19.3.1971, *Mobayen* (TUH) - Bandar-e Khamir, ca. 10 m, 29.3.1986, *Mozaffarian 63635* (TARI) - Laristan, steinige Platze die Stadt Lingae (Lengeh), 27.2.1893, *Bornmüller 593* (B) - Lar near Bandar Abbas, 1000 m, 14.4.1939, *Parsa recte Gauba 355* (K, TEH) - 35 km from Senderk to Araghin, Deh-e Ziaraton, 1000 m, 9.5.1983, *Mozaffarian 44510* (TARI) - 136 km from Minab to Jask, 150 m, 4.5.1983, *Mozaffarian et al. 44086* (TARI) - Bashagerd, 105 km from Sederk to Anguهران, between Jakdan and Sardasht, 680-1000 m, 8.5.1983, *Mozaffarian 44414* (TARI) - Gheshm Island, 26-27.6.1977, *Termeh & Moussavi* (IRAN) - dto., 12.2.1975, *Iranshahr & Termeh 33063* (IRAN) - Gheshm, S of Dargahan, 40 m, 6.4.1975, *Wendelbo & Foroughi 15599* (TARI, W). -- Baluchestan: inter Khash et Iranshahr, montes Karvandar, ca. 1500-1600 m, 16-17.5.1948, *Rechinger et al. 4006* (B, G, IRAN, K, M, W) - Sarbaz, 23.3.1949, *Salavatian 512 E* (IRAN, W) - Khash to Iranshahr, 60 km N of Iranshahr, 1000 m, 27.4.1983, *Termeh, Moussavi & Tehrani* (IRAN) - Bahukalat towards Houdar, 7.3.1974, *Iranshahr & Ershad 16253* (IRAN) - Tange Sarhé, 24.3.1949, *Scharif 522* (IRAN, W) - Iranshahr to Bazman, 3.3.1949, *Scharif* (IRAN) - Pishin, *Makouei 5358* (IRAN, W) - 83 miles S of Rask, road to Chahbahar, 300 ft, *Grey-Wilson & Hower 272* (W) - Bahukalat, Houdar, Rask road, 150 m, 7.5.1974, *Foroughi 10717* (TARI, W) - 130 km from Khash to Iranshahr, after Daman, 780 m, 13.4.1983, *Mozaffarian 42983 & 42984* (TARI) - 130 km from Bampur to Iranshahr, Tang-e Sarhe, 1150-1250 m, 14.4.1983, *Mozaffarian 43088* (TARI) - Chahbahar, 47 km Rask road, 4.3.1974, 220 m, *Foroughi 10700* (TARI, W) - 5 km on road from Rask to Chahbahar, 400 m, 9.3.1977, *Assadi & Sardabi 22533* (TARI) - 30 km from Rask on road to Chahbahar, 150 m, 8.3.1977, *Runemark et al. 22428* (TARI) - 50 km from Chahbahar to Iranshahr, 90 m, 17.4.1983, *Mozaffarian 43828* (TARI). -- Kerman: Bordure montagneuse de la depression du Jaz Murian, 57°45'E, 27°24'N, 27.4.1972, 520 m, *Léonard 5872* (IRAN, W) - Jiroft, Kahnouj, 5 km NE Kahnouj, Kouhha-ye Bardyalou, 600 m, 12.3.1986, *Termeh & Moussavi* (IRAN) - Esfandagheh to Jiroft, 25 km W to Jiroft (Sabzavaran), *Taeverniera, Blepharis* steppe, 28°35'N, 57°33'E, 1100 m, 11.6.1977, *Assadi et al. 1894 & 1981*

(TARI, W) - Aliabad to Esfandagheh, 58 km E of Hajiabad to Esfandagheh, 1450 m, 11.6.1977, *Assadi et al.* 1939 (TARI, W) - 42 km E of Hajiabad towards Esfandagheh, 1500 m, 10.6.1977, *Assadi et al.* 1932 (TARI, W) - 79 km from Esfandagheh, on road to Jiroft, 12.6.1977, *Assadi & Miller* 25321 (TARI) - 20-30 km from Hajiabad on the road to Ebrahimabad, ca. 1600 m, 10.6.1977, *Assadi & Miller* 25254 (TARI) - 88 km from Hajiabad on the road to Esfandagheh, 1500 m, 11.6.1977, *Assadi & Miller* 25276 (TARI) - Jiroft, Maran, 9 km on the road to Esfandagheh, 800 m, 16.4.1975, *Foroughi* 15958 (TARI, W). -- Not exactly to localize: in Oriente probabilititer Persia australi, *Aucher* 5005 A (G, G-BOIS, K, M, P).

Pakistan. Baluchistan: 16 km W Bela, 26°12'N, 66°20'E, in jugo Jan, 100 m, 9.4.1965, *Rechinger* 27601 (M, W) - Punjgur, 20.4.1965, *Kazmi* 1217 (M) - 10-30 km SW Turbat, 26°00'N, 63°06'E, versus Gwadar, 25°09'N, 62°21'E, 100-200 m, 12.4.1965, *Rechinger* 27803 (M, W) - Ras Nuh prope Gwadar, 25°09'N, 62°21'E, 50-150 m, 15.4.1965, *Rechinger* 27924 (W) - 30 km SW Turbat, 26°00'N, 63°06'E, versus Pasni, 25°13'N, 63°30'E, 13.4.1965, *Rechinger* 27823 & 27822 (M, W) - inter Awaran et Turbat, 26°00'N, 63°06'E, in alveo lapidoso, 100-200 m, 11.4.1965, *Rechinger* 27772 (W) - in planitie Balgathar inter Hoshab 26°00'N, 62°50'E, et Panjgur, 26°58'N, 64°06'E, 600 m, 19.4.1965, *Rechinger* 28063 (W) - 60 km S Panjgur, 26°58'N, 64°06'E, 800-850 m, 19.4.1965, *Rechinger* 28098 (W) - 70 km NE Panjgur, 26°58'N, 64°06'E, in alveo, 1100 m, 21.4.1965, *Rechinger* 28233 (W) - W Awaran versus Hoshab, 26°00'N, 62°50'E, 10.4.1965, *Rechinger* 27693 (M, W) - infra Mach, 29°52'N, 67°20'E, versus Ab-i Gum, substr. conglom. 23.4.1965, *Rechinger* 28479 (W) - Kalat, 25-50 km E Jhal Jhao, 26°20'N, 65°40'E, 400 m, 10.4.1965, *Rechinger* 27667 (M, W) - inter Wad, 27°21'N, 66°30'E, et Bela, 26°12'N, 66°20'E, 1100-1250 m, 2.4.1965, *Rechinger* 27445 (W). -- **Quetta**: between Harnai and Wam Tangi, 15.5.1965, *Kazmi* 1754 (M) - infra Mach, 29°52'E, 600-800 m, 6.5.1965, *Rechinger* 28774 (M, W) - in alveo 8 km NW Harnai, 30°05'N, 68°00'E, 900-1200 m, 15.5.1965, *Rechinger* 29534 (M, W). -- **Sind**: Jamshoro, *Kazmi* 6424 (M) - in collibus calc. 10-15 km S Sehwan, 26°26'N, 67°52'E, 5.5.1965, *Rechinger* 28701 (M, W) - dto., *Rechinger* 28700 (M, W, Herb. PODL.).

H. brevilimbe is one of the polymorphic species which was - concerning to this area - handled in literature under different names before: as *H. calcareum* (NASIR 1989; LÉONARD 1985; KAZMI 1970), *H. laricum*, *H. makranicum*, *H. multiflorum* and *H. gaubae* (RIEDL 1967). Clearly most of the former authors followed Flora Iranica. Now the type of *H. brevilimbe* and many specimens from Iran and Pakistan including those formerly studied by RIEDL and KAZMI have been examined again; that drew up our conclusion: minor and local variations are not as constant characters as to distinguish several species.

Due to its distribution in south of Iran it is not expected to find this species also in northern parts. Therefore the specimens from Esfahan and Kashan collected by BODE & KAPHERR and cited in Flora Iranica (RIEDL 1967: 32) must be a misidentification.

- 8. *Heliotropium bucharicum*** B.Fedtsch., *Izv. Imp. S.-Petersburgsk. Bot. Sada* 15 (1): 1, tab. 1. 1915. **Syntypes**: Buchar pr. Kaltaminora, 9.8.1913, *Fedtschenko* 778; dto., 10.8.1913, *Fedtschenko* 786 (G!, K!, LE!). **Lectotype** (hoc loco designatus): Buchar pr. Kaltaminora, 9.8.1913, *Fedtschenko* 778 (LE!; **Isotypes**: BP!, K!, LE!, M!, STU!).

Fig.: B.FEDTSCHENKO l.c.: 1, tab. 1.

Robust annual up to 70 cm high, simple or branched, densely covered by pannose-floccose whitish or yellowish hairs. Leaves 2-5 cm long and broad, broadly ovate, rounded or subacute at top, truncate to subcordate at base, margin slightly undulate, subsessile or with petiole up to 0.5 cm, both sides densley covered with wooly multicellular hairs; upper side with a reticulate pattern, nerves strongly impressed; lower side with prominent nerves. Inflorescence lateral and terminal, simple or with 2-4 branches; cymes very dense, 2-6 cm long with up to 40 flowers, lanate, biseriate, ± unilateral. Calyx ± sessile, persistent; calyx lobes nearly free to base, linear-lanceolate, in fruiting time ca. 6-6.5 mm long, 1.5-2 mm broad, outside ± tomentose, inside in

lower part glabrous, upwards sparsely pilose. Corolla 6-8 mm long, yellow, tubular, inside above anthers densely tomentose, outside $\pm$ continuously downwards villose; corolla lobes 1-1.2 mm long, 0.2-0.3 mm broad, oblong-lanceolate, subacute, margin indistinctly crenulate, without intercalary lobes. Anthers 1-1.2 mm long, acutely apiculate, inserted ca. 1 mm above corolla base. Stigma ca. 0.5 mm long, shortly conical to pillow-shaped, glabrous. Style ca. 1 mm long, glabrous. Nutlets 3 mm long, 1.2-1.4 mm broad, ellipsoide-ovoide, smooth, glabrous.

General distribution: Endemic in Uzbekistan and adjacent part of Afghanistan.

Specimen seen:

Afghanistan: Hazarbagh, 2000 ft., dry ground, 27.8.1937, *Koelz 13151* (W).

In Flora Iranica Area *H. bucharicum* was only once collected in NE Afghanistan. Its main distribution is out of Flora Iranica Area in Uzbekistan. The peculiar wooly hairs and vigorous habit is very unique. We agree with the view of POPOV (1953) that this species is related to *H. griffithii*. Both resembles each other in many characters, e.g. shortly conical to pillow-shaped stigma, tubular corolla and specially multicellular leaves hairs.

9. *Heliotropium cabulicum* Bunge, Bull. Soc. Imp. Naturalistes Moscou 42: 328. 1869.

Lectotype (hoc loco designatus): Affghanistan, in regno cabulico, *Griffith* distr. nr. 5930 (P!; **Isotypes:** GOET!, K!, L!, LE!, M!, P!, W!).

Fig.: NASIR, Fl. Pakistan 191: 33, fig. 10 A-G.

Perennial plant of 20-40 cm height, much branched from base, divaricately branched in stems, green, covered by $\pm$ scattered, scabrous, subappressed hairs. Leaves 0.5-4.5 cm long, 0.2-3.5 cm broad, elliptic, elliptic-ovate, ovate-lanceolate to lanceolate, subacute at top, angustate at the base, margin distinctly undulate (especially in late collected plants) and revolute, usually sessile, rarely with petiole up to 0.5 cm; upper side sparsely covered with short subappressed tuberculate hairs, lower side with short patent hairs, distinctly tuberculate at base. Inflorescence terminal, usually in two branches; laxe cymes up to 6 cm long with 2-6 flowers. Calyx sessile; calyx lobes 2.3-3.5 mm long, 1-1.5 mm broad, lanceolate to ovate-lanceolate, subacute, nearly free to base, both sides pilose, base of inside tomentose. Corolla 7-10 mm long, hypocrateriform, tube 5-6 mm, lobes yellow, tube brown, inside above anther tips densely pilose, outside subappressed pilose; lobes 1-2.5 mm broad, rotundate, obscurely crenulate, folded between lobes, but without intercalary lobes. Anthers 1.2-2 mm long, inserted 1.2-2.2 mm above corolla base. Stigma shortly conical, usually glabrous, rarely pilose, apex obscurely bilobed. Style 0.1-0.5 mm long, glabrous. Nutlets ovoide to ellipsoid, 2-3 x 1-1.5 mm large, rugose, glabrous.

General distribution: Endemic in Afghanistan and Pakistan.

Specimens seen:

Afghanistan. Samangan: Hänge des Kotale Mirza Atbili, 5 km östlich der Passhöhe, 1200 m, Lößboden, 5.6.1970, *Podlech 18224* (M). -- **Baghlan:** in valle fluvii Qunduz prope Doshi, ca. 35°37'N, 68°41'E, ca. 850 m, 11.6.1962, *Rechinger 16545* (M, W) - Doshi, in glareosis mobilibus, 900 m, 14.7.1967, *Rechinger 37030* (M, W) - unteres Andarab-Tal 12 km östlich von Doshi, 950 m, 21.5.1971, *Podlech 21340* (M, Herb. PODL.) - dto., 10 km östlich Doshi, 980 m, 6.10.1970, *Podlech*

19724 (M, Herb. PODL.) - dto., 12 km E Doshi, 950 m, 68/47-35/36, 21.5.1971, *Anders* 6552 (Herb. PODL.) - ca. 2 miles W of Doshi, road to Doab, ca. 2800 ft. rocky slopes and cliffs by rivers bank, 9.5.1971, *Grey-Wilson & Hewer* 812 (W) - Unteres Andarab-Tal bei Gazan, 6 km westlich Khijan, 1050 m, 4.6.1970, *Podlech* 18224 (M, Herb. PODL.) - Andarab valley, Hindu Kush, 4000', 7.6.1964, *Furse* 6539 (M) - in valle Andarab, substr. serpentin, 1100 m, 1.7.1965, *Rechinger* 31751 (M, W) - Unteres Khenjan-Tal, 2 km oberhalb Khenjan, 1750 m, 17.8.1969, *Podlech* 16110 (M, Herb. PODL.) - Surkhab-Tal bei Dahane Kayan (Mündung des Darrah-i-Kayan, westlich Doshi), 950 m, 7.6.1970 *Podlech* 18357 (M, Herb. PODL.) - Unteres Khenjan-Tal bei Chandara, 1430 m, 4.6.1970, *Podlech* 22213 (Herb. PODL.). -- Parwan: in valle Ghorband, in glareosis, 1900 m, 11.7.1967, *Rechinger* 36875 (M, W) - unteres Ghorband Tal bei Syahgerd, 1800 m, 68/52-34/59, 15.7.1970, *Anders* 4323 (Herb. PODL.). -- Kabul: in regno cabulico, *Griffith* 5930 (GOET, K, L, LE, M, P, W) - Kabul, dry plain, 7000 ft. 11.8.1939, *Koelz* 13489 (W) - Kabul, in collibus ab urbe orientem versus, ca. 34°30'N, 69°10'E, ca. 1800 m, 17.8.1962, *Rechinger* 19335 (M, W) - E Kabul, Tang-e Garu, 14.6.1963, *Neubauer* 3186 & 3180 (W) - Tang-i-Gharu bei Dagari, 1170 m, 69/35-34/35, 22.5.1970, *Anders* 3726 (Herb. PODL.) - Tang-i-Ghara bei Mahipar, Berghänge SW Shpole Baba, 1350-1500 m, 69/32-34/33, 11.5.1973, *Anders* 9711 (Herb. PODL.) - Khurd-Kabul, SE von Kabul, 1900 m, 23.5.1965, *Kasy* 16 (W) - Kabul, Shar-e-Nau, 1810 m, 15.7.1963, *Neubauer* 3207 (W, Herb. PODL.) - Sarobi, Wegrund, Brache, 21.3.1950, *Volk* 1194a (M) - dto., in degenerierter *Cymbopogon*-Steppe, 28.5.1950, *Volk* 1583 (W) - dto., 30.4.1952, *Volk* 2572 (M) - Berg SE von Sarobi, Schutthalde, 1100 m, 28.5.1951, *Gilli* 3104 (W) - Abzweigung der Straße nach Golbahar nördlich Sarobi, 1200 m, 21.4.1967, *Breckle* 233 (Herb. PODL.) - W of Sarobi, ca. 3800 ft. dry rocky slopes by roadside, 4.6.1971, *Grey-Wilson & Hewer* 1027 (W) - 2-25 km W Sarobi, 34°40'N, 69°46'E, ad viam versus Kabul, 34°30'N, 69°10'E, substr. calc., 1000-1300 m, 13.5.1967, *Rechinger* 34404 (M, W) - Hügel 2 km östlich des Flughafens Kabul, 1850 m, 29.4.1970, *Podlech* 17747 (M, Herb. PODL.) - in latere occidentali jugi Latabad, 1800-2100 m, 20.6.1965, *Rechinger* 31112 (M, W) - bei Bagrami, trockener Platz, auch in Ruinenfeld, 25.6.1951, *Neubauer* 277 & 284 (W). -- Nangahar: Jalalabd, *Edelberg* 2345 (W) - 13 km SE von Jalalabad nahe der Straße nach Torkham, 550 m, 70/34-34/22, 17.4.1977, *Podlech* 28648 (M, Herb. PODL.) - 4 km NO von Shahi Kot gegen die Hauptstraße Jalalabad-Torkham, 680 m, 70/36-34/16, 19.4.1977, *Podlech* 28736 (M, Herb. PODL.) - 5 km SW Memla bei Araban, 1150-1250 m, 70/05-34/17, 17.6.1973, *Anders* 10384 (Herb. PODL.). -- Laghman: Alishang-Tal 2 km sülich Rayn, 1030 m, 10.4.1970, *Podlech* 17581 (M, Herb. PODL.). -- Paktia: Umgebung von Yaqubi (NO von Khost), 1170 m, 22.9.1971, *Volk* 71/813 (Herb. PODL.) - dto., 26.5.1971, *Volk* 71/123 (Herb. PODL.) - Khost, 1170 m, 10.1971, *Volk* 71/877b (Herb. PODL.) - 5 km nördlich Khost an der Straße nach Yaqubi, 1170 m, 3.7.1970, *Podlech* 18553 (M, Herb. PODL.) - 4 km S von Yaqubi, 1100 m, 70/00-33/25, 8.5.1970, *Anders* 3529 (Herb. PODL.) - 7 km NW von Yaqubi an der Straße nach Zambar, 1270 m, 3.7.1970, *Podlech* 22482 (Herb. PODL.) - Lmaro, 30 km westlich von Khost an der Straße nach Gardez, 1460 m, 5.7.1970, *Podlech* 18637 (M, Herb. PODL.) - Nadershah Kot, an der Straße Gardez - Khost, 1400 m, 69/41-33/19, 12.5.1972, *Anders* 8929 (Herb. PODL.) - Khost, 33°22'N, 70°01'E, in collibus saxosis, 1200 m, 4.6.1967, *Rechinger* 35530 (M, W). -- Maidan: Wardak-Tal bei Ebrahimkhel, 2030 m, Trockenhänge, Silikat, 68/52-33/58, 19.5.1978, *Podlech* 31193 (Herb. PODL.). -- Loghar: ca. 10 km östlich von Mangokhel an der Straße nach Dobanday, 5.7.1971, *Volk*, 71/479 (Herb. PODL.). -- Not exactly to localize: Giri, 7000 ft. 20.5.1937, *Koelz* 11505 (W).

Pakistan. Kurram: Kurram valley, *Afendi* 313 (M) - inter Amul Khot et Sadda, 33°43'N, 70°25'E, 1400 m, in glareosis, 13.6.1965, *Rechinger* 30959 (M, W) - inter Thal, 33°24'N, 70°36'E, et Parachinar, 33°56'N, 70°04'E, *Rechinger* 30886 (M, W). -- S-Waziristan: Sarwaki, 19.5.1973, *Kazmi* 4479 (M).

In eastern Afghanistan and adjacent parts of Pakistan *H. cabulicum* is a frequent species. Its habit is similar to *H. dasycarpum* which is easily distinguished by its rotundate corolla lobes, densely pilose corolla inside and shortly conical ± glabrous stigmas.

See also notes under *H. ulophyllum*.

10. *Heliotropium chorassanicum* Bunge, Bull. Soc. Imp. Naturalistes Moscou 42: 301. 1869.

≡ *H. chorassanicum* f. *lasiocarpum* Bunge, l.c., nomen illegitimum. **Syntypes**: in prov.

- Chorassan pr. Nischapur, 20.6.1858, *Bunge & Bienert*; Achmed-abad, [1858], *Bunge* (P); in Affghanistano pr. Herat, *Bunge & Bienert* (P). **Lectotype** (hoc loco designatus): in prov. Chorassan pr. Nischapur, 20.6.1858, *Bunge & Bienert* (P!; **Isotypes**: G-BOIS!, LE!).
- = *H. chorassanicum* f. *leiocarpum* Bunge, l.c.: 302. **Syntypes**: in montosis argillosis pr. Tabat-kuh, [?Bunge & Bienert] (G-BOIS!, P); ad orientem ab urbe Meschhed [Mashhad, VII.1858], *Bunge*. **Lectotype** (hoc loco designatus): ad orientem ab urbe Meschhed [Mashhad, 7.1858], *Bunge* (P!; **Isotypes**: G-BOIS!, K!, LE!, NY! microfiche).
- = *H. longicalyx* Rech.f., Ann. Naturhist. Mus. Wien 58: 47, fig. 147. 1951. **Holotype**: Afghanistan, Kala Sarkari, 7000', 9.9.1939, *Koelz 13933* (W!; **Isotype**: US).

Fig.: plate 4 a + b, page 221.

Annual, 15-50 cm high, erect or ascending, stem simple or branched, rarely branched from base, whitish villose; indument of short patent to subappressed, 0.5-1 mm long hairs mixed with long patent, ca. 1-1.5 mm long ones. Leaves 2-5 cm long, 1.5-4 cm broad, ovate, ovate-cordate, elliptic-ovate to suborbicular, with distinct petiole of 1-5 cm, acute, with dentate margin; upper side yellowish-green, with subappressed hairs; lower side basically darkgreen, sometimes appearing whitish due to indument colour. Inflorescence very dense, at the end of main stems and branches, branched in (2-) 3 (-4) cymes, sometimes appearing head-like in field; cymes 1-6 cm long with 10-50 flowers, strongly scorpioid, biseriate. Flowers usually without pedicel or sometimes lower flowers with a short pedicel up to 1 mm. Calyx easily dropping; calyx lobes 3.5-6.5 (-8) mm long, 0.5-0.75 mm broad, linear, acute, nearly free to base, on both sides long hairy. Corolla 7-11 mm long, hypocrateriform, inside from anther base to corolla lobes pilose; corolla lobes 1.5-5 mm broad, rounded, margin obscurely crenulate. Anthers 1.3-1.7 mm long, inserted 1.5-2 mm above corolla base. Stigma (0.5) 1.5-2.5 mm long, beaked from the middle, elongate-conical, sparsely pilose to subglabrous. Style 0.6-1.2 mm long, glabrous or very rarely with few hairs. Nutlets 1.3-2 mm long, 0.8-1.2 mm broad, ovoid to ellipsoid-ovoid, pilose, smooth.

General distribution: Northeastern Iran, Turkmenistan, Afghanistan, Uzbekistan.

Specimens seen:

Afghanistan. Herat: Herat, 19.6.1959, *Lindberg 631* (W) - 7 km N Herat an der Straße nach Toraghundi, 1120 m, 62/11-34/24, *Podlech 32487* (Herb. PODL.) - 150 km west of Herat near the border to Iran, wadi in semidesert, 1100 m, 11.7.1969, *Anderson & Petersen 363* (W) - Badghiz, inter Herat, 34°20'N, 62°10'E, et Kisil Islam Qaleh, 34°40'N, 61°05'E, 23.7.1965, *Rechinger 32522* (W) - Takht-Safar, 2.6.1947, *Lindberg 11* (W) - Ardewan, 1100, 13.6.1948, *Koeie 2264* (W) - Chashma-i-Obeh, 10 km NW Obeh, 63/07 E-34/26 N, 1720 m, 3.9.1978, *Podlech 32518* (Herb. PODL.). -- **Faryab:** Steppe bei Ankhoi, Grasversuchsplatz, 7.10.1950, *Neubauer 147* (W) - Dasht-i-Laili, 25 km ENE von Dawlatabad an der Straße nach Sheberghan, 450 m, 8.10.1970, *Podlech 22373* (Herb. PODL.). -- **Badghis:** Schlucht des Darya-i-Darrah-i-Bum S Samira (55 km S Bala Murghab), 720 m, 6.10.1969, *Podlech 16956* (M) - Qala-i-Naw, juli 1968, *Toncev* (Herb. PODL.) - Schlucht des Darya-i-Bum südlich Samira (55 km südlich Bala Murghab), 720 m, 6.10.1969, *Podlech 16956* (Herb. PODL.). -- **Ghorat:** Sharak, 29.8.1950, *Neubauer* (Herb. PODL.). -- **Not exactly to localize:** Decht-Aoudan Miralem, 10.7.1959, *Lindberg 580* (W) - Kala Sarkari, 7000', 9.9.1939, *Koelz 13933* (W).

Iran. Khorassan: Mashhad, 2.7.1937, *Gaubä* (IRAN) - prope Meschhed [Mashhad] et in montis ad orientem sitis, [7.1858], *Bunge* (G-BOIS, K, LE, NY, P) - prope Achmedabad, [1858], *Bunge* (P) - Tabat-kuh, *Bunge & Bienert* (G-BOIS, K, P) - prope Nischapur, [20.6.1858], *Bunge* (G-BOIS, LE, P) - inter Nischapur et Mashhad, prope Scharifabad, ca. 1000-1300 m, 2.7.1937, *Rechinger 1345* (W) - Neyshahbur, Kharv-e-Olia, Binalud, 1300-1500 m, 5.8.1976, *Termeh & Tehrani* (IRAN) -

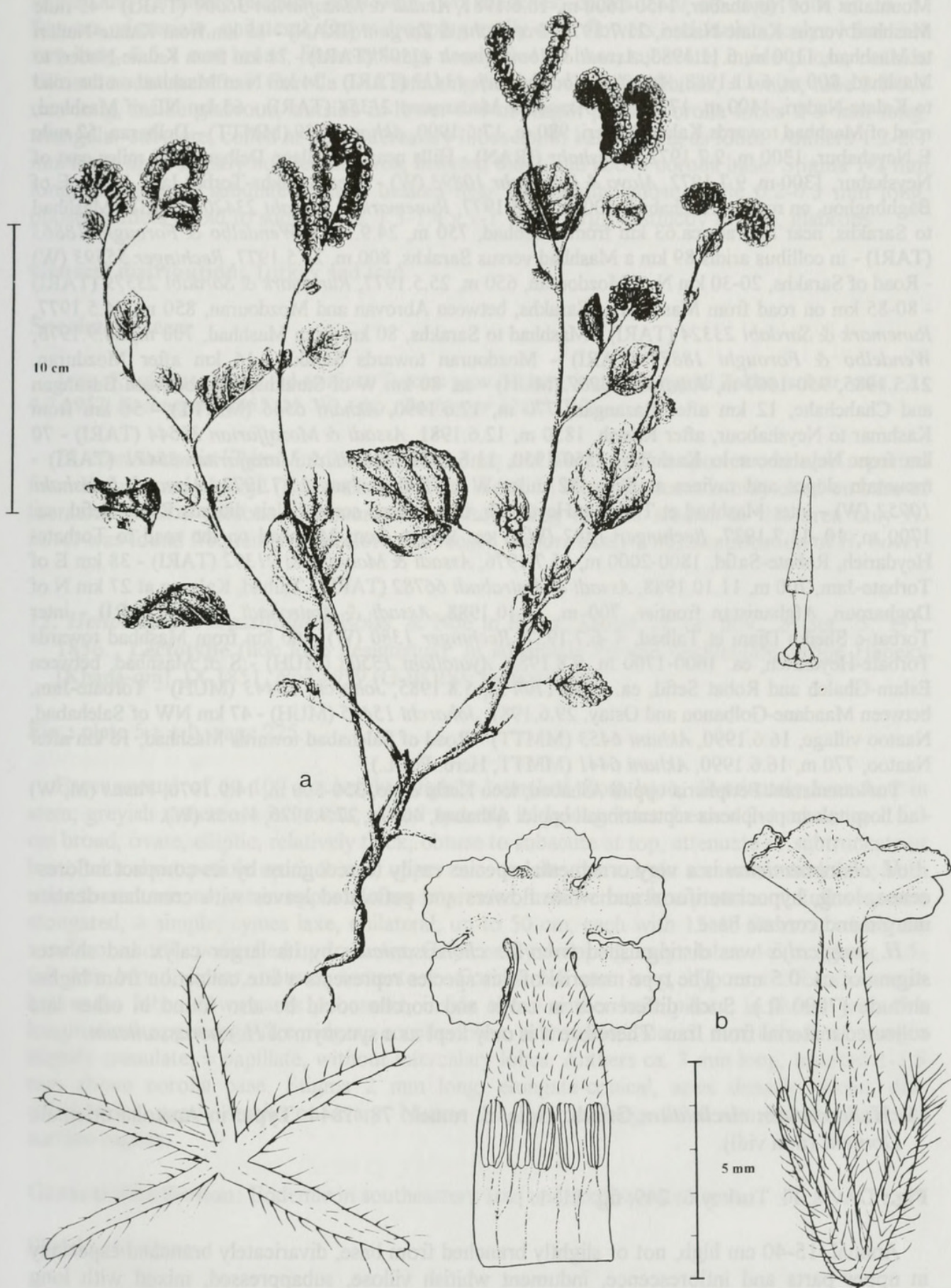


Plate 4: *H. chorassanicum* Bunge: a) habit (Akhani 6441), b) flower (Wendelbo & Foroughi 18863).

Mountains N of Neyshabur, 1450-1600 m, 16.6.1981, *Assadi & Mozaffarian 36004* (TARI) - 45 mile Mashhad versus Kalate-Naderi, 21.7.1972, *Iranshahr & Zargani* (IRAN) - 15 km from Kalate-Naderi to Mashhad, 1100 m, 6.11.1983, *Assadi & Abouhamzeh 43397* (TARI) - 71 km from Kalate-Naderi to Mashhad, 800 m, 6.11.1983, *Assadi & Abouhamzeh 43412* (TARI) - 34 km N of Mashhad on the road to Kalate-Naderi, 1400 m, 17.7.1976, *Assadi & Maassoumi 21354* (TARI) - 65 km NE of Mashhad, road of Mashhad towards Kalate-Naderi, 980 m, 17.6.1990, *Akhani 6539* (MMTT) - Delbaran, 52 mile E Neyshabur, 1300 m, 9.7.1972, *Iranshahr* (IRAN) - Hills near the village Delbaran, 50 miles east of Neyshabur, 1300 m, 9.7.1972, *Alava & Iranshahr 10893* (W) - Area Sarakhs-Torbat Jam, 10 km E of Baghbaghou, on road to Salehabad, 800 m, 26.5.1977, *Runemark & Sardabi 23420* (TARI) - Mashhad to Sarakhs, near Shurak, ca. 63 km from Mashhad, 750 m, 24.9.1975, *Wendelbo & Foroughi 18863* (TARI) - in collibus aridis 89 km a Mashhad versus Sarakhs, 800 m, 24.5.1977, *Rechinger 55593* (W) - Road of Sarakhs, 20-30 km N of Mozdouran, 650 m, 25.5.1977, *Runemark & Sardabi 23379* (TARI) - 80-85 km on road from Mashhad to Sarakhs, between Abrovan and Mozdouran, 850 m, 24.5.1977, *Runemark & Sardabi 23324* (TARI) - Mashhad to Sarakhs, 80 km from Mashhad, 700 m, 24.9.1975, *Wendelbo & Foroughi 18871* (TARI) - Mozdouran towards Sarakhs, 14 km after Mozduran, 21.5.1985, 950-1000 m, *Joharchi 13207* (MUH) - ca. 80 km W of Sarakhs, road between Bazangan and Chahchahe, 12 km after Bazangan, 770 m, 17.6.1990, *Akhani 6566* (MMTT) - 56 km from Kashmar to Neyshabour, after Rivash, 1850 m, 12.6.1981, *Assadi & Mozaffarian 35644* (TARI) - 70 km from Neyshabour to Kashmar, 1550-1950, 11.6.1981, *Assadi & Mozaffarian 35471* (TARI) - mountain slopes and ravines at Bezg, 12 miles W of Torbate-Jam, 11.7.1972, *Alava & Iranshahr 10952* (W) - inter Mashhad et Torbat-e Heydarieh, in montibus serpentinicis ditionis Robat-Sefid, ca. 1700 m, 10.-11.7.1937, *Rechinger 1522* (W) - ca. 96 km from Mashhad on the road to Torbate-Heydarieh, Robate-Safid, 1800-2000 m, 15.7.1976, *Assadi & Maassoumi 21302* (TARI) - 38 km E of Torbate-Jam, 700 m, 11.10.1988, *Assadi & Amirabadi 66782* (TARI) - Taibad, Kalsang at 27 km N of Dogharoun, Afghanistan frontier, 700 m, 11.10.1988, *Assadi & Amirabadi 66771* (TARI) - inter Torbat-e Sheikh Djam et Taibad, 4.-6.7.1937, *Rechinger 1380* (W) - 60 km from Mashhad towards Torbate-Heydarieh, ca. 1600-1700 m, 9.8.1985, *Ayatollahi 13508* (MUH) - S of Mashhad, between Eslam-Ghaleh and Robat Sefid, ca. 1600-1700 m, 5.8.1985, *Joharchi 13443* (MUH) - Torbate-Jam, between Maadane-Golbanou and Ostay, 29.6.1987, *Joharchi 15415* (MUH) - 47 km NW of Salehabad, Naatoo village, 16.6.1990, *Akhani 6453* (MMTT) - Road of Salehabad towards Mashhad, 16 km after Naatoo, 770 m, 16.6.1990, *Akhani 6441* (MMTT, Herb. PODL.).

Turkmenistan. Peripheria oppidi Ashabad, loco Keshi dicto, 350-500 m, 14.9.1976, *Vasák* (M, W) - ad hospitale in peripheria septentrionali oppidi Ashabad, 400 m, 27.9.1976, *Vasák* (W).

H. chorassanicum is a very ornamental species easily to recognize by its compact inflorescence, long, hypocrateriform and white flowers and petiolated leaves with crenulate-dentate margin and cordate base.

H. longicalyx was distinguished from *H. chorassanicum* by its larger calyx and shorter stigma of ca. 0.5 mm. The type material of this species represents a late collection from higher altitude (7000 ft.). Such differences in calyx and corolla could be also found in other late collected material from Iran. Therefore it is only kept as a synonym of *H. chorassanicum*.

11. *Heliotropium circinatum* Griseb., Spic. fl. rumel.: 78. 1844. **Type:** in Anatolia orientali, *Donietti* (non vidi).

Fig.: DAVIS, Fl. Turkey 6: 249, fig. 11, 1.

Annual, 15-40 cm high, not or slightly branched from base, divaricately branched especially in upper parts and inflorescence, indument whitish villose, subappressed, mixed with long patent hairs up to 1.5 mm long. Leaves 1.6-5 cm long, 1-2.5 mm broad, ovate, elliptic-ovate, usually with petiole of ca. 0.5-3 cm, small or upper leaves sessile, subacute to obtuse at top, rotundate, truncate or rarely subcordate at base, margin slightly thickened; upper side subappressed villose to subtomentose; lower side patent villose to tomentose. Inflorescence

lateral and terminal, terminal ones with two branches; cymes 2-20 cm long with up to 70 flowers, uinseriate, unilateral. Calyx dropping easily with flowers and nutlets; calyx lobes 3-4 mm long, 0.5-1 mm broad, linear-oblong, nearly free to base, subacute, inside pilose, outside villose to subtomentose. Corolla 6-12 mm long (incl. lobes), infundibular, $\pm$ white; tube 2.5-3.5 mm long, inside glabrous, outside in lower $\frac{3}{4}$ of length pilose; corolla lobes 2-3 mm long, triangular-subulate, coiled at tips, intercalary lobes about half as long as lobes. Anthers 1.2-2.7 mm long, apex slightly hooked inwards, inserted 0.8-1 mm above corolla base. Stigma 1-2 mm long, elongate to subulate-conical, beaked near the middle, pilose. Style 0.2-0.3 mm long, pilose. Nutlets ovoid to subglobose, 1.3-1.4 x 1-1.1 mm large, distinctly rugose, glabrous.

General distribution: Turkey and Iraq.

Specimens seen:

Iraq. Kurdistan: Musel, ad confines Turciae prov. Hakari, in ditone oppidi Zakho, substr. calc., 2.-4.7.1957, *Rechinger 10683* (M, W) - dto., *Rechinger 12135* (W).

H. circinatum is limited in distribution to Iraq and Turkey. This species was also reported from Kaluraz near Manjil (BOISSIER & BUHSE 1860). In Flora Iranica it is only cited on base of literature (RIEDL personal communication). According to field studies in this area only *H. bovei* was found frequently. Therefore this record is more likely a misidentification of *H. bovei*.

12. *Heliotropium crassifolium* Boiss. & Noë in Boiss., *Diagn. pl. or. nov.*, 2. Ser., 3: 131.

1856. **Lectotype** (hoc loco designatus): In subalpinis Persiae occidentalis prope Haneky [Khana-qin], IX.1851, *Noë 1039* (G-BOIS!; **Isotype:** P).

Fig.: plate 5 a + b, page 225.

Erect annual of 60-100 cm height; slightly branched from base, divaricately branched in stem; greyish tomentose indument, mixed sparsely with long hairs. Leaves 2-4 cm long, 1.5-3 cm broad, ovate, elliptic, relatively thick, obtuse to subacute at top, attenuate or subtruncate at base, with short petiole up to 8 mm, upper ones sessile, the margin somewhat undulate; both sides tomentose, nerves in upper surface impressed, in lower surface prominent. Inflorescence elongated, $\pm$ simple; cymes laxe, unilateral, up to 50 cm, each with 15-45 flowers, which are sessile or shortly pedicelled up to 1 mm. Calyx easily dropping; calyx lobes 4-5 mm long, 0.5-0.8 mm broad, linear, obtuse, tomentose. Corolla 6-8 mm long, hypocrateriform, outside below the lobes downwards pubescent, inside above anther base pilose, in throat with five longitudinal appendage-like ridges; corolla lobes subrounded, ca. 2 mm broad, at margin slightly crenulate, $\pm$ papillate, without intercalary lobes. Anthers ca. 3 mm long, inserted 1-1.5 mm above corolla base. Stigma 2 mm long, elongate-conical, apex densely pilose, disc subglabrous, nearly sessile on ovary. Nutlets 1.3-1.4 mm long, 2-2.2 mm broad, glabrous, surface rugose.

General distribution: Endemic in southeastern Iraq and southwestern Iran.

Specimens seen:

Iraq. Kirkuk: in subalpinis Persiae occidentalis prope Haneky [Khanaqin, 9.1851], *Noë 1039* (G-BOIS, P).

Iran. Ilam: ca. 15 km NE of Mehran, Konjancham river bed, ca. 350 m, 3 & 7.8.1989, *Akhani 5442* (MMTT) - ca. 25-28 km N Mehran Konjancham river margin and surrounding gypsum slopes, ca. 300

m, 16.10.1993, *Akhani 9026* (Herb. AKHANI) - ca. 45 km from Mehran towards Dehloran, Changooleh river margin, ca. 300 m, 16.10.1993, *Akhani 9039* (Herb. AKHANI).

H. crassifolium is a new record for the flora of Iran. It was originally described from Iraq next to the border of Iran. The new collections are also close to the frontier of Iraq in margin of Konjancham and Changooleh rivers. This species typically grows along rivers and roads on gypsum soils covered by gravells and sand. It is associated with other species, e.g. *H. suaveolens*, *H. noeanum*, *Cornulaca monacantha*, *Rumex ephedroides*, *Amaranthus albus* and *Halimocnemis purpureus*.

Morphologically *H. crassifolium* is a very interesting endemic species of this area with relation to *H. kaserunense* (see notes under *H. kaserunense*, p. 254). It is an erect tall growing plant sometimes more than 1 m with elongate cyme up to 50 cm long. Leaves are thick, nearly sessile or with short petioles up to 0.8 cm. Lower leaves are very large up to 8 cm long and 5 cm broad. Corolla is characterized by salver-shape, rounded lobes, hairy inside and interestingly with 5 longitudinal appendages-like ridges inside the tube from the throat til the anthers. Previously such ribs inside of corolla were known from *H. hirsutissimum* Grauer (BRUMMITT 1972). This species is mostly distributed in Mediterranean area and totally different from *H. crassifolium* especially by its pillow-shape stigma. In *H. crassifolium* stigmas are elongate-conical.

13. *Heliotropium curassavicum* L., Sp. pl. 1: 130. 1753. Lectotype (Iconotype) (VERDCOURT 1991: 67): Curaçao, Morris., Pl. Hist. 3: 452, S. 11, t. 31/12. 1699; **Typotype:** Herb. MORISON (OXF: vidimus foto!).

Fig.: NASIR, Fl. Pakistan 191: 22, fig. 6 G-L.

Halophytic prostrate perennial (rarely annual), glaucous, completely glabrous, stems up to 40 cm long. Leaves 1-5 cm long, 0.2-0.8 cm broad, glaucous, $\pm$ fleshy, oblong or oblanceolate, obtuse at top, narrowed at base, the entire margin slightly thickened. Inflorescence terminal and lateral, with 1-3 branches; cymes up to 10 cm long, densely flowering, appearing biseriate when fruiting, bilateral. The sessile calyx persistant after dropping of nutlets; calyx lobes 1-1.3 mm long, lanceolate, subacute, nearly free to base. Corolla 1-1.5 mm long, tubular, on both sides glabrous; corolla lobes up to 0.5 mm broad, oblong to rounded. Anthers 0.6-1 mm long, acute, inserted 0.5-0.7 mm above corolla base. Stigma ca. 0.5 mm long, shortly conical, glabrous. Style inconspicuous. Nutlets ca. 2 mm long, glabrous, $\pm$ rugose, with few ribs in dorsal side.

General distribution: Originally a probable native of America, but introduced or adventive in all continents.

Specimens seen:

Pakistan. Karachi: Darsano-Chano village, near Mulir, 23.9.1972, *Kazmi 4102 & 4139* (M) - Memon Goth-Malir, 18.2.1965, *Tasnif* (M) - Mizar-e-Quaid-e-Azam, 8.9.1972, *Kazmi & Akhtar 4181* (M).

H. curassavicum is the only completely glabrous species and by that way easily to recognize. It is one of the few cosmopolitans in *Heliotropium* with distribution range from N & S America over Africa, sometimes introduced to Europe, Asia and Australia. Compared with this enormous area the variability of the species is relatively poor. The preferred habitats are coastal areas and sometimes weedy places. For Flora Iranica Area it is only known from extreme

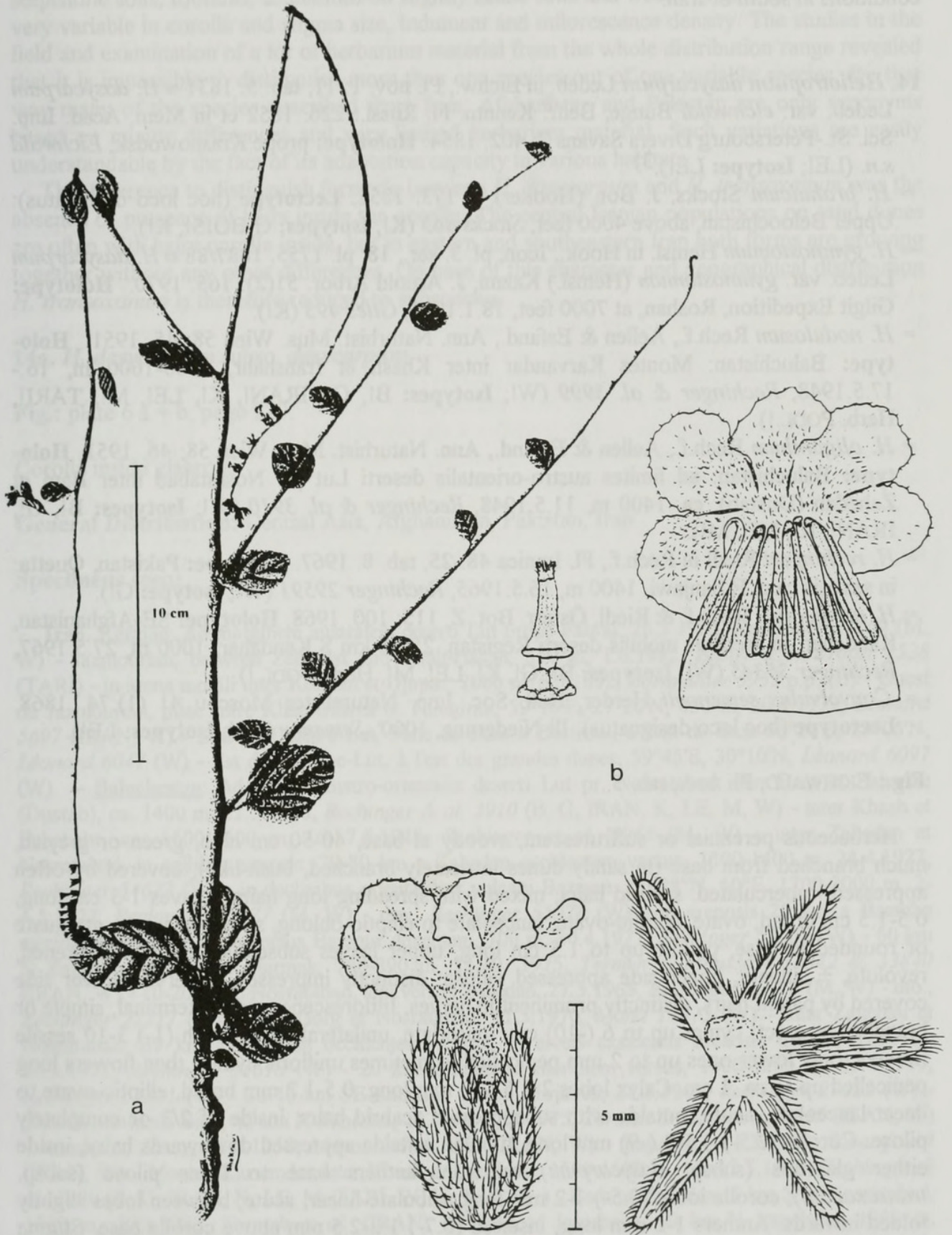


Plate 5: *H. crassifolium* Boiss. & Noë: a) habit (Akhani 5442), b) flower (Akhani 5442).

southeastern part of Pakistan. It is more likely that the species might be found under similar conditions in south of Iran.

- 14. *Heliotropium dasycarpum*** Ledeb. in Eichw., Pl. nov. 1: 11, tab. 5. 1831 $\equiv$ *H. dasycarpum* Ledeb. var. *eichwaldi* Bunge, Beitr. Kenntn. Fl. Russl.: 226. 1852 et in Mém. Acad. Imp. Sci. St.-Pétersbourg Divers Savans 7: 402. 1854. **Holotype:** prope Krasnowodsk, *Eichwald s.n.* (LE!; **Isotype:** LE!).³⁾
- = *H. brahuicum* Stocks, J. Bot. (Hooker) 4: 173. 1852. **Lectotype** (hoc loco designatus): Upper Beloochistan, above 4000 feet, *Stocks* 865 (K!; **Isotypes:** G-BOIS!, K!).
- = *H. gymnostomum* Hemsl. in Hook., Icon. pl. 3. ser., 18: pl. 1755. 1887/88 $\equiv$ *H. dasycarpum* Ledeb. var. *gymnostomum* (Hemsl.) Kazmi, J. Arnold Arbor. 51(2): 165. 1970. **Holotype:** Gilgit Expedition, Roshan, at 7000 feet, 18.1.1881, *Giles* 493 (K!).
- = *H. nodulosum* Rech.f., Aellen & Esfand., Ann. Naturhist. Mus. Wien 58: 45. 1951. **Holotype:** Baluchistan: Montes Karvandar inter Khash et Iranshahr, 1500-1600 m, 16.-17.5.1948, *Rechinger & al.* 3999 (W!; **Isotypes:** B!, G!, IRAN!, K!, LE!, M!, TARI!, Herb. PODL!).
- = *H. oliganthum* Rech.f., Aellen & Esfand., Ann. Naturhist. Mus. Wien 58: 46. 1951. **Holotype:** Baluchistan: ad limites austro-orientalis deserti Lut pr. Nosratabad inter Bam et Zahedan (Dustab), ca. 1400 m, 11.5.1948, *Rechinger & al.* 3910 (W!; **Isotypes:** B!, G!, IRAN!, K!, LE!, M!).
- = *H. rechingeri* Riedl in Rech.f., Fl. Iranica 48: 25, tab. 8. 1967. **Holotype:** Pakistan, Quetta: in saxosis calc. E Sanjawi, 1400 m, 16.5.1965, *Rechinger* 29591 (W!; **Isotype:** G!).
- = *H. arenicolum* Rech.f. & Riedl, Österr. Bot. Z. 115: 100. 1968. **Holotype:** SE-Afghanistan, Kandahar: in arenosis mobilis deserti Registan, 25-30 km S Kandahar, 1000 m, 27.5.1967, *Rechinger* 35345 (W!; **Isotypes:** B!, G!, K!, LE!, M!, Herb. PODL!).
- = *Convolvulus semenovii* Herder, Bull. Soc. Imp. Naturalistes Moscou 41 (1): 74. 1868. **Lectotype** (hoc loco designatus): Ili-Niederung, 1000', *Semenov* (LE!; **Isotypes:** LE!).

Fig.: EICHWALD, Pl. nov., tab. 5.

Herbaceous perennial or suffrutescent, woody at base, 40-50 cm high, green or greyish, much branched from base (in sandy dunes intricately branched, bush-like), covered by often appressed, tuberculated, scabrid hairs, mixed with spreading long hairs. Leaves 1-3 cm long, 0.5-1.5 cm broad, ovate, elliptic-ovate, lanceolate to elliptic-oblong, subacute at top, attenuate or rounded at base, petiole up to 1.5 cm long, upper leaves subsessile, margins thickened, revolute, $\pm$ sinuate; upper side appressed villose, distinctly impressed in nerves; lower side covered by patent hairs, distinctly prominent in nerves. Inflorescence mainly terminal, simple or branched, $\pm$ erect; cymes up to 6 (-10) cm, uniseriate, unilateral, laxely with (1-) 3-10 sessile flowers, only lower ones up to 2 mm pedicelled; sometimes unifloral cymes, then flowers long pedicelled up to ca. 1 cm. Calyx lobes 2-3.5 (-4) mm long, 0.5-1.2 mm broad, elliptic-ovate to linear-lanceolate, acute, outside with subappressed scabrid hairs, inside of 2/3 or completely pilose. Corolla (2.5-) 4.5-8 (-9) mm long, tubular, outside appressed downwards hairy, inside either glabrous (subsp. *dasycarpum*) or from anthers base to lobes pilose (subsp. *transoxanum*); corolla lobes (0.5-) 1-2 mm long, subulate-linear, acute, between lobes slightly folded inwards. Anthers 1-2 mm long, inserted (0.7-) 1.2-2.5 mm above corolla base. Stigma (0.8-) 1-1.5 mm long, elongate-conical, above middle sparsely pilose. Style 0.3-0.9 (-1.1) mm long, often glabrous. Nutlets 3.5-4 mm large, ovoid, smooth, covered first by white, long silky, easily deciduous hairs, later becoming glabrous.

³⁾ The specimen noted here as Holotype is exactly the plant by which the tabula 5 in EICHWALD was drawn!

H. dasycarpum is a desertic species growing in dry steppes, wastelands, on sand dunes, serpentine soils, foothills, sometimes on slightly saline soils and weedy in cultivated lands. It is very variable in corolla and stigma size, indument and inflorescence density. The studies in the field and examination of a lot of herbarium material from the whole distribution range revealed that it is impossible to distinguish more than one species out of one variable species. By that way many of the species described from Iran, Afghanistan and Pakistan are only synonyms based on minute differences and very limited herbarium material. Such variations are easily understandable by the fact of its adaptation capacity in various habitats.

The difference to distinguish formerly between *H. dasycarpum* and *H. transoxanum* was the absence or presence of hairs inside the corolla. The central Iranian populations on sand dunes are often with hairy corolla inside, but in eastern and southeastern Iran both forms are growing together without any other differences. On base of this character and geographical distribution *H. transoxanum* is therefore reduced to subspecies.

14a. *H. dasycarpum* subsp. *dasycarpum*

Fig.: plate 6 a + b, page 229.

Corolla inside glabrous.

General Distribution: Central Asia, Afghanistan, Pakistan, Iran.

Specimens seen:

Iran. Kerman: Ad marginem australem deserti Lut prope Fahraj, 26.3.1965, *Rechinger* 27169 (M, W) - Jazmourian, between Zehkalat and Chah-Hasan, 350 m, 1.6.1982, *Basiri & Nowroozi* 1528 (TARI) - in arena mobili inter Kerman et Djupar, 2000 m, 6.5.1892, *Bornmüller* 3932 p.p. (B) - Ouest du Jazmourian, piste entre Khan Mitrza et Tumgiran, 59°10'E, 27°20'N, 450 m, 20.4.1972, *Léonard* 5697 (IRAN, W) - Sud du Dasht-e-Lut, Piste de Bam à Daristan, à l'est de Bam 58°26'E, 29°05'N, *Léonard* 6047 (W) - Est du Dasht-e-Lut, à l'est des grandes dunes, 59°45'E, 30°10'N, *Léonard* 6097 (W). -- **Baluchestan:** Ad limites austro-orientalis deserti Lut pr. Nosratabad inter Bam et Zahedan (Dustab), ca. 1400 m, 11.5.1948, *Rechinger & al.* 3910 (B, G, IRAN, K, LE, M, W) - inter Khash et Iranshahr, ca. 1500-1600 m, 16-17.5.1948, *Rechinger et al.* 3966 (M, W) - inter Zahedan et Nosratabad, in collibus saxosis, 70-80 km a Zahedan occidentem versus, 1300-1400 m, 24.4.1977, *Rechinger* 54627 (W) - in declivibus orientalibus vulcani Bazman, ca. 28°N, 60°E, 1700-2000 m, 2-4.5.1977, *Rechinger* 55077 (M, W) - dto., *Rechinger* 55078 (W) - in arenosis 25 km a Bazman meridiem versus ad viam versus Bampur ducentem, 700 m, 30.4.1977, *Rechinger* 55002 (W) - 60 km N Zahedan, Gharieh-ye Harmak, 780-890 m, 31.10. 1975, *Termeh & Moussavi* 33842 & 33840 (IRAN, W) - 10-20 km E Nosratabad, sipi versus Zahedan, 27.3.1965, *Rechinger* 27215 (M, W) - dto., *Rechinger* 27217 (W) - inter Gorg et Nosratabad, 11.3.1970, *Mond* 14473 (W) - inter Zahedan et Nosratabad, 39 km a Zahedan occidentem versus, in alveis exsiccatis arenosis deserti, 1250 m, 24.4.1977, *Rechinger* 54618 (W) - 20 km a Zahedan meridiem versus, 1000-1200 m, 23.4.1977, *Rechinger* 54561 (W) - 30-40 km SE Zahedan versus Mirjaveh, 28.3.1965, *Rechinger* 27221 (W) - Zahedan towards Bam, 45 km N Zahedan, 1270 m, 2.11.1975, *Termeh & Moussavi* 33837 (IRAN, W) - Iranshahr, Abtar, 28.4.1950, *Manouchehri* 5353 (IRAN, W) - Iranshahr, 11.3.1949, *Scharif* 515 (IRAN, W) - Montes Karvandar inter Khash et Iranshahr, 1500-1600 m, 16.-17.5.1948, *Rechinger & al.* 3999 (B, G, IRAN, K, LE, M, TARI, W, Herb. PODL.) - Bam to Zahedan, 8 km S of Nosratabad, 1100 m, 20.4.1983, *Termeh et al.* (IRAN) - Khash to Iranshahr, 60 km N Iranshahr, 1000 m, 27.4.1983, *Termeh et al.* (IRAN) - ca. 30 km from Nosratabad to Zahedan, 1550 m, 26.5.1985, *Mozaffarian* 52909 (TARI) - Bazman, between Iranshahr and Bam, Kuhe Khezr, 1700 m, 3.5.1977, *Assadi* 23153 (TARI) - Zahedan, 71 km on the road to Bam, 1350 m, 24.4.1977, *Assadi* 22711 (TARI) - 20 km on the road to Mirjaveh, 1200 m, 23.4.1977, *Assadi* 22681 (TARI) - 5 km from Zahedan to Zabol, 1400 m, 24.5.1984, *Mozaffarian* 63418 (TARI) - ca. 40 km from Iranshahr on the road to Bam, ca. 1600 m, 29.4.1977, *Assadi* 23061 (TARI) - 35 km from Iranshahr on road to Bazman, 570 m,

10.3.1977, *Runemark et al.* 22577 (TARI) - 30 km from Khash-Iranshahr on road to Irandegan, 1400 m, 12.4.1983, *Mozaffarian* 42862 (TARI). -- Khorassan: Sarakhs, in arenosis, 400 m, 25.5.1977, *Rechinger* 55711 (W) - 35 km S of Sarakhs, Norouzabad, 350 m, 16.6.1990, *Akhani* 6438 & 6444 (MMTT) - 26 km S of Sarakhs, 5 km S of Doulatabad, 350 m, 16.6.1990, *Akhani* 6475 (MMTT) - Sarakhs-Torbate Jam area, 5-10 km S of Salehabad, 750 m, 27.5.1977, *Runemark & Sardabi* 23443 (TARI) - Shurak, Sarakhs road, 1020 m, 20.5.1972, *Foroughi* 3756 (TARI) - 20 km S of Sarakhs on road to Mashhad, 600 m, 25.5.1977, *Runemark & Sardabi* 23401 (TARI) - 47 km NW of Salehabad, Naatoo village, 860 m, 16.6.1990, *Akhani* 6451 (MMTT) - Salehabad, 660 m, 16.6.1990, *Akhani* 6450 (MMTT, Herb. PODL.) - 7 km N of Taibad towards Torbate-Jam, 780 m, 15.6.1990, *Akhani* 6523 (MMTT) - ad versus argillosus inter Salehabad et Jannatabad, ca. 35°43'N, 61°03'E, 650 m, 27.5.1977, *Rechinger* 55783 (W) - between Torbate-Jam and Salehabad, 11 km after Bani-Tak towards Salehabad, near Padeh village, 1150 m, 15.6.1990, *Akhani* 6479 (MMTT, Herb. PODL.) - in declivibus aridis saxosis a Qayen, 80 km Meridiem versus, 1900 m, 31.5.1977, *Rechinger* 56049 (W) - Neyshabur, Kharve-Olia, Binalud, 1300-1500 m, 5.8.1976, *Termeh & Tehrani* (IRAN) - Kharve-Olia, 30 km E Neyshabur, 1500 m, 19.7.1972, *Iranshahr* 16267 (IRAN) - 16 km from Mashhad to Neyshabur, 1200 m, 16.6.1981, *Assadi & Mozaffarian* 35942 (TARI) - Mashhad to Kalate-Naderi, 800 m, 21.7.1972, *Iranshahr & Zargani* 16266 (IRAN) - near Darreh-Gaz, 1000 m, 29.5.1984, *Assadi & Maassoumi* 50859 (TARI) - 18 km N of Mashhad, on the road to Kalate-Naderi, ca. 1000 m, 17.7.1976, *Assadi & Massoumi* 21350 (TARI) - Kuhe Najafi, near Mashhad, 10.7.1972, *Alava & Iranshahr* 10915 (W) - Kuh Sangi, prope Mashhad, in collibus granite, ca. 1000 m, 5.6.1948, *Rechinger & Aellen* 4880 (W) - Mashhad, *Bunge s.n.* (P).

Afghanistan. Herat: Qindedjan, steppe 50 km W Herat, 7.6.1962, *Lindberg* 36/1962 (W) - 40 km westlich Herat an der Straße nach Khusan, 880 m, 8.5.1968, *Freitag* 5394 (Herb. PODL.) - 17 km westlich von Herat an der Straße nach Khusan, 1050 m, 8.5.1968, *Freitag* 5341 (Herb. PODL.) - Karez-i-Haidar Khan an der Straße von Qara Bagh (Woluswoli Gulran) nach Shir Band, 1000 m, 61°44'/34°56', 24.4.1977, *Podlech & Jarmal* 29458 (M, Herb. PODL.) - 3 km südlich Shir Band (Gulran), 850 m, 61°40'/35°00', 28.4.1977, *Podlech & Jarmal* 29479 (M, Herb. PODL.) - 18 km östlich Herat, sterile Flächen nach der Straße nach Obbeh, 980 m, 62°19'/34°21', *Podlech & Jarmal* 29580 a (Herb. PODL.) - Montes Paropamisus, Cheshma Obbeh (Tscheschme obeh), ca. 34°25'N, 63°05'E, substr. granit, ca. 7800 m, 5.8.1962, *Rechinger* 19210 (M, W) - 10 km S Obbeh springs, 100 km east of Herat, semidesert, 1800 m, 14.7.1969, *Anderson & al.* 430 (W) - Nordhänge des Kotale Rabat-i-Mirza S von Rabat-i-Bala, an der Straße von Herat nach Torghundi, 1250 m, 62°06'/34°45', 29.4.1977, *Podlech & Jarmal* 29523 (M, Herb. PODL.) - Kotal-i-Surkh, 15 km N von Herat an der Straße nach Toraghundi, 1120 m, 62°11'E, 34°27' N, 28.4.1977, *Podlech & Jarmal* 29410 (Herb. PODL.). -- Kabul: in glareosis supra Sarobi, ca. 34°35'N, 69°39'E, ca. 1000 m, 20.8.1962, *Rechinger* 19345 (M, W). -- Laghman: Ufer des Kabul Flusses 10 km N Darunta, 630 m, 23.10.1970, *Podlech* 19868 (M) - W von Dschelalabad bei Tscharbagh, am Zusammenfluss von Mingan and Kabul-Fluss, ca. 600-700 m, *Kerstan* 651 (W) - Ufer des Kabul-Flusses 10 km westlich Darunta, 630 m, 23.10.1970, *Podlech* 19868 (M, Herb. PODL.). -- Nangahar: inter Jalalabad et Torkham, ca. 34°16'N, 70°52'E, in deserto arenoso, ca. 700 m, 20.8.1962, *Rechinger* 19366 (M, W) - inter Sarobi et Jalalabad, ca. 34°30'N, 70°00'E, ca. 800 m, 20.8.1962, *Rechinger* 19348 (W). -- Paktia: 25 km südlich Garder an der Straße nach Urgun, 2150 m, 3.7.1968, *Freitag* 3249 (Herb. PODL.) - 2 km SW von Hokumati Motakham, an der Straße von Garder nach Zarghun Shar, 2120 m, 15.8.1970, *Podlech* 19438 a (Herb. PODL.). -- Ghazni: in arenosis 35 km SW Ghazni, 33°33'N, 68°28'E, versus Mukur, 32°52'N, 67°47'E, 2100 m, 28.5.1967, *Rechinger* 35359 (M, W). -- Ghorat: Tal des Rode Ghor bei Awlade Rahmatbeg (an der Straße von Taywara nach Pasaband), 2140 m, 5.6.1971, *Podlech* 21820 (M, Herb. PODL.). -- Kandahar: Near Kandahar, Pirzada, 900 m, 20.4.1948, *Koeie* 2078 (W) - Bum Dasht, 7 km N Chineh, an der neuen Straße nach Tirin, 1550, 65°40' 32°05', 14.6.1978, *Podlech* 31671 (Herb. PODL.) - in collibus inter lacum artificiale Arghandab Reservoir, 31°50'N, 65°45'E et Tirin, 32°40'N, 65°50'E, 1400-1700 m, 23.5.1967, *Rechinger* 35010 (W) - in lapidosis 10-20 km NE Kandahar, 31°36'N, 65°47'E, 1100 m, 26.5.1967, *Rechinger* 35257 (M, W) - 34 km N Kandahar 31°36'N, 65°47'E, versus lacum artificiale Arghandab Reservoir, 31°50'N, 65°45'E, 1100-1200 m, 22.-23.5.1967, *Rechinger* 34868 (M, W) - ca. 50 km N Kandahar, 31°36'N, 65°47'E, ad lacum artificiale Arghandab Reservoir, 31°50'N, 65°45'E, 1200 m, 23.5.1967, *Rechinger* 34954 (W) - Zarni Dasht, 3 km SO Ghanigay an der neuen Straße nach Tirin, 1650 m, Sand, 65°53' 32°24', 15.6.53, *Podlech* 31728 (Herb. PODL.) - 7 km E der Straßengabelung Girishk-Kandahar-Lashkargah, 900 m, Halbwüste, 64°53' - 31°41', 17.4.1978,

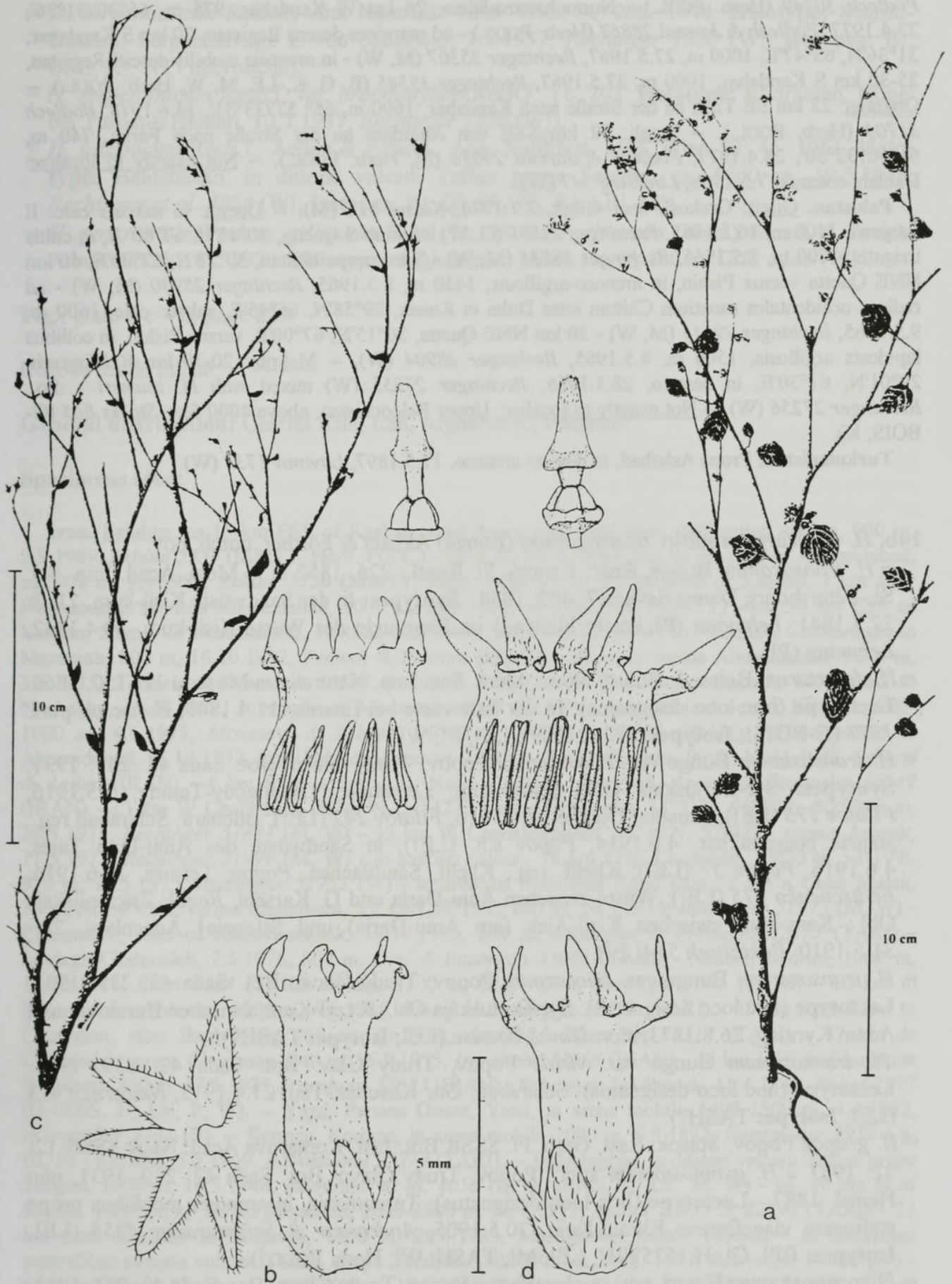


Plate 6: *H. dasycarpum* Ledeb. subsp. *dasycarpum*: a) habit (Akhani 6479), b) flower (Foroughi 3756); *H. dasycarpum* Ledeb. subsp. *transsoxanum* (Bunge) Akhani & Förther: c) habit (Akhani 6544), d) flower (Freitag & Jadidi 29011).

Podlech 30749 (Herb. PODL.) - Nurmohammadkhan, 24 km W Kandahar, 975 m, 65°30'/31°36', 22.4.1977, *Podlech & Jarmal* 28867 (Herb. PODL.) - ad margines deserti Registan, 20 km S Kandahar, 31°36'N, 65°47'E, 1000 m, 27.5.1967, *Rechinger* 35307 (M, W) - in arenosis mobilis deserti Registan, 25-30 km S Kandahar, 1000 m, 27.5.1967, *Rechinger* 35345 (B, G, K, LE, M, W, Herb. PODL.). -- Orozgan: 22 km SE Tirin an der Straße nach Kandahar, 1600 m, 65° 57'/33°31', 14.6.1978, *Podlech* 31703 (Herb. PODL.). -- Farah: 32 km SSE von Anardara an der Straße nach Farah, 740 m, 61°50'/32°30', 24.4.1977, *Podlech & Jarmal* 29076 (M, Herb. PODL.). -- Not exactly to localize: Dahlah, coteaux, 7.5.1958, *Lindberg* 347 (W).

Pakistan. Gilgit: Grakusl, near Gilgit, 2.7.1974, *Kazmi* 615 (M). -- Quetta: in saxosis calc. E Sanjawi, 1400 m, 16.5.1965, *Rechinger* 29591 (G, W) - Sariab S Quetta, 30°15'N, 67°00' E, in cultis irrigatis, 1700 m, 7.5.1965, *Rechinger* 28831 (M, W) - Yaro prope Bostan, 30°23'N, 67°00'E, 40 km NNE Quetta versus Pishin, in arenoso-argillosis, 1450 m, 8.5.1965, *Rechinger* 28930 (M, W) - ad radices occidentales montium Chittan inter Dulai et Kanak, 29°58'N, 66°45'E, substr. calc. 1600 m, 9.5.1965, *Rechinger* 29115 (M, W) - 30 km NNE Quetta, 30°15'N, 67°00'E, versus Pishin, in collibus lapidosis argillosis, 1500 m, 8.5.1965, *Rechinger* 28904 (W). -- Makran: 20-30 km E Mirjaveh, 29°01'N, 61°30'E, in deserto, 28.3.1965, *Rechinger* 27255 (W) mixed with *H. aucheri* - dto., *Rechinger* 27256 (W). -- Not exactly to localize: Upper Beloochistan, above 4000 feet, *Stocks* 865 (G-BOIS, K).

Turkmenistan: Prope Ashabad, in deserto arenoso, 17.5.1897, *Litvinov* 1739 (W).

14b. *H. dasycarpum* subsp. *transoxanum* (Bunge) Akhani & Förther, comb. nov.

≡ *H. transoxanum* Bunge, Beitr. Kenntn. Fl. Russl.: 226. 1852 et in Mém. Acad. Imp. Sci. St.-Petersbourg Divers Savans 7: 402. 1854. **Syntypes**: In der Sandwüste Kisil-kum, 21. & 22.7.1841, *Lehmann* (P); (nicht blühend) im Flugsande der Wüste Kisil-kum, 30.4.1842, *Lehmann* (P!).

= *H. desertorum* Boiss. & Buhse, Nouv. Mém. Soc. Imp. Naturalistes Moscou 12: 150. 1860.

Lectotype (hoc loco designatus): In der Salzwüste bei Enarek, 11.4.1849, *Buhse* pl. pers. 1277 (G-BOIS!; **Isotypes**: H 1611509!, LE!, P!, W!).

= *H. transoxanum* Bunge var. *lasiocarpum* Popov, Trudy Glavn. Bot. Sada 42: 239. 1931.

Syntypes: Syr-Dariuskaja Obl.: Kyzyl-kum, *Lehmann*; Tschipgildy-Tamdy, 5.5.1916, *Filatov* 175 (LE!); Amantaj-Ojgenet, 8.5.1916, *Filatov* 242 (LE!); Bucharra: Schirabad reg., stanzia Nauschikhar, 4.6.1914, *Popov* s.n. (LE!); in Sandwüste des Amu-Dari Tales, 4.6.1916, *Popov* 57 (LE!); Khelif. reg., Khelif, Sandflächen, *Popov*; Termes, 10.6.1916, *Fedischenko* 475 (LE!); Wüste zwischen Amu-Darja und G. Karschi, *Regel*; Zakaspijskaja Obl.: Kara-kum zwischen Kizil-Ajak (am Amu-Darja) und St[anzia] Annenkov, 20.-31.5.1910, *Bukinitsch* 54 (LE!).

= *H. transoxanum* Bunge var. *leiocarpum* Popov, Trudy Glavn. Bot. Sada 42: 239. 1931.

Lectotype (hoc loco designatus): Syr-Dariuskaja Obl., Kyzyl-Kum, zwischen Karak-ata und Adam Kyrulag, 26.8.1873, *Korolkov & Krause* (LE!; **Isotype**: TASH?).

= *H. transoxanum* Bunge var. *viride* Popov, Trudy Glavn. Bot. Sada 42: 239. 1931.

Lectotype (hoc loco designatus): Schirabad, Gor Khaudak-Tau, 21.4.1912, *Neustruev* 428 (LE!; **Isotype**: TASH?).

= *H. grande* Popov, Spisok. Rast. Gerb. Fl. SSSR Bot. Inst. Komarova Acad. Nauk SSSR 12:

32. 1953 ≡ *H. gymnostomum* auct.: Popov, Trudy Glavn. Bot. Sada 42: 239. 1931, non Hemsl. 1887. **Lectotype** (hoc loco designatus): Turcomania, in arenosis mobilibus prope stationem viae ferreae Karaul-Kuju, 30.5.1905, *Androssov & Seidmuradov* 3555 (LE!; **Isotypes**: BP!, G!, H 1535791!, LE!, M!, TASH, W!, Herb. PODL!).

= *H. gymnostomum* Hemsl. var. *aucheriiforme* Popov, Trudy Glavn. Bot. Sada 42: 241. 1931

≡ *H. popovii* Riedl in Rech.f., Fl. Iranica 48: 27. 1967. **Lectotype** (hoc loco designatus): Turcomania: inter Kolaburum et Abdal-achan ad fluvium Murgab, 6.-11.6.1884, *Regel* (LE!; **Isotype**: TASH).

- = *H. serpentinum* Rech.f., Ann Naturhist. Mus. Wien 56: 202. 1948. **Holotype:** Sharud-Bustam: Serpentinberge E von Sabzewar, 1.7.1937, *Rechinger 1318* (W!; **Isotypes:** B!, BM!, K!, NY! microfiche).
- = *H. serpentinum* Rech.f. var. *brachystylum* Rech.f., l.c. 203. **Holotype:** Khorassan: Hügel bei Turbat-e Haidari, 10.7.1937, *Rechinger 1586* (W!).
- = *H. taftanicum* Rech.f., Aellen & Esfand., Ann. Naturhist. Mus. Wien 58: 46. 1951. **Holotype:** Baluchistan: in ditione vulcani Taftan prope Sangon, ca. 1600 m, 19.5.1948, *Rechinger et al. 4058* (W!; **Isotypes:** B!, G!, IRAN!, K!, LE!, M!).
- = *H. popovii* Riedl subsp. *gillianum* Riedl, l.c. 28 = *H. gillianum* (Riedl) Kazmi, J. Arnold Arbor. 51(2): 167. 1970. **Holotype:** Afghanistan, North Herat, 490 m, *Gilli 3106* (W!).

Fig.: plate 6 c + d, page 229.

Corolla inside pilose.

General distribution: Central Asia, Iran, Afghanistan, Pakistan.

Specimens seen:

Iran. Esfahan: ca. 15 km ESE of Kashan, sand dunes near sand dune stablization station, 900 m, 9.9.1989, *Akhani 5755* (MMTT, Herb. PODL.) - ca. 8-10 km E of Kashan, in the road of Abuzeidabad, ca. 900 m, 9.9.1989, *Akhani 5750* (MMTT, Herb. PODL.) - ca. 45 km ESE of Kashan, 2 km after Hosseinabad towards Abuzeidabad, 1000 m, 10.9.1989, *Akhani 5798* (MMTT) - ca. 50 km ESE of Kashan, 5 km S of Hosseinabad, 1000 m, 10.9.1989, *Akhani 5795* (MMTT) - Kashan, Chahartaghi to Maranjab, 800 m, 16.10.1982, *Termeh & Tehrani* (IRAN) - Dehabad versus Abuzeidabad, 1000 m, 3.6.1975, *Termeh & Moussavi 30738 & 30739 & 30740* (IRAN) - near Kashan, Fakhrabad to Nushabad, 15.10.1972, *Iranshahr & Moussavi 16240* (IRAN) - Abuzeidabad versus Fakhreh, 900-1000 m, 4.6.1975, *Moussavi & Tehrani 30735 & 30736 & 30737* (IRAN) - Hosseinabad to Abuzeidabad, 14.10.1972, *Iranshahr & Moussavi* (IRAN) - Kavire-Kashan, Pireh, 18.11.1948, *Scharif & Aellen* (IRAN) - 4 km from Ardestan to Naein, 1400 m, 6.6.1986, *Assadi & Bazgosha 56549* (IRAN) - 15 km W Chahmalek, 33°46'N, 54°42'E, versus Chupanan, 33°33'N, 54°19'E, 800-900 m, 16.5.1975, *Rechinger 51844* (M, W) - 12 km W Chahkharbozeh, 33°29'N, 53°47'E, versus Anarak, 17.5.1975, *Rechinger 51999* (M, W) - in saxosis calcar., 18 km ENE Chupanan, 33°33'N, 54°19'E, 850 m, 17.5.1975, *Rechinger 51952* (W) - in arenosis mobilibus Rig-e Djin 37 km a Chah Malek, 33°46'N, 54°42'E, versus Chupanan, 33°33'N, 54°19'E, 800 m, 16.5.1975, *Rechinger 51913* (M, W) - Chahmalek, road of Khur-Biabanak, 12.10.1976, 800 m, *Bazargan & Foroughi 32375* (TARI) - Jandagh-Chahmalek, 7.5.1978, 800 m, *Dini & Bazargan 33061* (TARI) - Natanz, Badrud, 1000 m, 10.10.1972, *Riazi 6384* (TARI) - Nain, 1500 m, 22.11.1970, *Foroughi 1003* (TARI) - 10 km to Natanz from Ardestan, 1500 m, 6.6.1986, *Assadi & Bazargan 56558* (TARI) - 43 km from Khor to Chupanan, after Baghmalek, 950 m, 5.6.1986, *Assadi & Bazargan 56514* (TARI) - 37 km de Chahmalek versus Chupanan, 840 m, 16.5.1975, *Iranshahr 33058* (IRAN) - 14 km ESE de Chupanan (Ravines), 850 m, 17.5.1975, *Iranshahr 33083* (IRAN) - Salzwüste bei Enarek, 11.4.1849, *Buhse 1277* (G-BOIS, H, LE, P, W). -- Yazd: Persiae Orient, Yazd, in arena mobili, 1400-1500 m, 4.4.1892, *Bornmüller 3931* (B). -- Kerman: Kerman, in arena mobili, 2000 m, 6.5.1892, *Bornmüller 3932* p.p. (B, P) - Kerman, 5.5.1969, *Babakhanlu 25274* (TARI). -- Baluchestan: In ditione vulcani Taftan prope Sangon, 1600 m, 19.5.1948, *Rechinger et al. 4058* (B, G, IRAN, K, LE, M, W) - ca. 40 km N of Khash, Torshab, at Taftan Mountain, 2000-2300 m, 26.4.1977, *Assadi 22875 & 22898* (TARI) - 21 km from Zahedan to Mirjaveh, 1200 m, 20.4.1983, *Mozaffarian 43969* (TARI) - in declivibus australibus saxosis vulcani Taftan, prope Torshab, 1900-2300 m, 26.4. 1977, *Rechinger 54767* (W) - inter Zahedan et Khash, ca. 1300-1600 m, 15.5.1948, *Rechinger 4216 & 4265* (IRAN, M, W) - 39 km to Khash, on the road from Zahedan, 1700 m, 17.11.1977, *Assadi & Mozaffarian 25636* (TARI) - 20 km a Zahedan meridiem versus, 1000 m, 23.4.1977, *Rechinger 54575* (W) - vicinity of Khash, 1290 m, 24.4.1983, *Termeh et al.* (IRAN) - Saravan, 2.4.1950, *Salavatian* (IRAN). -- Khorassan: 5 km N of Sangon, 900 m, 15.6.1990, *Akhani 6472* (MMTT, Herb. PODL.) - Khaf, 960 m, 15.6.1990, *Akhani*

6476 (MMTT) - between Kashmar and Torbate-Heydarieh, 15 km after Torbate-Heydarieh, around cultivated lands, 1170 m, 14.6.1990, *Akhani 6547* (MMTT) - wastelands around Mesinan village, 850 m, 13.6.1990, *Akhani 6434* (MMTT, Herb. PODL.) - 17 km E of Bardeskan, around cultivated lands, 14.6.1990, *Akhani 6542* (MMTT, Herb. PODL.) - 35 km after Torbate-Jam towards Salehabad, 1470 m, 15.6.1990, *Akhani 6531* (MMTT) - in arenosis 56-60 km N Gonabad inter Mahneh, 34°59'N, 58°51'E, et Emrani, 34°35'N, 58°40'E, 900 m, 9.5.1975, *Rechinger 51431* (M) - 20-30 km N of Gonabad, 70 km on road from Torbate-Heydarieh, 900 m, 30.5.1977, *Runemark & Sardabi 23629* (TARI) - Shoukatabad prope Birjand, in incultis, ca. 1400 m, 24.5.1948, *Rechinger et al. 4142* (M, W) - SW of Kashmar, 14 km from Kondor to Bajestan, 1000 m, 18.10.1982, *Assadi & Abouhamzeh 40169* (TARI) - 8 km from Davarzan to Sabzevar, 1000 m, 16.10.1982, *Assadi & Abouhamzeh 40111* (TARI) - 21 km to Boshrooyeh on the road from Ferdows, 1000 m, 19.10.1982, *Assadi & Abouhamzeh 40197* (TARI) - 44 km from Neyshabour to Kashmar, 1250 m, 10.6.1981, *Assadi & Mozaffarian 35448* (TARI) - Mountains ca. 4 km S of Birjand, 1600-1900 m, 31.5.1977, *Runemark & Sardabi 23677* (TARI) - Pass 15-20 km S of Ghaen, 1800-1900 m, 31.5.1977, *Runemark & Sardabi 23653* (TARI) - inter Shahrud et Nishabur, VI.1858, *Bunge s.n.* (P) - 6 km N Kashmar, Dasht, 1100 m, 5.5.1975, *Rechinger 51265* (W) - 10 km SW Ferdows versus Deyhuk, 33°18'N, 57°30'E, 10.5.1975, *Rechinger 57568* (W) - Tehran-Mashhad road, two miles east to Sabzevar, 900 m, 9.7.1972, *Alava & Iranshahr 10884* (W) - ad deserti margines prope Gonabad, inter Ghaen et Torbate-Heydarieh, ca. 900 m, 26.5.1948, *Rechinger et al. 4195* (IRAN, W) - in montibus inter Birjand et Ghaen, ca. 1900 m, 26.5.1948, *Rechinger et al. 4164* (M, W) - Nischapur, 20.6.1858, *Bunge & Bienert s.n.* (P) - 46 km NE Deyhuk, 33°18'N, 57°30'E, dasht, 1050 m, 11.5.1975, *Rechinger 51649* (W) - 43-47 km E of Ghaen, on the road to Yardam, 1200 m, 8.10.1988, *Assadi & Amirabadi 66631* (TARI) - 30 km N of Torbate-Heydarieh, 1900 m, 15.7.1976, *Assadi & Maassoumi 21313* (TARI) - 44 km from Neyshabur to Kashmar, 1250 m, 10.6.1981, *Assadi & Mozaffarian 35448* (TARI) - in montibus serpentinicum ditionis Robat Safid, ca. 1800-2000 m, 27.5.1948, *Rechinger et al. 7346* (W) - 7 km N of Taibad towards Torbate-Jam, 780 m, 15.6.1990, *Akhani 6526* (MMTT) - Hügel bei Turbat-e Haidari, 10.7.1937, *Rechinger 1586* (W) - between Kashmar and Torbate-Heydarieh, 20 km W of Shadmehr, 1250 m, 14.6.1990, *Akhani 6544* (MMTT) - 10 km SO de Ferdows, 1200 m, 10.5.1975, *Iranshahr* (IRAN) - 25 km SE de Boshrooyeh, 900 m, 11.5.1975, *Iranshahr* (IRAN) - dto., *Rechinger 51657* (M) - 2 mile Taibad versus Afghanistan, 1700 m, 12.7.1972, *Iranshahr 16264* (IRAN) - 6 km NE Zamanabad, 1100 m, 13.6.1990, *Akhani 6445* (MMTT) - between Kashmar and Torbate-Heydarieh, ca. 10 km after Torbate-Heydarieh, Houze-Sorkh field, 1180 m, 14.6.1990, *Akhani 6501* (MMTT, Herb. PODL.) - 10 km W of Anabat towards Bardeskan, 900 m, 14.6.1990, *Akhani 6465* (MMTT) - in collibus at Torbate-Heydarieh, 10 & 11.7.1937, *Rechinger 1584* (W) - dto., *Gaub & Mirdamadi 999* (W) - dto., *Gaub* (IRAN) - dto., 27.5.1948, *Rechinger et al. 4345* (M, W) - Torbate-Heydarieh, enter Mehneh et Lute-Emrani, 850 m, 9.5.1975, *Iranshahr* (IRAN) - Serpentinberge E von Sabzewar, 1.7.1937, *Rechinger 1318* (B, BM, K, NY, W). -- Semnan: Touran Protected Area NNE Ahmadabad, 35°46'N, 56°36'E, versus Darbahang, in arenosis, 29.4.1975, *Rechinger 50657* (M, TARI, W) - in arenosis 7 km E Salehabad, 35°33'N, 56°48'N versus Asb Keshan, 35°21'N, 56°56'E, 1100 m, 2.5.1975, *Rechinger 50964* (TARI, W) - Dune ridge between Salehabad and Talkhab, 1200 m, 13.7.1976, *Freitag 13645* (TARI) - between Ahmadabad & Zamanabad, 900-1100 m, 21.9.1975, *Wendelbo & Foroughi 18820* (TARI) - 3 km from Darbahang to Kalleh Dehkadeh, 940 m, 12.5.1875, *Freitag & Jadidi 29011* (TARI) - 3 km WNW of Hajjaj, between road and sand area, 1190 m, 13.7.1976, *Freitag 13663* (TARI) - Pres de Darbahang, 18 km NNO de Ahmadabad, 800 m, 29.4.1975, *Iranshahr 33108* (IRAN). -- Tehran: ca. 7 km SE of Shah Abbas Carvanserai, 900 m, 24.4.1974, *Wendelbo et al. 10913* (TARI) - East of Siah Kuh, 750 m, 10.9.1974, *Wendelbo & Foroughi 14658* (TARI, W) - inter Karavansarayeh Shah Abbas et Nakhjir, 25.5.1974, *Iranshahr 16845* (IRAN).

Afghanistan. Herat: North Herat, 490 m, *Gilli 3106* (W) - in valle fluvii Heri Rud infra Chisht (Tschischt), ca 34°20'N, 63°35'E, ca. 1500 m, 4.8.1962, *Rechinger 19207* (M, W) - 250 km WNW Girishk, 31°50'N, 64°35'E, ad viam versus Shindand, 33°16'N, 62°05'E, 22.7.1965, *Rechinger 32486* (M, W). -- Badghis: inter Herat, 34°20'N, 62°10'E, et Kisil Islam Qaleh, 34°40'N, 61°05'E, 23.7.1965, *Rechinger 32573* (W). -- Faryab: Sandsteppe bei Ankhoi, 7.10.1950, *Neubauer 136* (W). -- Jawz Jan: Ufer des Darya-i-Safid bei Sar-i-Jaz (4 km westlich Sheberghan), 350 m, 8.10.1970, *Podlech 19830* (M, Herb. PODL.). -- Balkh: Bei Aqsha, 300 m, 66°11'/36°54', 19.6.1964, *Neubauer 4254* (W, Herb. PODL.) - 14 miles E of Mazar-i-Sharif, ca. 1500 ft. 11.5.1971, *Grey-Wilson & Hewer 832* (W) - in

deserto arenoso 23-35 km E Mazari-Sharif, 36°43'N, 67°05'E versus Tashkurgahn, 36°44'N, 67°41'E, 400 m, 10.5.1967, *Rechinger 34203* (M, W). -- Samangan: in declivibus occidentalibus jugi Shibaghlu, 36°43'N, 68°07'E, 34 km E Tashkurgahn, 600 m, 10.5.1967, *Rechinger 34262* (M, W). -- Kabul: Sarobi, 21.8.1950, *Volk 1194* (W). -- Kandahar: Ad margines deserti Registan, 20 km S Kandahar, 31°36'N, 65°47'E, 1000 m, 27.5.1967, *Rechinger 35307* (M) - ad marginem deserti Dasht-i Margo SW Qala Bist, 31°28'N, 64°21'E, 820 m, 18.5.1967, *Rechinger 34490* (M, W) - in deserto Dasht-i Margo 20 km NNW Darweshan, 20.5.1967, *Rechinger 34706* (W) - 7 km O der Straßegabelung Girish-Kandahar-Lashkargah, 900 m, Halbwüste, 64°53'/31°41', 17.4.1978, *Podlech 30751* (Herb. PODL.). -- Farah: 32 km SSE von Anardara an der Straße nach Farah, 740 m, 61°50'/32°30', 24.4.1977, *Podlech & Jarmal 29076* (Herb. PODL.) - 10 km SO von Farah Rud an der Straße nach Dilaram, 27.8.1971, *Volk 71/639* (Herb. PODL.) - Bei Surkhab, 85 km NW Delbaram, an der Hauptstraße nach Herat, 1030 m, 62°56'/32°32', 23.4.1977, *Podlech & Jarmal 29011* (Herb. PODL.) - 10 km SE von Farah Rud an der Straße von Herat nach Dilaram, Halbwüste, 27.8.1971, *Volk 71/646* (Herb. PODL.). -- Helmand: Zwischen Girishk und Delaran am Koh Gerd, 21.9.1976, 800 m NN, *Breckle 4876* (W, Herb. PODL.) - Kajaki on the road to Girishk, 1200 m, 17.7.1969, *Anderson & Peterson 445* (W) - Westufer des Helmand ca. 35 km südlich Lashkargah, am Rand der Dasht-i-Margo, 18.5.1967, *Freitag 655* (Herb. PODL.) - 15 km westlich von Girishk an der Straße nach Dilaram, 820 m, 23.8.1968, *Freitag 3694* (Herb. PODL.) - Halbwüste 33 km WNW von Girishk an der Straße nach Delaram, 900 m, 64°15'/31°53', 22.4.1977, *Podlech & Jarmal 28966* (Herb. PODL.) - Boghra, steppe, 13.10.1950, *Volk 1318* (W). -- Nimrouz: Chakhansur, Ostrand des Jehile Puzak, Ton- und Sandwüste, 23.9.1976, 460 m, *Breckle 4814* (Herb. PODL.). -- Not exactly to localize: Djidja, steppe, 21.6.1962, *Lindberg 107* (W).

Pakistan. Baluchistan: Chagai, 20-30 km E Miraveh, 29°01'N, 61°3'E, in deserto, 28.3.1965, *Rechinger 27256* (M, W) - Chagai, 100-150 km E Nok Kundi, 28°49'N, 62°50'E, in deserto arenoso, 29.3.1965, *Rechinger 27273* (M, W) - 8 km W of Warechah and 45 km E of Mirjaveh, 800 m, 26.3.1964, *Grant 15/324* (W).

15. *Heliotropium denticulatum* Boiss. & Hausskn. in Boissier, Fl. or. 4: 145. 1879. **Lectotype** (hoc loco designatus): [Ilam], in rupestribus calcareis montanis ditionis Elymaïtidis Persiae austro-occid. pr. Malamir, VIII.1868, *Haussknecht* (G-DC!; **Isotypes**: BM!, JE!, K!, LE!, P!, W!).

Fig.: plate 1 e, page 197.

Suffrutescent perennial plant with woody base, up to 35 cm high, richly branched from base, greyish-tomentose. Leaves 2.5-3 cm long, 1.5-2 cm broad, elliptic, acute at top, attenuate at base, sessile or with very short petiole up to 0.5 cm, margins slightly thickened, both sides covered by subtomentose, appressed hairs, nerves on upper side impressed, on lower one prominent. Inflorescence terminal, simple or branched; cymes uniseriate, up to 12 cm, with 10-40 sessile flowers. Calyx deciduous; calyx lobes 2.5-3 mm long, 0.6-0.8 mm broad, linear-lanceolate, acute, on both sides hairy. Corolla 5-5.5 mm long, tubular; lobes 0.8-1.2 mm long, 0.5-0.6 mm broad, linear-oblong to subspathulate, their margin distinctly denticulate, intercalary lobes as long as or slightly longer than main lobes, subulate-linear. Anthers 1.5 mm long, inserted 1.5 mm above corolla base, apiculate, recured inwards. Stigma ca. 1.3 mm long, conical, pilose at apex. Style indistinct, hidden by stigmatic disk. Nutlets 1.3 x 2.2 mm large, ellipsoid-ovoid, glabrous, rugose-reticulate.

General distribution: Endemic in SW Iran.

Specimens seen:

Iran. Ilam: ca. 40 km NE of Mehran at the road towards Ilam, in ploughed land around the road, 700 m, *Akhani 5435* (MMTT) - in rupestribus calcareis montanis ditionis Elymaïtidis [Ilam], prope Malamir, 8.1868, *Haussknecht* (BM, G-DC, JE, K, LE, P, W) - ca. 40-45 km NE of Mehran in the

road towards Ilam, 800 m, 16.10.1993, *Akhani 9014* (Herb. AKHANI, Herb. PODL.) - ca. 35 km NE of Mehran at the road towards Ilam, 16.10.1993, *Akhani 9018* (Herb. AKHANI).

The new collections of this species seem to be the first after type collection. Nowadays is no village called Malamir between Mehran and Ilam, but according to statements from native people there was a little village destroyed about 100 years ago.

H. denticulatum is one of the endemic *Heliotropium* species in Iran interesting ecologically as morphologically. As far as known it is restricted to gypsum hills in southwestern Iran next to the border of Iraq as well on cultivated as waste land and associated with other endemic species, e.g. *Rumex ephedroides* and *Pteropyrum* spec. Morphologically it is easily to recognize by its semi-shrubby habit and the presence of long filiform secondary lobes between the oblong main lobes. The whole plant is densely covered by greyish, tomentose hairs.

16. *Heliotropium digynum* (Forssk.) C.Christ., Dansk Bot. Ark. 4 (3): 14. 1922 $\equiv$ *Lithospermum digynum* Forssk., Fl. aegypt.-arab.: 40. 1775. **Typus:** in desertis montosis Kahirinis, 3.1762, *Forsskål 278* (C-FORSSK., non vidi).

Fig.: plate 7 a, page 235.

Suffrutescent psammophytic perennial, woody at base, up to 50 cm high, branched, erect or ascending, sometimes with long cord-like rhizomes; stems whitish, densely covered by subappressed, short hairs and sparsely by long, patent hairs. Leaves 1-3 cm long, 0.7-2 cm broad, ovate or oblong-ovate, more or less obtuse at top, subtruncate at the base, revolute at margin, petiole up to 1 cm, sometimes $\pm$ sessile; upper side with subappressed and subtomentose indument, nerves distinctly impressed; lower side densely covered by patent hairs, nerves distinctly prominent. Inflorescence often divided into two branches; cymes up to 4 cm long with up to 10 flowers. Calyx lobes 2.3-3.5 mm long, 0.8-1 mm broad, oblong-linear, acute, nearly free to base, densely hairy. Corolla 3.5-4 mm long, tubular; corolla lobes 0.7-0.9 mm long, acute, between lobes folded inwards, outside in lower 3/4 densely appressed, downwards pilose. Anthers 1.1-1.2 mm long, apex emarginate, inserted 1.5-2 mm above corolla base. Stigma 0.7-0.8 mm long, shortly conical, apex pilose. Style 0.7-1.2 mm long, pilose. Nutlets 2-2.5 x 1.7-1.8 mm large, $\pm$ ellipsoid, covered by long, white, silky hairs.

General distribution: North Africa, Arabian Peninsula, Iraq and Southwestern Iran.

Specimens seen:

Iraq. Basra: Desertum meridionale, inter Ur et Al Busaiya, 6.11.56, *Rechinger 8191* (W).

Iran. Khuzestan: NE of Bostan, around Kuhe-Mishdagh, 50-200 m, sand dunes, 16.4.1985, *Mozaffarian 53707* (TARI) - Sand dunes NE of Bostan, 70 m, 16.11.1985, *Mozaffarian 58517* (TARI) - NE of Susangerd, Segur region, Farheh, 40 m, 12.4.1985, *Mozaffarian 53478* (TARI) - ca. 60 km N of Ahvaz, sand dunes N of Bamdezh wetland, near Ahudasht, 18.4.1986, *Akhani* (SBUH).

H. digynum is a new record for Iran distributed in southwest of Iran on sand dunes of Khuzestan province. This psammophytic species particularly occurs on sand dunes in the Saharo-Sindian region.

Certainly *H. digynum* is closely related to central Iranian species *H. aucheri*. Main differences are: longer style and anthers inserted in uppermost parts of corolla tube just below the corolla lobes. However there are sometimes similar forms in *H. aucheri* as well. More studies are necessary to fix their positions.

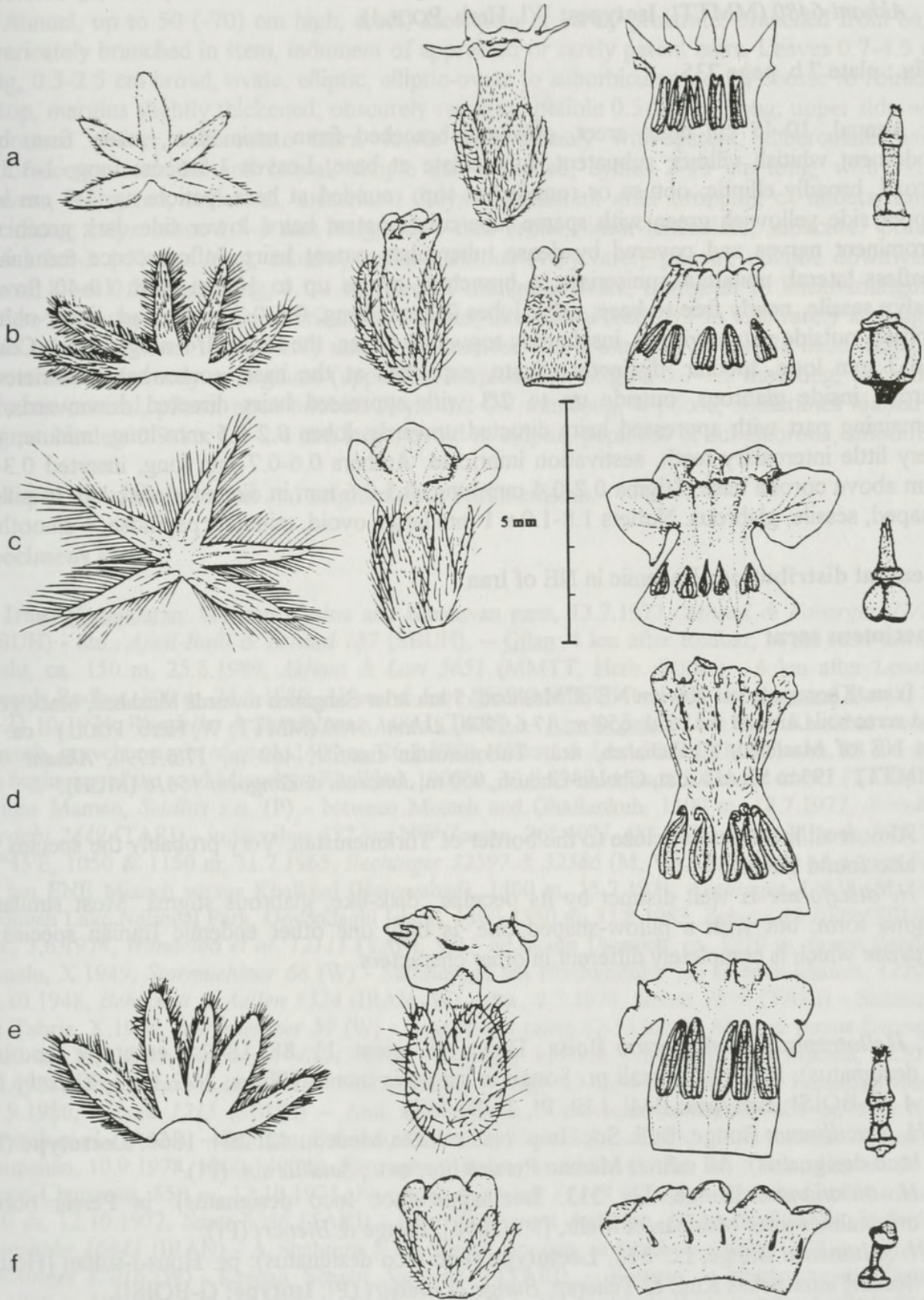


Plate 7: a) *H. digynum* (Forssk.) C.Christ. (Mozaffarian 53478); b) *H. disciforme* Akhani (Akhani 6480, type); c) *H. europaeum* L. s.l. (Ghorbanli & Akhani 4238); d) *H. kaserunense* Bornm. (type, Bornmüller 3930); e) *H. noeum* Boiss. (Akhani 5433); f) *H. rariflorum* Stocks (Wendelbo & Foroughi 15324).

17. *Heliotropium disciforme* Akhani, Linzer biol. Beitr. 23: 569. 1991. **Holotype:** Khorassan, ca. 100 km NE of Mashhad, 5 km after Sanganeh towards Mashhad, 650 m, 17.6.1990, *Akhani 6480* (MMTT!; **Isotypes:** W!, Herb. PODL!).

Fig.: plate 7 b, page 235.

Annual, 10-45 cm high, erect, obliquely branched from main stem, rarely from base. Indument whitish villous, subpatent, tuberculate at base. Leaves 1.5-6 cm long, 1-3.5 cm broad, broadly elliptic, obtuse or rounded at top, rounded at base, petiole ca. 1-3 cm long, upper side yellowish green with sparse tuberculate patent hairs, lower side dark green with prominent nerves and covered by dense tuberculate patent hairs. Inflorescence terminal or leafless lateral, unilateral, uniseriate, $\pm$ branched; cymes up to 10 cm, with 10-40 flowers. Calyx sessile, nearly free to base; calyx lobes 2-3 mm long, 0.5-0.7 mm broad, linear-oblong, obtuse, outside patent villous, inside only topwards pilose, the lower 1/4 subglabrous. Corolla 2.5-3 mm long, tubular, distinctly plicate, expanded at the base, somewhat constricted in throat, inside glabrous, outside up to 2/3 with appressed hairs directed downwards, the remaining part with appressed hairs directed upwards; lobes 0.2-0.5 mm long, minute, with very little intercalary teeth, aestivation imbricate. Anthers 0.6-0.7 mm long, inserted 0.3-0.5 mm above corolla base. Stigma 0.2-0.4 mm long, 0.5-0.6 mm in diameter, disc-like to pillow-shaped, sessile, glabrous. Nutlets 1.8-1.9 x 1 mm large, ovoid, minutely papillose, $\pm$ smooth.

General distribution: Endemic in NE of Iran.

Specimens seen:

Iran. Khorassan: ca. 100 km NE of Mashhad, 5 km after Sanganeh towards Mashhad, black gravel and scree soils around the road, 650 m, 17.6.1990, *Akhani 6480* (MMTT, W, Herb. PODL.) - ca. 110 km NE of Mashhad, Chahchaheh, near Turkmenistan frontier, 460 m, 17.6.1990, *Akhani 6458* (MMTT) - 19 km SE of Kalat, Gholan-Ghoush, 950 m, *Joharchi & Zangoeei 15618* (MUH).

Almost all localities are close to the border of Turkmenistan. Very probably the species will be also found there.

H. disciforme is well distinct by its peculiar, disk-like, glabrous stigma. Most similar in stigma form, but with a pillow-shaped one, is only one other endemic Iranian species *H. agdense* which is completely different in other characters.

18. *Heliotropium dissitiflorum* Boiss., Diagn. pl. orient. 11: 88. 1849. **Lectotype** (hoc loco designatus): in Persia boreali pr. Sonak in lapidosis montis Elbrus, 26.7.1843, *Kotschy 583 A* (G-BOIS!; **Isotypes:** BM!, LE!, P!, TUB!, W!).

= *H. gracillimum* Bunge, Bull. Soc. Imp. Naturalistes Moscou 42: 294. 1869. **Lectotype** (hoc loco designatus): Ad salinas Maman Persiae bor. occ., *Seidlitz s.n.* (P!).

= *H. mesinanum* Bunge, l.c. 313. **Lectotype** (hoc loco designatus): in Persia boreali orientaliore inter Mesinan et Mehr, [8.6.1858], *Bunge & Bienert* (P!).

= *H. sultanense* Bunge, l.c. 315. **Lectotype** (hoc loco designatus): pr. Hous-i-sultan [Houze-Soltan] inter urbes Kum & Teheran, *Bunge & Bienert* (P!; **Isotype:** G-BOIS!).

= *H. litvinovii* Popov, Trudy Glavn. Bot. Sada 42: 218. 1931. **Lectotype** (hoc loco designatus): in Turcomaniae montibus Kopet-dagh, in schistosis pr. pagum Czuli, 19.9.1898, *Litvinov 1747* (LE!; **Isotypes:** G!, LE!, M!, TASH, W!).

= *H. kavirense* Riedl, Iranian J. Bot. 1(1): 33. 1976. **Holotype:** Kavir Protected Region, ca. 50 km W of Shah Abbas Caravanserai, 780 m, 9.9.1974, *Wendelbo & Foroughi 14603* (W!; **Isotypes:** LE!, TARI!).

Fig.: plate 8 a-c, page 239.

Annual, up to 50 (-70) cm high, erect, ascending or rarely prostrate, branched from base, divaricately branched in stem, indument of appressed or rarely patent hairs. Leaves 0.7-4.5 cm long, 0.3-2.5 cm broad, ovate, elliptic, elliptic-ovate to suborbicular, acute, obtuse to rounded at top, margins slightly thickened, obscurely revolute, petiole 0.5-2.5 cm long; upper side with appressed and $\pm$ tuberculate hairs, lower side densely with patent, tuberculate hairs. Inflorescence terminal and lateral, simple and branched; cymes 2-55 cm long, with 5-140 flowers, elongated, unilateral, uniseriate. Calyx $\pm$ persistent after dropping of nutlets, rarely deciduous; calyx lobes 1.5-3 mm long, 0.3-1 mm broad, linear-lanceolate, subacute. Corolla (1.5-) 2.5-3 (-5) mm long, tubular, inside glabrous (very rarely pilose), outside downwards pilose; lobes 0.2-1 mm long, 0.1-1 mm broad, triangular-ovate, triangular to linear-triangular, obtuse to acute, aestivation imbricate to valvate; intercalary teeth $1/3$ to $1/2$, rarely as long as main lobes. Anthers 1-1.5 (-1.7) mm long, inserted 0.5-1 mm above corolla base, acute or sometimes indistinctly emarginate (appearing biapiculate). Stigma 0.7-1.2 mm long, conical to subulate-conical, pilose, apex bilobed. Style 0.2-0.7 mm long, $\pm$ pilose, sometimes hidden by stigma. Nutlets 0.9-1 x 1.1-2.4 mm large, ovoid to elliptic, papillose or subglabrous, smooth.

General distribution: Iran and neighbouring Turkmenistan.

Specimens seen:

Iran. Mazandaran: between Chalus and Kandavan pass, 13.7.1977, Zehzad & Favarger 77/254 (SBUH) - dto., Afzal-Rafii & Zehzad 187 (SBUH). -- Gilan: 4 km after Rudbar, in the road towards Rasht, ca. 150 m, 25.8.1989, Akhani & Lari 5651 (MMTT, Herb. PODL.) - 4 km after Loushan towards Rudbar, 300 m, 24.8.1989, Akhani & Lari 5639 (MMTT) - between Loushan and Manjil, 360 m, 21.10.1974, Wendelbo & Shirdelpour 14853 (TARI). -- Azərbaycan: 27 km W of Khalkhal towards Mianeh, gravels margin of road, 1400 m, 26.8.1989, Akhani & Lari 5697 (MMTT) - ca. 28 km from the beginning of the road Mianeh to Khalkhal, 1000 m, 30.9.1987, Assadi & Akhani 61263 (TARI) - ad salinas Maman, Seidlitz s.n. (P) - between Mianeh and Ghaflankuh, 1100 m, 18.7.1977, Assadi & Sardabi 2449 (TARI) - in faucibus 122 km NW Zanjan, $36^{\circ} 40'N$, $48^{\circ} 30'E$, versus Mianeh, $37^{\circ} 23'N$, $47^{\circ} 45'E$, 1050 & 1150 m, 31.7.1965, Rechinger 32597 & 32586 (M, W) - in saxosis ad pagum Kivi, 90 km ENE Mianeh versus Khalkhal (Herowabad), 1400 m, 15.7.1971, Rechinger 43328 (M, W) - Uromieh Lake National Park, Qoyondaghi Island, 1300-1350 m, 31.8.1983, Zehzad 83/1009 (SBUH) - dto., 3.6.1974, Wendelbo et al. 12111 (TARI, W) - ad lacum Uromieh, ca. 1220 m, prope Bandare-Danalu, X.1949, Starmuehlner 68 (W) - Salzsteppen am Nordwestufer bei Golman-khaneh, 1220 m, 18.10.1948, Behboudi & Aellen 1324 (IRAN, W) - dto., 2.7.1974, Sabeti 2895 (TARI) - Salzsteppe bei Tabriz, X.1949, Starmuehlner 59 (W) - in argillosis salsis 42-55 km W Marand versus Evowghli, 1000 m, 31.7.1971, Rechinger 43843 (W). -- Zanjan: 113 km from Zanjan to Mianeh, 1250 m, 6.9.1981, Mozaffarian & Mohamadi 37379 (TARI). -- Arak: 13 km E of Saveh, near Rezaabad village, 17.9.1986, Akhani 1215 (SBUH) -- Arak to Hamadan, 5 km from Saveh, 920-950 m, 3.11.1987, Termeh et al. (IRAN). -- Esfahan: Esfahan, 19.8.1934, Field & Lazar 1092 (W) - between Anarak and Chupanan, 10.9.1978, 1000-1400 m, Foroughi & Bazargan 32383 (TARI, W) - Nain, Anarak, 94 km prope Chupanan, 850 m, 13.10.1974, Foroughi & Assadi 15149 (TARI) - Anarak, Chahkharbozeh, 880 m, 12.10.1972, Sanii 6386 (TARI) - inter Varamin et Ardestan, 18 km N Sefidab, 25.5.1974, Iranshahr 16841 (IRAN) - A Shahreza 8 km versus Borujen, in lapidosis aridis, 1900 m, 2.6.1974, Rechinger 47016 (W) - Kashan, Sensen, Sanii 6379 (TARI). -- Kerman: in ditione oppidis Kerman, ca. 1700 m, VIII.1949, Starmuehlner 180 (W). -- Semnan: Tal des Hable-Rud zwischen Simindasht und Kabutardarreh, 3-4.9.1948, Manuchehri & Aellen 1179 (IRAN, W) - Garmsar, 900 m, 25.6.1972, Riazi 3720 (TARI) - inter Mesinan et Mehr, Bunge & Bienert s.n. (P). -- Tehran: Tehran, in lapidosis et arenosis, 23.8.1969, Martincic & Wraber 59 (M) - 18-20 km from Rudhen towards Tehran, around Khoramdasht, 24.8.1982, Zehzad 82/1076 (MMTT) - East of Tehran, Sorkheh Hesar, ca. 1200 m, 10.8.1990, Akhani 7123 (MMTT, Herb. PODL.) - inter Tehran et Damavand, in collibus arenosis ad Djaji-rud, 21.7.1902, Bornmüller 7653 (B, P) - Elburz, in vallibus subalpini prope Ahar et Egli, 2000

m, VII.1902, *Bornmüller 7652* (B, P) - pr. Sonak in lapidosis montis Elburs, 26.7.1843, *Kotschy 583 A* (BM, G-BOIS, LE, P, TUB, W) - Steppenhügel zwischen Rudhen und dem Fluß Delijaj, 40-60 km östlich Tehran, 1800 m, 14.7.1948, *Aellen 1249* (W) - Jajrud, river side, 2.9.1974, *Iranshahr* (IRAN) - Steppenhügel am Passübergang zwischen Tehran und dem Djajrud, 1590 m, 3.8.1948, *Aellen 1175* (W) - Rudehen, 2 km Firuzkuh road, 23.8.1972, 1850 m, *Rowshan 5959* (TARI) - Mountains NW of Tehran, Suleghan valley, 19.7.1980, 1550 m, *Assadi, Mozaffarian & Jamzad 33561* (TARI) - 26 km NE Tehran, Ghouchak, 24.7.1972, 1800 m, *Babakhanlou et al. 1276* (TARI) - Damavand to Tehran, 60 km W of Farahnaze-Pahlavi Dam, junction on road to Tehran, 1720 m, 25.8.1977, *Buttler & Bothmer 22791* (TARI) - NE Tehran, 18.6.1974, 1400 m, *Amin & Bazargan 18974* (TARI) - ENE of Tehran, Lashgarak, ca. 1700 m, 8.8.1988, *Akhani 65272* (TARI) - Taleghan, 2000 m, 10.9.1970, *Termeh 16216* (IRAN) - Tehran, *Koelz, 16064 & 18395* (W) - Montes Elburz in declivibus siccis, ca. 50 km a Tehran, 9.9.1949, *Starmuehlner 190* (W) - Kiessteppen beim Flugplatz Tehran, 1135 m, 8.9.1948, *Aellen 1256 & 1332 & 1340* (W) - Kiessteppe um Mahmudieh, 15 km nordlich Tehran, 1250 m, 15.7.1948, *Aellen 1278* (W) - Road side and waste places at the village Darrakeh, 5.7.1972, *Alava 10812* (W) - W of Tehran, Share-Ziba, ca. 1250 m, 17.8.1989, *Akhani 5408* (MMTT, Herb. PODL.) - Lavasanat, Latian, 10.7.1989, *Kavousi 1862* (MMTT) - 23 km S of Loushan, in the road of Ghazvin, 850 m, 24.8.1989, *Akhani & Lari 5637* (MMTT) - hills to the north of the Melli (now Shahid Beheshti) University Campus, Evin, 26.6.1979, *Zehzad 79168* (SBUH) - between Tehran & Karaj, near Chitgar, in non-cultivated lands, 15.5.1989, *Zehzad 82/1118* (SBUH) - Chitgar, on the road to Karaj, 1320 m, 16.6.1974, *Wendelbo & Sanii 2515* (TARI) - dto., 27.7.1972, *Riazi 5987* (TARI) - dto., 27.10.1971, *Riazi 2871* (TARI) - dto., 17.7.1971, *Ahmadi 1894* (TARI) - dto., 25.10.1970, *Foroughi 1004* (TARI) - dto., 11.7.1970, *Foroughi 143* (TARI) - between Tehran & Chalus, at the hills to Karaj Damp. 12.7.1977, *Afzall-Rafii & Zehzad 192* (SBUH) - Karaj, Kuhdashte, 1600 m, *Gauba* (B) - in ditone oppidi Karaj, in declivibus saxosis versus Vessich, 1500 m, 1.9.1949, *Rechinger 6842* (M, W) - in collibus Halkedar and Mardabad, prope Karaj, ca. 1200 m, 31.8.1948, *Rechinger 6812* (M, W) - Karaj, in lapidosis aridis versus Tehran, ca. 1400 m, 20.8.1948, *Rechinger 6681* (W) - Montes Elburz, in lapidosis prope Wardavard, 7.6.1937, *Rechinger 796* (W) - in Artemisietis ad orientalis montis Kuh Dashte prope hortum botanicum Iranicii, 1300 m, 24.6.1975, *Rechinger 53793* (W) - above Botanical Garden of Iran, Vardavard valley, 1450 m, 14.7.1974, *Wendelbo & Sanii 12591* (TARI) - Hills W of Mardabad, 1250 m, 20.9.1974, *Hedge et al. 14688* (TARI) - between Tehran and Karaj, Garmdarreh, 2000-2400 m, 6.9.1978, *Assadi & Mozaffarian 30828* (TARI) - Aliabad, Karaj valley, 1480 m, 5.6.1974, *Foroughi et al. 12324* (TARI) - Damavand, beginning of the road Saran-Evanakey to Bulan, 1600 m, 24.6.1985, *Mozaffarian 54073* (TARI) - 7 km W of Ayvanakey in the road of Tehran, 11.6.1990, *Akhani 6354* (MMTT) - 13 km E of Eyvanakey, 1100 m, 8.7.1974, *Renz & Iranshahr 16576* (IRAN, W) - 45 km SE of Tehran to Ghom, 16.8.1972, 1000 m, *Babakhanlu & Bazargan 1274* (TARI) - Salzige Steppenhügel beim Bahnhof, Rudshur, 60 km Südwestlich Tehran, ca. 950 m, 21.9.1948, *Aellen 1327 & 1326* (W) - W of Houze-Soltan Lake, ca. 850 m, 22.7.1989, *Akhani 5405* (MMTT) - SW of Houze-Soltan Lake, ca. 850 m, 5.6.1987, *Ghorbanli et al. 4839* (MMTT) - NNE of Houze-i-Sultan (Houze-Soltan), inter urbes Kum & Tehran, in limoso-salsis, *Bunge & Bienert s.n.* (P) - Margin of Ghom Lake, 950 m, 7.6.1986, *Assadi & Bazgosha 5604* (TARI) - Ghom Lake, 9.10.1972, *Sanii 6377* (TARI) - 100 km S Tehran towards Ghom, salt Lake, 4.5.1974, *Riedl & Iranshahr 15827* (W) - 80 km to Qom, Nalbandan, 1420 m, 19.10.1981, *Mozaffarian & Karimi 37784* (TARI) - 144 km S of Tehran, Saveh road, 910 m, 17.9.1972, *Amin & Bazargan 1268* (TARI) - Salzlehmwüste beim Bahnhof Kavir, 88 km östlich Tehran, ca. 1000 m, 22.8.1948, *Aellen 1342 & 1343 & 1345* (W) - between Tehran & Ghom, Rude-Shur, ca. 1000 m, 6.9.1987, *Akhani 4780* (MMTT) - ca. 25 km N of Ghom, near Ain-abad, 950 m, 11.9.1989, *Akhani 5815* (MMTT, Herb. PODL.) - Kavire-Namak, Kuhe Sefidab, 12.10.1972, *Iranshahr & Moussavi 16236* (IRAN) - Tehran to Ghom, Hassanabad, *Sabeti* (IRAN) - Kavir Protected Area: in deserti lapidoso ad ripam Orientalem lacum salsi Daryacheh-ye Namak, prope cisternam Howze-Gheylughey, 18 km a Karvansarai Shah Abbas meridiem versus, 25.5.1974, *Rechinger & Iranshahr 46379-a* (W) - dto., *Iranshahr 16836* (IRAN) - Mobarakieyeh, 40 km a Varamin meridiem versus, 900 m, 22.6.1974, *Rechinger 46106* (M, TARI, W) - ca. 25 km SE of Mobarakieh, in *Artemisia* steppe, 25.9.1986, 800-850 m, *Akhani 1334* (SBUH) - near Shah Abbas Carvanserai, 6.10.1986, 800-850 m, *Akhani 1352* (SBUH) - Mobarakieh, 3 km S plains N of Nare-Khar Kuh, 820 m, 2.8.1976, *Freitag 13/981* (KAS) - 25 km from Shah Abbas Caravanserei, on the road to Varamin, 850 m, 26.5.1975, *Assadi & Varneke 17150* (TARI) - Eynorrashid, 1000 m, 9.10.1972, *Iranshahr & Moussavi 16237* (IRAN) - Siah-Kuh to Baba-Hemmat, 700 m, 9.10.1972,

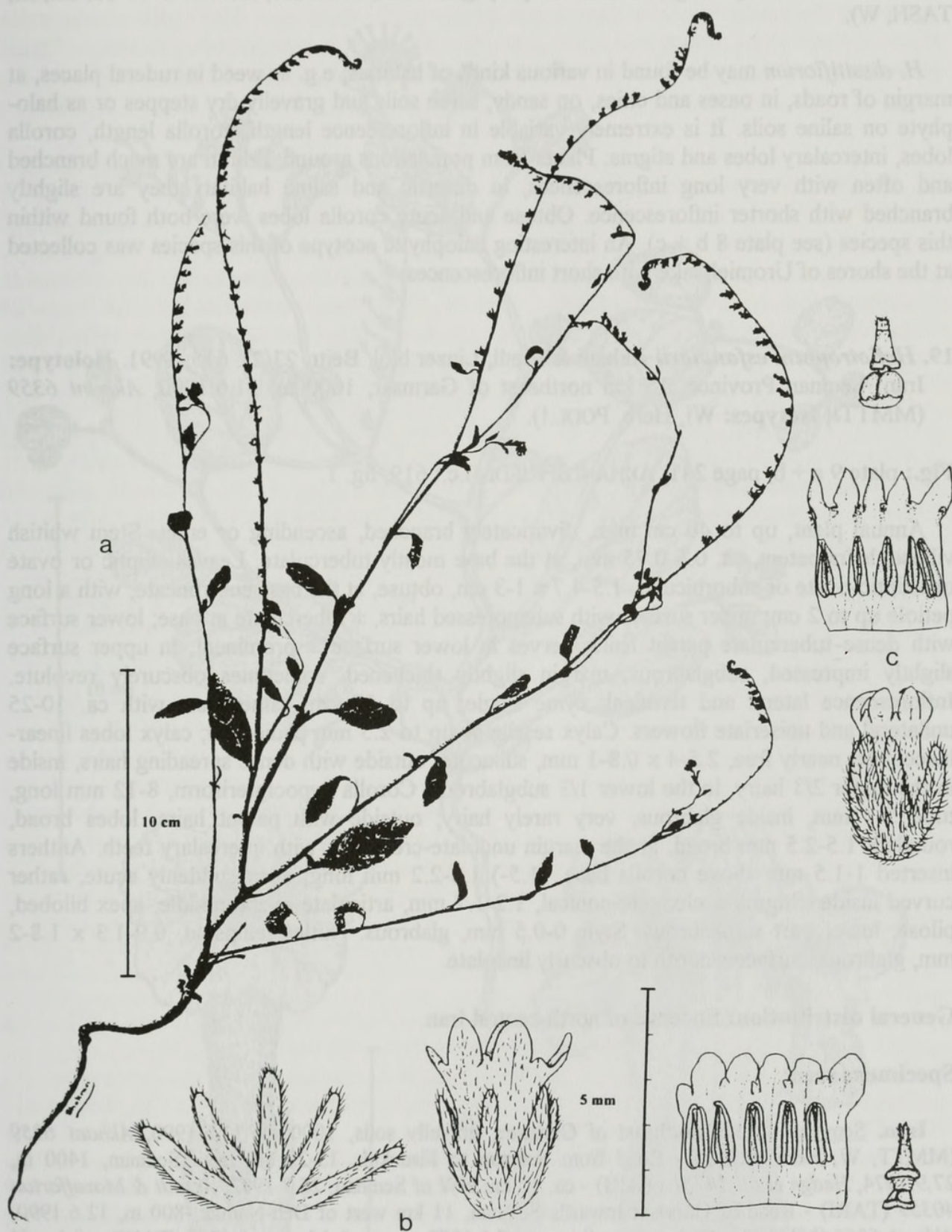


Plate 8: *H. dissitiflorum* Boiss.: a) habit (Akhani 7123), b) flower (Amin & Bazargan 1268), c) flower (Bunge & Bienert, type of *H. mesinatum* Bunge).

Iranshahr & Moussavi (IRAN) - Cheshmeh-Shah, 11.10.1972, *Iranshahr & Moussavi* (IRAN) - ca. 50 km W of Shah Abbas Caravanserai, 780 m, 9.9.1974, *Wendelbo & Foroughi* 14603 (LE, TARI, W).

Turkmenistan: Kopet-dagh, in schistosis pr. pagum Czuli, 19.9.1898, *Litvinov* 1747 (G, LE, M, TASH, W).

H. dissitiflorum may be found in various kinds of habitats, e.g. as weed in ruderal places, at margin of roads, in oases and cities, on sandy, scree soils and gravelly dry steppes or as halophyte on saline soils. It is extremely variable in inflorescence length, corolla length, corolla lobes, intercalary lobes and stigma. Plants from populations around Tehran are much branched and often with very long inflorescences, in desertic and saline habitats they are slightly branched with shorter inflorescence. Obtuse and acute corolla lobes were both found within this species (see plate 8 b + c). An interesting halophytic ecotype of this species was collected at the shores of Uromieh lake with short inflorescences.

19. *Heliotropium esfandiarii* Akhani & Riedl, *Linzer biol. Beitr.* 23(2): 615. 1991. **Holotype:** Iran: Semnan Province, 15 km northeast of Garmsar, 1000 m, 11.6.1990, *Akhani* 6359 (MMTT!; **Isotypes:** W!, Herb. PODL!).

Fig.: plate 9 a + b, page 241; AKHANI & RIEDL, l.c.: 619, fig. 1.

Annual plant, up to 40 cm high, divaricately branched, ascending or erect. Stem whitish villose, hairs patent, ca. 0.5-0.75 mm, at the base mostly tuberculate. Leaves elliptic or ovate or elliptic-ovate or suborbicular, 1.5-4.7 x 1-3 cm, obtuse, at the base subtruncate, with a long petiole up to 2 cm; upper surface with subappressed hairs, $\pm$ tuberculate at base; lower surface with dense tuberculate patent hairs; nerves in lower surface $\pm$ prominent, in upper surface slightly impressed, subglabrous; margin slightly thickened, sometimes obscurely revolute. Inflorescence lateral and terminal; cyme single, up to 17 cm, rather laxe with ca. 10-25 unilateral and uniseriate flowers. Calyx sessile or up to 2.5 mm pedicelled; calyx lobes linear-lanceolate, nearly free, 2.5-4 x 0.8-1 mm, subacute, outside with dense spreading hairs, inside in the upper 2/3 hairy, in the lower 1/3 subglabrous. Corolla hypocrateriform, 8-12 mm long, tube 5-7 mm, inside glabrous, very rarely hairy; outside with patent hairs, lobes broad, rounded, 1.5-2.5 mm broad, at the margin undulate-crenulate, with intercalary teeth. Anthers inserted 1-1.5 mm above corolla base, (1.5-) 1.8-2.2 mm long; apex suddenly acute, rather curved inside. Stigma $\pm$ elongate-conical, 1.2-1.7 mm, articulate at the middle, apex bilobed, pilose, lower part subglabrous. Style 0-0.5 mm, glabrous. Nutlets ellipsoid, 0.9-1.3 x 1.8-2 mm, glabrous, surface smooth to obscurely lineolate.

General distribution: Endemic of north-central Iran.

Specimens seen:

Iran. Semnan: 15 km northeast of Garmsar, gravelly soils, 1000 m, 11.6.1990, *Akhani* 6359 (MMTT, W, Herb. PODL.) - Road from Semnan to Firuzkuh, 15-25 km from Semnan, 1400 m, 27.9.1974, *Hedge et al.* 14731 (TARI) - ca. 10 km NW of Semnan, 26.7.1982, *Assadi & Mozaffarian* 40359 (TARI) - Road of Garmsar towards Semnan, 11 km west of Deh-Namak, 800 m, 12.6.1990, *Akhani* 6366 (MMTT) - 67 km from Semnan, 7.6.1972, *Amin & Moussavi* 1278 (TARI) - 8 km N Garmsar, Booneh-kuh, 19.6.1974, *Amin & Bazargan* 19050 (TARI) - ca. 15 km E of Garmsar, 1000 m, 27.9.1974, *Hedge et al.* 14765 (TARI) - 50 km after Garmsar towards Semnan, 900 m, 7.7.1972, *Iranshahr* 16265 (IRAN) - Simindasht towards Kabutar-darreh, Hable-rud, 3-4.9.1948, *Aellen & Manuchehri* 5356 (IRAN, W) - 13 km east of Eyvanakey, gypsum and salted hills, 1000 m, 8.7.1974, *Renz & Iranshahr* 16575 (IRAN, W) - along the river Hableh-rud, between Mahmoudabad and Kabutar-darreh, 1500 m, 5.9.1988, *Assadi & Abouhamzeh* 66337 (TARI) - between Simindasht and

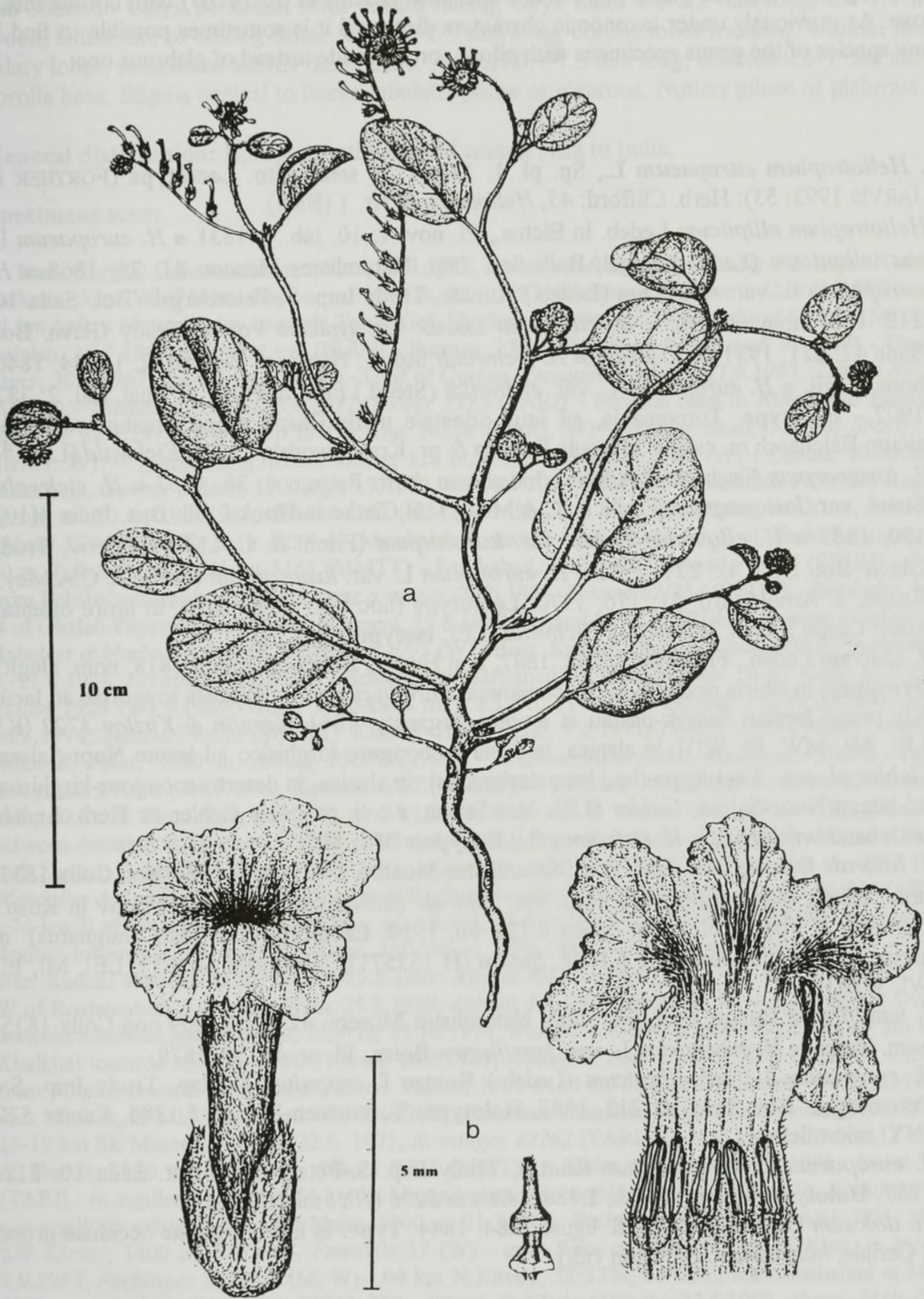


Plate 9: *H. esfandiarii* Akhani & Riedl: a) habit (Akhani 6359, type), b) flower (Akhani 6359, type).

Kabutardarreh, 1150 m, *Aellen 1180 & 1181* (W). -- Tehran: Varamin, 1050 m, 12.10.1972, *Rowshan 6375* (TARI).

Among the examined plants there is one specimen (*Hedge et al. 14765*) with corolla inside pilose. As previously under taxonomic characters discussed it is sometimes possible to find in many species of the genus specimens with pilose corolla inside instead of glabrous one.

20. *Heliotropium europaeum* L., Sp. pl. 1: 130. 1753 sensu lato. **Lectotype** (FÖRTHNER in JARVIS 1993: 53): Herb. Clifford: 45, *Heliotropium* Nr. 1 (BM!).

= *Heliotropium ellipticum* Ledeb. in Eichw., Pl. nov. 1: 10, tab. 4. 1831 = *H. europaeum* L. var. *ellipticum* (Ledeb.) Regel, Bull. Soc. Imp. Naturalistes Moscou 41: 75. 1868 = *H. europaeum* L. var. *ellipticum* (Ledeb.) Kuntze, Trudy Imp. S.-Peterburgsk. Bot. Sada 10: 212. 1887 nom. superfl. = *H. ellipticum* Ledeb. var. *typicum* Popov, Trudy Glavn. Bot. Sada 42: 221. 1931 nom. illegit. = *H. eichwaldi* Steud., Nomencl. Bot. ed. 2, 1: 744. 1840, nom. illegit. = *H. europaeum* L. var. *eichwaldi* (Steud.) Fiori & Paol., Fl. anal. Ital. 2: 383. 1902. **Holotype**: Turcomania, ad litus orientale maris Caspii prope Krasnowodsk, [ad sinum Balchasch m. caspici in insula Dagada & pr. Krasnowodsk, 1827], *Eichwald* (LE!).⁴⁾

= *H. lasiocarpum* Fisch. & C.A.Mey., Index sem. hort. Petrop. 4: 38. 1837 = *H. eichwaldi* Steud. var. *lasiocarpum* (Fisch. & C.A.Mey.) C.B. Clarke in Hook.f., Fl. Brit. India 4(10): 150. 1883 = *H. ellipticum* Ledeb. var. *lasiocarpum* (Fisch. & C.A.Mey.) Popov, Trudy Glavn. Bot. Sada 42: 221. 1931 = *H. europaeum* L. var. *lasiocarpum* (Fisch. & C.A.Mey.) Kazmi, J. Arnold Arb. 51: 176. 1970. **Lectotype** (hoc loco designatus): in litore orientali maris Caspii [Penin. Dardscha], *Eichwald* (LE!; **Isotypes**: K, LE!).

= *H. strictum* Ledeb., Fl. Ross. 3: 100. 1847, non Humb., Bonpl. & Kunth 1818, nom. illegit.. **Syntypes**: in sibiria uralensi; in Turcomannia, *Karelin pl. exs.* [= in salsis songoriae ad lacus Kly prope fontem Sassyk-pastau et montes Arganaty, 1841, *Karelin & Kirilov 1722* (K!, LE!, M!, MW, P!, W!)]]; in alzaica, in deserto soongoro-kirghisico ad lacum Noor-Saisan, *Gebler pl. exs.* **Lectotype** (hoc loco designatus): in alzaica, in deserto soongoro-kirghisico ad lacum Noor-Saisan, *Gebler* (LE!: Nor-Saisan, s.coll. probably Gebler ex Herb. Ledeb. with hand-written note: *H. strictum* mihi; **Isotypes**: BR!, M!).

= *H. littorale* Steven, Bull. Soc. Imp. Naturalistes Moscou 24(2): 565. 1851, non Colla 1835, nom. illegit. = *H. ellipticum* Ledeb. var. *littorale* (Steven) Kusn. & N.P. Popov in Kusn., N. Busch & Fomin, Fl. cauc. critica 4 (2): 90. 1914. **Lectotype** (hoc loco designatus): in arena littorali circa Sudak, 4.7.1848, *Steven* (H 1535717!; **Isotypes**: GOET!, LE!, M!, P!, W!, WAG!).

= *H. tenuiflorum* Bunge, Bull. Soc. Imp. Naturalistes Moscou 42: 293. 1869 non Colla 1835, nom. illegit. = *H. europaeum* L. var. *tenuiflorum* Boiss., Fl. or. 4: 130. 1879.

= *H. europaeum* L. var. *ellipticum* (Ledeb.) Kuntze f. *crispulum* Kuntze, Trudy Imp. S.-Peterburgsk. Bot. Sada 10: 212. 1887. **Holotype**: Turkmenen-Steppe, 5.1886, *Kuntze 529* (NY! microfiche).

= *H. europaeum* L. var. *exsertum* Kuntze, Trudy Imp. S.-Peterburgsk. Bot. Sada 10: 212. 1887. **Holotype**: Krasnowodsk, 5.1886, *Kuntze 529b* (NY! microfiche).

= ?*H. dolosum* De Not., Repert. fl. ligust.: 284. 1844. **Type**: in litore Liguria occiduae prope il Ceriale, *hortulanus H.R.* (non vidi).

Fig.: plate 7 c, page 235.

⁴⁾ The specimen called here Holotype was the exact model for tabula 4 in EICHWALD!

Annual, 5-60 cm high, erect or ascending, indument appressed or patent. Leaves up to 6 cm long and 4 cm broad, ovate to elliptic, rounded or acutish at top, cuneate to almost rounded at base, petiole up to 3.5 cm. Inflorescence often branched; cymes dense, in fruiting time biseriate and bilateral. Calyx persistent after nutlets falling; calyx lobes 1.8-3.2 mm long, 0.4-1.1 mm broad, lanceolate to oblong-linear. Corolla 2-5 mm long; corolla lobes rounded, without intercalary lobes, sometimes shortly denticulate. Anthers 0.7-1.5 mm long, inserted 0.6-1 mm above corolla base. Stigma conical to linear subulate, pilose or glabrous. Nutlets pilose or glabrous.

General distribution: Europe, southwest and central Asia to India.

Specimens seen:

Iran. Gorgan: Golestan forest, 500 m, 27.7.1972, *Iranshahr & Zargani* (IRAN) - Golestan National Park, ca. 5 km W of Mirza-baylou, ca. 1200 m, 21.8.1987, *Ghorbanli & Akhani* 4238 (MMTT) - 22-24 km before Mirza-baylou towards Tange-Gol, Sharlegh, 900 m, 1.8.1982, *Zehzad* 82/226 (SBUH) - Kalaleh, 15.7.1967, *Hashemi s.n.* (IRAN) - Ramian, 270 m, *Gaubu & Mirdamadi* 994 (W) - Gorgan River, 30.9.1967, *Eyvazi s.n.* (IRAN) - Gulf of Gorgan, Esmacilsay Island, 17.8.1987, *Zehzad* 87/306 (SBUH) - Miandaht, 120 m, 6.6.1977, *Hewer* 3913 (TARI) - between road to Almel and Bekadeh, 1300 m, 28.7.1974, *Wendelbo & Cobham* 14234 (TARI, W) - Bandar Shah, 5.1948, *Sharif* 504 (IRAN, W). -- Mazandaran: Minou-Dasht, 120 m, 6.6.1977, *Hewer* 3913 (W) - Chalus, Kelardasht, Miandasht, Gavitar to Ican, 1500 m, 26.7.1990, *Kavousi* 7233 (MMTT) - Miankaleh Protected Region, Sasan, ca. 20 m, 29.6.1988, *Akhani* 4239 (MMTT) - dto., ca. 7 km SW Sasan, ca. 20 m, 8.6.1987, *Akhani* 5244 (MMTT, Herb. PODL.) - Miankaleh Protected Area, ca. 15 km E of Ghale-Palangan, ca. 20 m, 7 & 8.6.1987, *Akhani* 5165 (MMTT) - Farahabad, 16.8.1974, *Zehzad* 74/664 (SBUH) - 7 km from Behshahr towards Zaghmarz, near a stream, 22.6.1987, *Zehzad* 87/254 (SBUH) - Behshahr, 7 km N of Ghaleh-Payan towards Gulf of Gorgan, 15.8.1987, *Zehzad* 87/225 (SBUH) - in litore caspico inter Babolsar et Noshar, 5.8.1937, *Rechinger* 2095 (W) - distr. Kudjur, Dasht-e Nazir, 800 m; in ruderals, 9.-11.8.1948, *Rechinger* 6666 (W) - Schloßhügel Saffiabad bei Behshahr, ca. 10 m, Kalk, 13.9.1948, *Aellen* 1323 (W) - Pole-Veresk, 1400-1450 m, 5.8.1975, *Termeh & Izadyar* 16228 (IRAN) - Sari, 16.8.1974, *Zehzad* 74/666 (SBUH) - Kahrud, Haraz, road, 9.8.1971, *Panahi* 2593 (TARI) - between Amol & Polur, 1050 m, *Assadi* 25607 (TARI) - Chalus, Kelardasht, Rudbarak, Mount. Takhte Soleyman, 2100 m, 24.7.1990, *Kavousi* 6607 (MMTT) - Flußebene des oberen Tedschen bei Kom-rud pain, 60 km E Firuz Kuh, ca. 2200 m, 24.7.1948, *Behboudi & Aellen* 1463 (W). -- Gilan: Lahijan, between Assiabar & Deylaman, 1500-1600 m, 8.7.1972, *Termeh & Daryadel* (IRAN) - between Manjil and Zanjan, 3 km W Tashvir, 31.5.1971, *Iranshahr* (IRAN) - E of Rudbar, 200 m, 13.7.1975, *Wendelbo & Assadi* 18301 A (W) - 1 km N Rudbar towards Rasht, 25.6.1976, *Zehzad* 76/834 (SBUH) - 74 km N of Ghazvin towards Rudbar, near Kokil, 25.6.1976, *Zehzad* 76/837 (SBUH) - 24 km from Rudbar towards Rasht, Sefidrud River, 150-200 m, 16.9.1989, *Zehzad et al.* 67183 (TARI) - 16 km after Rudbar towards Rasht, 100 m, 25.8.1989, *Akhani & Lari* 5664 (MMTT) - 67 km S Rasht, 2 km W of Rostamabad, Kaluraz, 400 m, 25.8.1989, *Akhani & Lari* 5669 (MMTT). -- Azarbayjan: Ilvanak between Khalkhal and Minaneh, 1550 m, 23.10.1974, *Wendelbo & Shirdelpur* 14916 (W) - 7 km W of Khalkhal towards Mianeh, 1660-1700 m, 26.8.1989, *Akhani & Lari* 5692 & 5693 (MMTT) - 29 km from Mianeh towards Bostanabad, above Tunnel, 1400-1450 m, 26.6.1991, *Akhani* 7882 (MMTT) - near Mianeh, 19.8.1974, *Zehzad* 74/548 (SBUH) - in saxosis faucium fluvii Qezel-Owzan (Kizil Uzan), 13-19 km SE Mianeh, 1200 m, 22.6. 1971, *Rechinger* 42262 (TARI, W) - 32 km E of Maku, 2 km W of Shavat, 1050 m, 24.6.1991, *Akhani* 7725 (MMTT) - Maku, Azizabad, 22.7.1975, *Amini* 1708 (TARI) - in argillosis salsis 42-55 km W Marand versus Evowghli, 1000 m, 31.7.1971, *Rechinger* (W) - in argillosis salsis 40 km ESE Maku, 1200 m, 31.7.1971, *Rechinger* 43858 (M, TARI, W) - 20 km SW Khvoy, 1400 m, 6.7.1968, *Petrovitz* 57 (W) - inter Khoi et Maku, 15 km N Khoi, in incultis, 3.9.1957, *Rechinger* 14936 a (M, W) - 94 km N Khvoy, 38°32'N, 45°02'E, inter Shahabad et Maku, 1000 m, 2.8.1965, *Rechinger* 32739 (W) - 20 mi. E Khoi, 4500 ft., 27.5.1962, *Furse* 2319 (W) - Haiderabad (S-Ufer des Urmia Sees), Bergvorsprung, 10.9.1956, *Bobek* 156 (W) - ad ripam occidentalem lacus Urmia, 8.7.1968, *Petrovitz* 159 (W) - W of Uromieh Lake, marshes of Golmankhaneh, ca. 1300 m, 23.6.1991, *Akhani* 7639 (MMTT) - SE of Uromieh Lake, Qareh-Qeshlaq Protected Region, Jarchelu, 22.8.1990, *Zehzad & Kiabi* 90/19 (SBUH) - Uromieh Lake, Bandare-

Golmankhaneh, 1150 m, 7.7.1990, *Izadpanah & Taheri* 68299 (TARI) - Uromieh, 21.8.1974, *Zehzad* 74/661 (SBUH) - road of Uromieh towards Ghassemlu, 12 km from Ghassemlu, 1400 m, 26.7.1990, *Izadpanah & Taheri* 68211 (TARI) - Uromieh-Mahabad road, 23.8. 1974, *Farboodin* 3941 (TARI) - Uromieh, Targavar, Pessan, 1580-1600 m, 31.8.1976, *Zehzad & Rogers* 7088 (TARI) - 23 km ESE of Poldasht, margin of Aras River, 800 m, 25.6.1991, *Akhani* 7824 (MMTT) - Arasbaran Protected Region, Veinagh to Ghaghalu, 500-800 m, 11.6.1976, *Assadi & Maassoumi* 20543 (TARI) - 30 km from Varzeghan to Jolfa, 1900 m, 7.10.1983, *Mozaffarian* 43585 (TARI) - Ahar, Garmadouz, 1.7.1968, *Termeh* 16227 (IRAN) - Shahindezh, 30 km of Takab road, Mahmoudabad, 20.7.1976, *Siami & Zehzad* 7085 & 7086 (TARI) - Azarshahr, 15 km W of Gogan, 1320 m, 2.10.1987, *Assadi & Akhani* 61397 (TARI) - Norouzlu Dam towards Miandoab, 2 km from Gamisholi, Ghalehye Hosseinabad, 1200 m, 29.7.1990, *Izadpanah & Taheri* 68375 (TARI) - ca. 36 km from Ghara-Chaman to Maragheh, 1000 m, 28.9.1987, *Assadi & Akhani* 61287 (TARI) - Bergsteppe am Paßübergang zum Adji-Tschai nördlich von Täbris, ca. 1600 m, 6.10.1948, *Behboudi & Aellen* 1336 (W) - 23 km NW Tabriz versus Sufian, 5.6.1971, *Rechinger* 41119 (W) - inter Tabriz et Ahar, in jugo Goja Bel, 83 km NE Tabriz, 1800 m, 2.9.1957, *Rechinger* 14891 (W) - in declivibus siccis inter Sufian et Shabestar, 1400 m, 22.7.1971, *Rechinger* 43606 (M, W) - Tabriz, along the river Talkheh-rud, ca. 1500 m, 4.10.1987, *Assadi & Akhani* 61519 (TARI) - Dasht-e Moghan, in graminosis aridissimis 14 km SE Alirezaabad-e Jadid, 21.5.1971, *Rechinger* 40126 (M, W) - Dasht-e Moghan, in collibus aridis inter Alirezaabad-e Jadid et Sarband, 39°35'N, 47°50'E, 200 m, 23.5.1971, *Rechinger* 40242 (W). -- Kermanshahan: Eslamabade-Gharb, forestry administration, 7.10.1986, *Hamzehee & Lashkar-Boluki* 27 (TARI) - Mahidasht, Sazemane-Omran, 1350 m, 23.8.1987, *Hamzehee* 1645 (TARI) - 3 km after Paveh to Ravansar, 1550 m, 7.7.1994, *Chehregani & Zarre* 17825 (M, TEH, Herb. Förther). -- Zanjan: 51 km NW of Zanjan towards Mianeh, 1320 m, 26.8.1989, *Akhani & Lari* 5730 (MMTT) - ca. 57 km S of Mianeh towards Zanjan, Ghezel-Ozan River bed, 1150 m, 26.8.1989, *Akhani & Lari* 5720 (MMTT) - beginning of the road from Zanjan to Tabriz, 1450 m, 28.9.1987, *Assadi & Akhani* 61142 (TARI) - ca. 10 km SE of Mahneshan, margin of Ghezel-Ozan River, 1300 m, 29.9.1987, *Assadi & Akhani* 61181 (TARI) - 20 km ESE Kazvin [Qazvin], 16.6.1968, *Petrovitz* 173 (W) - Ghazvin, Moradtapeh, 12.6.1972, 1210 m, *Foroughi & Hariri* 1267 & 1277 (TARI) - Alamout, Akbarabad, 2500 m, 8.9.1970, *Termeh* (IRAN) - Shirkuh, 1200 m, 1.9.1971, *Foroughi* 2622 (TARI) - Gilan, near Ghezel-Ozan River, 300 m, 18.6.1991, *Akhani* 7254 (MMTT). -- Kordestan: Saqez, 5.8.1964, 5.8.1964, *Haghighi* 6261 (IRAN, W) - Bijar, 1750 m, 9.7.1968, *Iranshahr & Dezfoulia* (IRAN) - 100 km from Zanjan to Bijar, 30.6.1971, *Termeh* (IRAN) - in saxosis et ad versuras 47 km W Bijar versus Divandarreh, 2000 m, 2.7.1971, *Rechinger* 42682 (W). -- Hamadan: Ghahavand, 18 km N of Boyaghchi, 1600 m, 10.9.1987, *Assadi* 61103 (TARI) - in monte Elvand, 1800 m, *Mirdamadi* 995 (W) - Shahnaz Dam, Yalpan Mount., 1980-2200 m, 2.7.1974, *Termeh & Moussavi* (IRAN) - beginning of the road Hamadan to Ghazvin, 1700 m, 9.9.1987, *Assadi* 61074 (TARI) - Montes Karaghan inter Kazvin et Hamadan, ca. 2000-2200 m, 16.8.1937, *Rechinger* 2118 (W). -- Arak: 6 km S of Arak, Senejan, near fields, 19.7.1985, *Akhani* 415 (SBUH). -- Lorestan: Bisheh, 50 km a Khorramabad orientem versus, ca. 1200-1400 m, 14.-16.7.1948, *Rechinger* 5720 (W) - Bisheh, 1948, *Rechinger & Manuchehri* 5771 (IRAN, W). -- Esfahan: Between Neyzar & Delijan, Ghomrud (Anarbar) River bank, near Hajiabad, 1050 m, 24.6.1989, *Zehzad & Taheri* 66843 (TARI) - Natanz, Aliabadenani, 1350 m, 18.10.1972, *Sanii* 6380 (TARI) - Ardestan, 1370 m, 17.10.1972, *Riazi* 6378 (TARI) - 24 km S of Kashan, in the road towards Ghahrud, Golestaneh, 1550 m, 10.9.1989, *Akhani* 5781 (MMTT, Herb. PODL.) - 12 km to Esfahan-Aligoudarz road towards Khomein, 2500 m, 25.10.1983, *Assadi & Karimi* 43476 (TARI) - Chadegan, Zayandehrud Dam, 1900-2150 m, 16.6.1981, *Nouroozi & Etemadi* 937 (TARI) - Zayanderud, Pole Shahrestan, 1450 m, 1.8.1973, *Moussavi & Satei* (IRAN). -- Fars: Between Shiraz and Ardkan, mountains above Ghalat, 2300 m, 25.8.1983, *Assadi & Abouhamzeh* 46636 (TARI) - Shiraz region, foothills of Kuhe-Sefid, along the road of Jahrom, 77 km from Shiraz, 27.6.1972, *Alava & Bokhari* 10681 (W) - Maharlu Lake, 1300 m, 1.7.1989, *Zehzad & Taheri* 66948 (IRAN). -- Ilam: In wastelands of Ilam city, 1360 m, 2.8.1989, *Akhani* 5428 (MMTT) - ca. 15 km NE of Mehran, Konjancham River bed, ca. 350 m, 7.8.1989, *Akhani* 5594 (MMTT) - 7 km from Dehloran in the road towards Dashte-Abbas, ca. 200 m, 5.8.1989, *Akhani* 5496 (MMTT) - ca. 45 km from Mehran towards Dehloran, Changooleh River margin, ca. 300 m, 16.10.1993, *Akhani* 9040 (Herb. AKHANI, Herb. PODL.). -- Khuzestan: Shooshtar, Sadrabad, 150 m, 31.5.1983, *Telvari* 1990 (TARI) - 20 km from Andimeshk to Ahvaz, 150 m, 14.11.1985, *Mozaffarian* 58438 (TARI) - Buschuferwald am Dez bei Harmallah, 27.9.1960, *Halthenorth* (M). -- Bushehr: Near Borazjan, on road to Genaveh, 70

m, 4.10.1974, *Bokhari et al.* 14783 (TARI). -- Hormozgan: 50 km from Bandar-Abbas to Minab, 7.3.1984, *Termeh et al.* (IRAN) - Sarzeh, 520 m, 8.3.1971, *Foroughi* 1179 (TARI) - 3 km on the road from Bastak to Bandare-Lengeh, 700 m, 30.11.1987, *Assadi & Akhani* 61925 (TARI) - Isin, ca. 50 m, 24.4.1985, *Mozaffarian* 49634 (TARI). -- Kerman: In montis Djebel-barez, 8-10.5.1948, *Rechinger et al.* 3729 (IRAN, W) - Bam towards Jiroft, 4 km SW of Bam, Gharieh-ye Mahmoudabad, 1820 m, 5.11.1976, *Ershad et al.* (IRAN) - 42 km from Hajiabad on the road to Esfandagheh, Ebrahimabad, 1500 m, 10.6.1977, *Assadi & Miller* 25268 (TARI) - 24 km from Jiroft on the road to Kerman, 1650 m, 15.6.1977, *Assadi & Miller* 25386 (TARI) - 20-30 km from Hajiabad on the road to Ebrahimabad, ca. 1600 m, 10.6.1977, *Assadi & Miller* 25255 (TARI) - Jiroft, 22.6.1960, *Dadashzadeh* 25552 (TARI). -- Baluchestan: Sangoun, bei Taftan, 18.5.1948, *Rechinger et al.* 4071 (IRAN, W) - Zabol, 22.5.1948, *Rechinger et al.* 4114 (IRAN, W) - Zabol to Miankangi (Doust Mohammad Khan), 500 m, 25.5.1984, *Mozaffarian* 63449 (TARI). -- Khorassan: Inter Kucan [Quchan] et Lutfabad, Allah Akbar, ca. 800 m, 14.-15.7.1937, *Rechinger* 1759 (W) - in arenosis inter Fariman et Turbat-e Sheikh Djam, 4.-6.7.1937, *Rechinger* 1374 (W) - between Taibad and Sangan, 19 km after Taibad, 910 m, 15.6.1990, *Akhani* 6490 (MMTT, Herb. PODL.) - between Bazangan & Chahchaheh, 15-17 km S of Chahchaheh, 530 m, 17.6.1990, *Akhani* 6540 (MMTT) - between Kashmar & Torbate-Heydarieh, 20 km W of Shadmehr, 1250 m, 14.6.1990, *Akhani* 6546 (MMTT) - between Kashmar and Torbate-Heydarieh, ca. 10 km after Torbate-Heydarieh, Houze-Sorkheh fields, 1180 m, 14.6.1990, *Akhani* 6460 (MMTT) - 10 km E of Anabat towards Bardaskan, 900 m, 14.6.1990, *Akhani* 6467 (MMTT) - ca. 55 km NW of Torbate-Heydarieh, 1730 m, 16.7.1976, *Assadi & Maassoumi* 21325 (TARI) - ca. 100 km NE of Mashhad, 5 km after Sanganeh towards Mashhad, 650 m, 17.6.1990, *Akhani* 6483 (MMTT) - inter Meshhed et Kucan [Quchan], ca. 100-1300 m, 13.7.1937, *Rechinger* 1591 (W) - dto., *Rechinger* 1605 (W) - between Mashhad and Chenaran, ca. 1100 m, 2.6.1948, *Rechinger et al.* 4688 (IRAN, W) - Mashhad in agris incultis, 5.6.1948, *Rechinger* 4842 (W) - Kuhe Najafi, prope Mashhad, 10.7.1972, *Iranshahr* (IRAN) - dto., *Alava* 10914 (W) - Mashhad to Sarakhs, near Shurak, ca. 63 km from Mashhad, 750 m, 24.9.1975, *Wendelbo & Foroughi* 18866 (TARI) - Kharve-Olia, 30 km E Neyshabur, 1500 m, 19.7.1972, *Iranshahr* (IRAN) - Bizg, in aridis, 4.-6.7.1937, *Rechinger* 1389 (W) - Tehran-Mashhad road, 2 mi. E Sabzevar, 900 m, 9.7.1972, *Alava* 10880 (W) - in montibus Sabzevar orientem versus, substr. Serpentin, 30.6.-1.7.1937, *Rechinger* 1309 (W) - 10 km SW of Sabzevar, 11.10.1971, 960 m, *Moussavi & Asefi* 24299 (IRAN) - 30 km S of Sarakhs, 5 km from Norouzabad towards Sarakhs, 350 m, 16.6.1990, *Akhani* 6487 (MMTT) - 26 km S of Sarakhs, 5 km S of Doulatabad, 350 m, 16.6.1990, *Akhani* 6466 (MMTT) - inter Maiomai et Abbasabad, in collibus arenosis, 13.-14.6.1948, *Rechinger* 5348 (W) - dto., *Rechinger* 5358 (W) - inter Maiomai et Shahrud, 13.-14.6.1948, *Rechinger* 5338 (W). -- Semnan: In desertis lapidosis ad Sorcheh prope Semnan, ca. 1600 m, 6.1937, *Rechinger* 1224 (W) - inter Mashhad et Shahrud, in montibus serpentinis a Sabzevar orientem versus, 13.-14.6.1948, *Rechinger* 5290 (W) - in montibus serpentinis 17-21 km E Sabzevar versus Soltanabad, 1150-1400 m, 17.6.1975, *Rechinger* 53686 (M, W) - between Mashhad and Sultanabad prope Sabzevar, 13.-14.6.1948, *Rechinger et al.* 5260 (IRAN, W) - ca. 210 km on the road to Sabzevar, northern mountain Sarough, 1650 m, 13.7.1976, *Assadi & Maassoumi* 21225 (TARI) - a Shahrud ca. 20 km orientem versus, 6.1948, *Rechinger* 5404 b (W) - 98 km from Shahrud on the road to Sabzevar, 1400 m, 14.7.1976, *Assadi & Maassoumi* 21215 (TARI) - S of Sabzevar, 940 m, 2.6.1976, *Bazargan* 32145 (W) - Touran Protected Area, Kuhe-Malhadu, N side, main river bed, ca. 11 km WSW Qale-e-Bala, 1220-1280 m, 24.8.1976, *Freitag* 14/160 (KAS) - S Delbar, around Game Warden Station, 1200 m, 24.8.1977, *Freitag & Bhadresra* 5086 (TARI) - Hable-rud Tal, Simin Dasht, 2.9.1948, *Aellen & Manuchehri* 1251 (IRAN, W) - 15 km NE Garmsar, 1000 m, 11.6.1990, *Akhani* 6358 (MMTT). -- Tehran: Tehran, 11.6.1940, *Koelz* 16060 (W) - W of Tehran, Shahre-Ziba region, ca. 1250 m, 17.8.1989, *Akhani* 5409 (MMTT) - Montes Elburs, ca. 50 km NE Teheran, 9.9.1949, *Starmuehlner* 235 (W) - Shimran, 1200 m, 8.7.1914, *Pravitz* 169 (W) - in ditione oppidi Keredj, in montibus Kuh-e Dasht, in lapidosis prope Wardoward, ca. 1350 m, 7.6.1937, *Rechinger* 777 a & 777 b (W) - Keredj, *Gauba* 996 (W) - in ditione oppidi Keredj, 1400 m, 20.8.-1.9.1948, *Rechinger* 6844 (W) - dto., *Rechinger* 6693 (M) - 43 km W of Ghazvin in the road towards Loushan, 1200-1280 m, 24.8.1989, *Akhani* 5621 (MMTT) - ca. 12 km SW of Abe-Yek, ca. 2 km after Gharpozabad, near Safar-Khojeh, 1100 m, 24.8.1989, *Akhani & Lari* 5611 (MMTT) - ca. 36 km W of Abe-Yek, in the road towards Ghazvin, 1130 m, 24.8.1989, *Akhani & Lari* 5616 (MMTT) - 23 km S of Loushan, in the road towards Ghazvin, 850 m, 24.8.1989, *Akhani & Lari* 5638 (MMTT, Herb. PODL.) - between Ghom and Ghom-rud, 16.10.1972, *Iranshahr & Moussavi s.n.* (IRAN) - Damavand, Abe-Sard, 9.8.1967,

Sabzevari (IRAN) - Abe-Garme Damavand, 2.9.1974, *Iranshahr* (IRAN) - Ghuchak, 1660 m, 30.6.1970, *Foroughi 633* (TARI) - Shemshak, 3.9.1971, 2280 m, *Gheiasari 2718* (TARI) - 20 km from Rudehen on the road to Firuzkuh, Giland, 1620 m, 13.10.1977, *Assadi 25519* (TARI) - Firuz Kuh, 9.1947, *Esfandiari 5* (W) - 59 km W Karaj, Vallian, 30.6.1974, 1800 m, *Amin & Bazargan 19547* (TARI) - ca. 20 km S of Damavand, between Tamisiun & Aselun, 1550-1650 m, 22.6.1985, *Mozaffarian, 53907* (TARI) - 20 km NE Karaj, Arangeh, 4.9.1972, 1750 m, *Bazargan & Dini 1265* (TARI) - Karaj, Shahrestanak, 2300 m, 18.7.1972, *Riazi 3996* (TARI) - SE of Karaj, 22.6.1972, 1300 m, *Foroughi 30319* (TARI) - E of Hassanabad, around Keyghobad village, ca. 1000 m, 6.9.1987, *Akhani 4775* (MMTT) - Chitgar, 1320 m, 17.7.1971, *Athari 2234* (TARI).

Afghanistan. Badghis: Schlucht des Darya-i-Darrah-i-Bum südlich Samira (55 km S Bala Murghab), 720 m, 6.10.1969, *Podlech 16955* (Herb. PODL.). -- Faryab: Rahmatabad (Woluswoli Shirin Tagao) an der Straße von Maymana nach Andkhoy, 475 m, 36°18'N, 64°53'E, 9.5.1977, *Podlech & Jarmal 30023* (M, Herb. PODL.) - Dawlatabad, 400 m, 7.10.1970, *Podlech 19818* (Herb. PODL.). -- Jawz Jan: inter Aqcha et Mazar-i Sharif, ca. 36°43'N, 66°50'E, ca. 400 m, 4.6.1962, *Rechinger 16136* (M, W) - 30 km S Aqcha, Ali Moghul, Ackerrand, 430 m, 29.8.1976, *Breckle 4689* (W, Herb. PODL.). -- Balkh: 8 km E Balkh an der Straße nach Mazar-i-Sharif, 360 m, 7.10.1970, *Podlech 19788* (M, Herb. PODL.) - Tal des Balkh-Flusses 1 km SE Tash Kanda an der Straße nach Aq Kupruk, 36°18'N, 66°54'E, Kalk, 580 m, 29.8.1978, *Podlech 32422* (Herb. PODL.) - Qurbaqa an der Straße von Balkh nach Aq Kupruk, Lößboden, 550 m, 36°21'N, 66°53'E, 10.5.1978, *Podlech 30900* (Herb. PODL.). -- Qunduz: Kunduz, ca. 34°47'N, 68°51'E, in horto inculto, 25.5.1962, *Rechinger 16020* (M, W) - dto., in declivibus siccis ad aerodromum, substr. Loess, ca. 450 m, 26.5.1962, *Rechinger 16101* (M, W) - 7 km SW von Khanabad an der Straße nach Aliabad, Löß, 520 m, 23.5.1971, *Podlech 21531* (M, Herb. PODL.) - dto., 36°38'N, 69°05'E, 530 m, *Anders 6724* (Herb. PODL.) - 4 km S Aliabad, Lößhänge nahe der Straße, 500 m, 8.5. 1971, *Podlech 21268* (M, Herb. PODL.). -- Takhar: Lößhänge bei Sulani (18 km NE Khanabad an der Straße nach Taluqan), 620 m, 21.5.1971, *Podlech 21379* (M, Herb. PODL.) - Namakab-Tal, Umgebung des Ortes Taqcha Khana, 1450 m, 24.5.1965, *Podlech 11520* (M, Herb. PODL.) - zwischen Khanabad und Taluqan, an der Straße 15 km W Taluqan, Löß, 640 m, 13.6.1965, *Podlech 11334* (M, Herb. PODL.) - Khost-o-Fereng, Chahar Queslaq E von Doabi, 2000 m, 19.7.1965, *Podlech 11900* (M, W, Herb. PODL.). -- Badakhshan: Faydzabad, 26.9.1965, *Podlech 12745* (M, Herb. PODL.) - W von Faydzabad, Kokcha-Tal, ca. 1100 m, 1.7.1965, *Frey 67* (Herb. PODL.) - Baharak, 37°01'N, 70°54'E, 1150 m, 1.7.1971, *Anders 6940* (Herb. PODL.). -- Baghlan: Andarab-Tal, Banu, 1550 m, 28.5.1965, *Podlech 10933* (M, Herb. PODL.) - Ufer des Andarab-Flusses bei Doshi, 900 m, 6.10.1970, *Podlech 22364* (Herb. PODL.) - Pul-i-Kumri, Trockenhänge W des Ortes, 11.6.1965, *Podlech 11319* (M, Herb. PODL.) - unterstes Karan Tal (nördl. Seitental des Surkhab Tales W Doshi) bei Dahane Kayan, 35°37'N, 68°32'E, 1000 m, 22.7.1970, *Anders 4710* (Herb. PODL.) - 18 km N Doshi an der Straße nach Pul-i-khumri (4 km S Sangsolakh) 35°45'N, 68°45'E, Straßenrand, 790 m, 28.8.1978, *Podlech 32381* (Herb. PODL.) - Ufer des Surkhab-Flusses 6 km S Pul-i-khumri, 700 m, 6.10.1970, *Podlech 19757* (Herb. PODL.) - Surkhab-Tal 20 km NNE Doshi, 770 m, 6.10.1970, *Podlech 19748* (M, Herb. PODL.) - in declivibus borealis jugi Salang, 2000-1100 m, 1.7.1965, *Rechinger 31732* (M, W). -- Parwan: Salang-Tal zwischen Qalatak und Samed, 2100 m, 25.7.1969, *Podlech 15940* (M, Herb. PODL.) - mittleres Panjir-Tal, Rokha, 27.7.1965, *Podlech 12036* (M) - zwischen Badakhshi und Kayli, 35°03'N, 69°38'E, 1700-2100 m, 22.7.1973, *Anders 10705* (Herb. PODL.) - zwischen Alekozi und Aroki, am Panjir Fluß, 1500-1550 m, 24.7.1973, *Anders 10860* (Herb. PODL.). -- Kabul: Kabul, in planitie ad orientem urbis secus viam versus Sarobi ducentem, ca. 34°32'N, 69°20'E, ca. 1700 m, 17.7.1962, *Rechinger 16881* (M, W) - Kabul, 1800 m, Gartenunkraut, 16.6.1963, *Neubauer 3152* (B, Herb. PODL.) - Kabul, in collibus ab urbe orientem versus, ca. 34°30'N, 69°10'E, ca. 1800 m, 17.8.1962, *Rechinger 19336* (M, W) - Sarobi, Brache, 28.5. 1951, *Volk 1584* (M) - Eingang zur Tang-i-Gharu, 25 km E Kabul, Hänge N des Flusses, 34°34'N, 69°24'E, 1750-1850 m, 18.5.1977, *Podlech 30276* (Herb. PODL.) - mittlere Tang-i-Gharu, im "Großen Kessel", Schlucht des Kabul-Flusses E Kabul, 34°34'N, 69°31'E, Silikat, 1500 m, 28.5.1978, *Podlech 31358* (Herb. PODL.) - obere Tang-i-Gharu, kleines Seitental S des Stausees, 1600 m, 13.6.1970, *Podlech 18427* (M, Herb. PODL.) - dto., 4 km unterhalb des Eingangs, 34°34'N, 69°26'E, 1750 m, 25.8. 1978, *Podlech 32346* (Herb. PODL.) - in latere occidentali jugi Lataband, 1800-2100 m, 20.6.1965, *Rechinger 31073* (M, W). -- Nangahar: Inter Jalalabad et Torkham, ca. 34°16'N, 70°52'E, in deserto arenoso, ca. 700 m, 20.8.1962, *Rechinger 19363* (M, W) - inter Chigha Sarai, 34°52'N, 71°10'E, et Kandai 34°55'N, 70°47'E, 16.7.1965, *Rechinger 32427* (M, W) - Ghaziabad (an der Straße Jalalabad-Torkham),

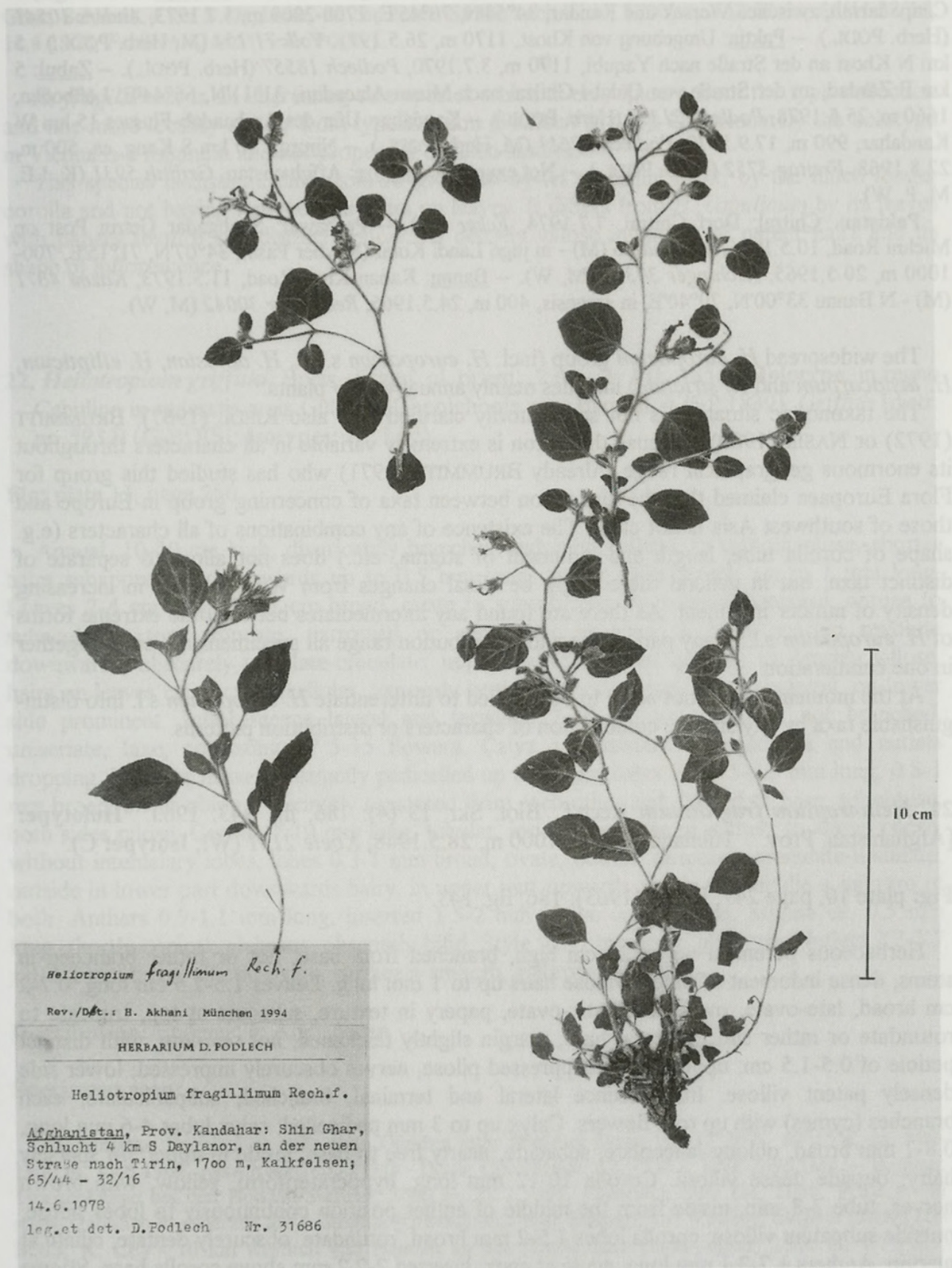


Plate 10: *H. fragillimum* Rech.f.: Podlech 31686 (Herb. Podlech).

Farmgelände, 500 m, 24.10.1970, *Podlech 19937* (M, Herb. PODL.) - zwischen Deh-e Bala und Oghz, 34°05'N, 70°29'E, 1600-1700 m, 15.6.1973, *Anders 10275* (Herb. PODL.). -- Kunar: Nuristan, Kunar-Tal 21 km oberhalb von Chgha Serai, ca. 950 m, 20.8.1969, *Podlech 16116* (M, Herb. PODL.) - Chapadarrak, zwischen Wersek und Kandar, 34°54'N, 70°45'E, 1700-2000 m, 5.7.1973, *Anders 10541* (Herb. PODL.). -- Paktia: Umgebung von Khost, 1170 m, 26.5.1971, *Volk 71/154* (M, Herb. PODL.) - 5 km N Khost an der Straße nach Yaqubi, 1170 m, 3.7.1970, *Podlech 18557* (Herb. PODL.). -- Zabul: 5 km E Zardad, an der Straße von Qalat-i-Ghilzai nach Mizan Alaqadari, 31°11'N, 66°44'E, Lössboden, 1660 m, 25.5.1978, *Podlech 31334* (Herb. PODL.). -- Kandahar: Ufer des Arghandab-Flusses 15 km W Kandahar, 990 m, 17.9.1970, *Podlech 19611* (M, Herb. PODL.). -- Nimroz: 10 km S Kang, ca. 500 m, 22.8.1968, *Freitag 3752* (Herb. PODL.). -- Not exactly to localize: Afghanistan, *Griffith 5931* (K, LE, M, P, W).

Pakistan. Chitral: Dorf Chitral, 7.7.1974, *Ecker* (W). -- Peshawar: Shabgadar Getroi Post on Michni Road, 10.5.1966, *Ahemad 66* (M) - in jugo Landi Kotal (Khyber Pass), 34°07'N, 71°15'E, 700-1000 m, 20.5.1965, *Rechinger 30316* (M, W). -- Bannu: Kahan Khan Road, 11.5.1973, *Kazmi 4871* (M) - N Bannu 33°00'N, 70°40'E, in arenosis, 400 m, 24.5.1965, *Rechinger 30042* (M, W).

The widespread *H. europaeum* group (incl. *H. europaeum* s.str., *H. dolosum*, *H. ellipticum*, *H. lasiocarpum* and *H. strictum*) includes mainly annual weedy plants.

The taxonomic situation is not satisfactorily clarified [see also RIEDL (1967), BRUMMITT (1972) or NASIR (1989)] because this taxon is extremely variable in all characters throughout its enormous geographical range. Already BRUMMITT (1971) who has studied this group for Flora Europaea claimed that the distinction between taxa of concerning group in Europe and those of southwest Asia is not clear. The existence of any combinations of all characters (e.g. shape of corolla tube, length and indument of stigma, etc.) does not allow to separate of distinct taxa, but in general there might be clinal changes from West to East in increasing density of nutlets' indument. As there are found any intermediates between the extreme forms of *H. europaeum* s.l. in any part of the wide distribution range all specimens are cited together in one enumeration.

At the moment it does not seem to be justified to differentiate *H. europaeum* s.l. into distinguishable taxa by any strange combination of characters or distribution patterns.

21. *Heliotropium fragillimum* Rech.f., Biol. Skr. 13 (4): 186, fig. 143. 1963. **Holotype**: [Afghanistan, Prov. Hilmand] Kajkai, 1000 m, 28.5.1948, *Koeie 2151* (W!; **Isotype**: C).

Fig: plate 10, page 247; RIEDL (1963): 186, fig. 143.

Herbaceous perennial up to 20 cm high, branched from base, not or rather branched in stems, dense indument of patent villose hairs up to 1 mm long. Leaves 1.5-2.5 cm long, 0.7-2 cm broad, late-ovate, ovate to elliptic-ovate, papery in texture, subacute at top, truncate to rotundate or rather subcordate at base, margin slightly thickened, not revolute, with distinct petiole of 0.5-1.5 cm; upper side subappressed pilose, nerves obscurely impressed; lower side densely patent villose. Inflorescence lateral and terminal, branched, subpaniculate; each branches (cymes) with up to 4 flowers. Calyx up to 3 mm pedicelled; calyx lobes 4-6 mm long, 0.8-1 mm broad, oblong-lanceolate, subacute, nearly free to base, inside in upper 3/4 sparsely hairy, outside dense villose. Corolla 10-12 mm long, hypocrateriform, yellow, with brown nerves, tube 7-8 mm, inside from the middle of anther position continuously to lobes pilose, outside subpatent villose; corolla lobes 1.5-2 mm broad, rotundate, obscurely dentate, ciliate at margin. Anthers 1.7-2.1 mm long, acute at apex, inserted 2-2.2 mm above corolla base. Stigma 1-1.2 mm long, elongate-conical, ± pilose. Style 0.7-0.9 mm long, subglabrous. Nutlets 1.7 x 1 mm large, ovoide, glabrous, ± rugose.

Distribution: Endemic in Afghanistan.

Specimens seen:

Afghanistan Hilmand: Kajkai, Felsspalten, 1000 m, 28.5.1948, *Koeie 2151* (W). -- Kandahar: Shin Ghar, Schlucht 4 km S Daylanor, an der neuen Straße nach Tirin, 1700 m, Kalkfelsen, 66/44-32/16, 14.6.1978, *Podlech 31686* (Herb. PODL.).

H. fragillimum is an interesting rare species which is only known from the type collection and one more locality not far from type location (*Podlech 31686*). Unfortunately the holotype in Vienna is a fragment and not proper for detailed studies.

This species is distinguished from *H. griffithii* by its perennial habit, by the much longer corolla and not having multicellular hairs on leaves. It differs from *H. cabulicum* by its leaves with papery texture and distinct petiole, its densely villose indument of patent hairs and its shape of inflorescence.

22. *Heliotropium griffithii* Boiss., *Diagn. pl. orient.*, 2.ser., 3: 131. 1856. **Holotype**: in regno Cabulico in ruderatis arcis Gulgula [Ghoolghoola near Bamian, 4./5.9.1839], *Griffith* [distr. nr. 5932] (G-BOIS!; **Isotypes**: K!, LE!).

Fig: plate 11, page 250.

Annual, 10-30 cm high, divaricately branched, indument villose, to subtomentose, shorter hairs subappressed downwards up to 0.5 mm long, longer hairs patent, up to 1 mm long. Leaves 2-4 cm long, 1.3-3 cm broad, ovate to suborbicular or rarely subcordate, obtuse to subacute at top, truncate, narrowed or sometimes rounded at base, margin revolute downwards, obscurely undulate-crenulate; upper and lower side sparsely to densley villose, hairs on leaves clearly multicellular, variously bent, nerves on upper side impressed, on lower side prominent. Inflorescence lateral and terminal, 2-10 cm long, usually not branched, uniseriate, laxe, consisting of 5-15 flowers. Calyx $\pm$ persistent after corolla and nutlets dropping, in lower flowers distinctly pedicelled up to 2 mm; calyx lobes 5-5.5 mm long, 0.8-1 mm broad, linear-oblong, distinctly separated from each other and divided to base, subobtuse, both sides pilose. Corolla 7-10 mm long, tubular, inside from base of anthers to above pilose, without intercalary lobes; lobes 0.3-1 mm broad, ovate, obtuse, obscurely crenulate-undulate, outside in lower part downwards hairy, in upper part upwards and in the middle a mixture of both. Anthers 0.9-1.1 mm long, inserted 1.5-2 mm above corolla base. Stigma ca. 0.5 mm long, shortly conical, glabrous, obscurely bifid. Style 0.5-1 mm long, glabrous. Nutlets 2.2-2.7 x 1-1.2 mm large, elliptic-ovate, surface $\pm$ smooth, glabrous.

Distribution: Endemic in Afghanistan.

Specimens seen:

Afghanistan Baghlan: in valle fluvi Qunduz inter Doshi et Doab, ca. 35°30'N, 68°15'E, ca. 800-1300 m, 11.6.1962, *Rechinger 16553* (M) - Doab, Geröllhalde, 23.6.1952, *Volk 2698* (M). -- Bamian: Trockenhänge bei den Buddah-Statuen, 2400 m, 29.7.1965, *Podlech 12191* (M, Herb. PODL.) - in regno Cabulico in ruderatis arcis Gulgula [Ghoolghoola near Bamian, 4./5.9.1839], *Griffith* [5932] (G-BOIS, K, LE) - 10 km westlich von Bamian an der Straße nach Band-i-Amir, 2500 m, 9.7.1969, *Breckle 2372* (Herb. PODL.) - Qatarsun, Nordseite des Kotal-i-Agrabot, NW Bamian, 3000 m, 26.6.1970, *Dieterle 497* (Herb. PODL.) - 2 km westlich von Bulola, 2400 m, 17.10.1969, *Podlech 17045* (M, Herb. PODL.).

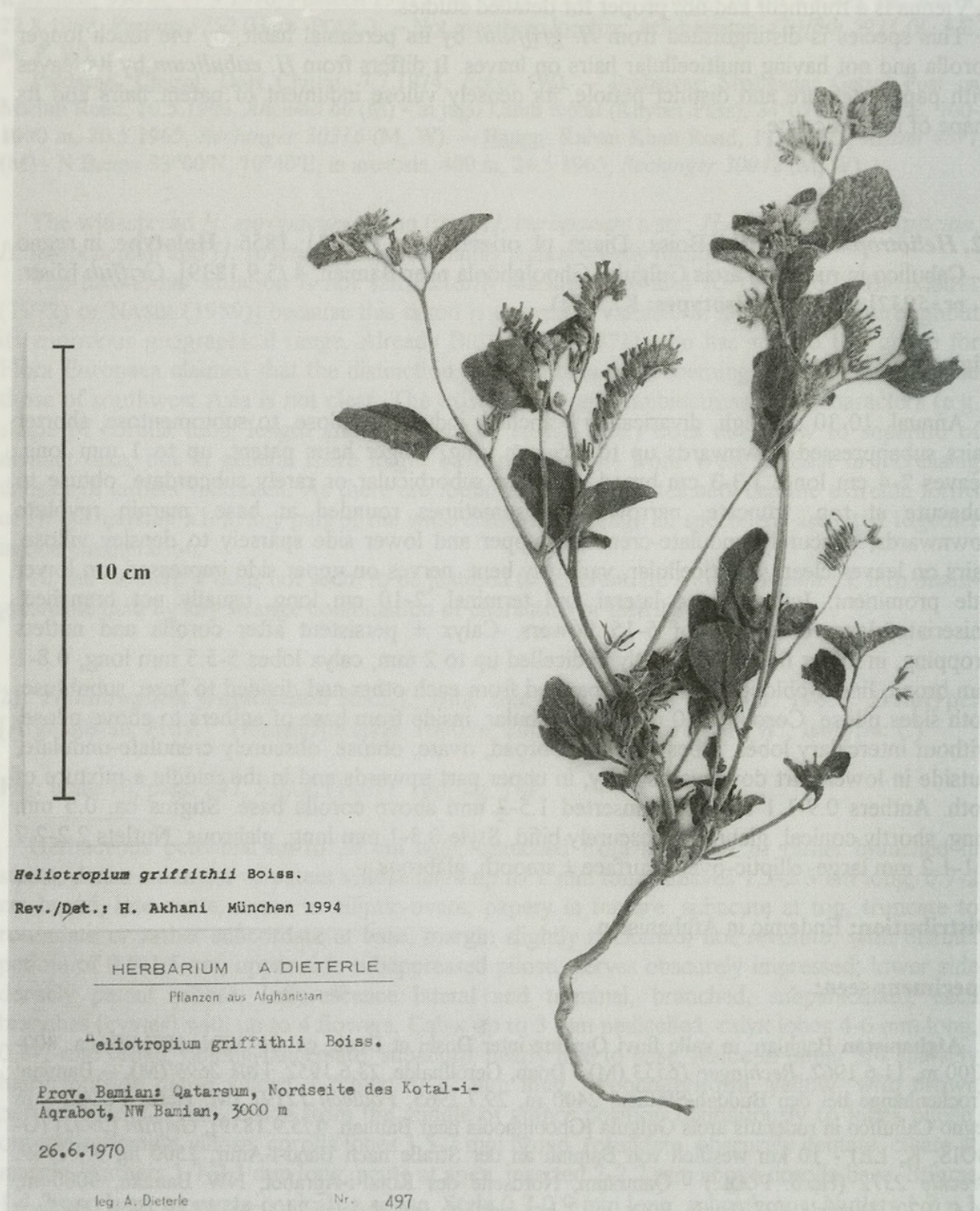
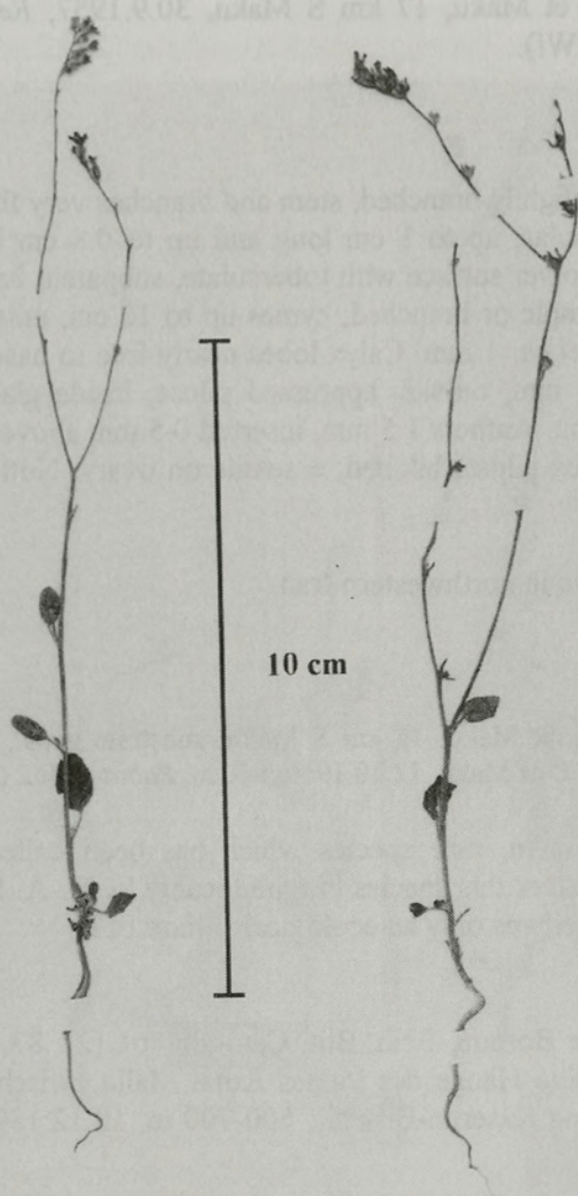


Plate 11: *H. griffithii* Boiss.: Dieterle 497 (Herb. Podlech).



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14951

Heliotropium gypsaceum RECH.f. &
H. RIEDL, sp.n.

PERSIA occidentalis: Prov. Azerbaidjan.
Inter Khoi et Maku.

17 km S Maku, substr. gyps.

3. IX. 1957

det. H. RIEDL

ISOTYPUS

Plate 12: *H. gypsaceum* Rech.f. & Riedl: Rechinger 14951 (part of the Isotype of M).

- 23. *Heliotropium gypsaceum*** Rech.f. & Riedl, Fl. Iranica, 48: 46. 1967. **Holotype:** Persia, Azerbaidzhan: inter Khoi et Maku, 17 km S Maku, 30.9.1957, *Rechinger 14951* (W!); **Isotypes:** B!, G!, LE!, M!, W!).

Fig: plate 12, page 251.

Annual, up to 20 cm high, slightly branched, stem and branches very fine, indument appressed. Leaves ovate to suborbicular, up to 1 cm long and up to 0.8 cm broad, obtuse; upper surface with appressed hairs; lower surface with tuberculate, subpatent hairs; petiole up to 0.5 cm. Inflorescence elongate, simple or branched; cymes up to 10 cm, uniseriate and unilateral, laxe, with 5-12 flowers, pedicel ca. 1 mm. Calyx lobes nearly free to base, lanceolate, 2-2.5 x 0.7-1 mm, acute. Corolla 4-5 mm, outside appressed pilose, inside glabrous. Corolla lobes rotundate, 1 mm broad and long. Anthers 1.5 mm, inserted 0.5 mm above corolla base. Stigma elongate-conical, 1 mm, at apex pilose, bilobed, $\pm$ sessile on ovary. Nutlets ovate, ca. 1 mm, smooth.

General distribution: Endemic in northwestern Iran.

Specimens seen:

Iran. Azarbayjan: Inter Khoi et Maku, 17 km S Maku, substrate gyps., 30.9.1957, *Rechinger 14951* (B, G, LE, M, W) - 34 km E of Maku, 12.10.1960, 960 m, *Pabot 25562* (TARI).

H. gypsaceum is a less known, rare species which has been collected only from two localities. An attempt to rediscover this species in type locality by H. A. failed. It seems to be very close to *H. szovitsii* and perhaps only an ecological variant of it.

- 24. *Heliotropium kaserunense*** Bornm., Beih. Bot. Centralbl. 61 (2): 87. 1941. **Holotype:** S-Persien, Faristan: steile felsige Hänge des Passes Kotal Mallu zwischen Kumaredsch und Konar-zakht der Marschroute Kaserun-Buschir, 500-700 m, 13.12.1892, *Bornmüller 3920* [3930 in schedis] (B!).

Fig.: plate 7 d, page 235 & plate 13, page 253.

Perennial (or probably annual and biannual), woody at base, branched from base, 30-40 cm, subappressed whitish-tomentose. Leaves 2-3.5 cm long, 1.5-2 cm broad, elliptic-ovate, with a short petiol up to 1 cm, obtuse at top, $\pm$ rotundate at base, margin slightly revolute in lower side; upper side appressed villose, nerves prominently impressed; lower side patent tomentose. Inflorescence terminal and lateral, erect, 5-15 cm long, with ca. 10-30 flowers, uniseriate and unilateral. Calyx easily dropping, lower flowers with a short pedicel up to 1 mm, upwards sessile; calyx lobes 3-3.5 mm long, 0.8-1.2 mm broad, oblong-lanceolate, $\pm$ obtuse, on both sides tomentose hairy, nearly free to base. Corolla 5-6 mm long, tubular, constricted in the middle, inside from anther base to lobes densely pilose, throat with 5 longitudinally ridges. Lobes ca. 0.5 mm broad, $\pm$ rotundate, folded inwards, obscurely crenulate; intercalary lobes very small. Anthers 1.5-1.7 mm long, hooked at top, inserted 1-1.5 mm above corolla base. Stigma 1.3 mm, conical, pilose. Nutlets 2-2.3 x 1.3-1.5 mm large, ovoid, smooth or somewhat rugose.

General distribution: Endemic in southwestern Iran.

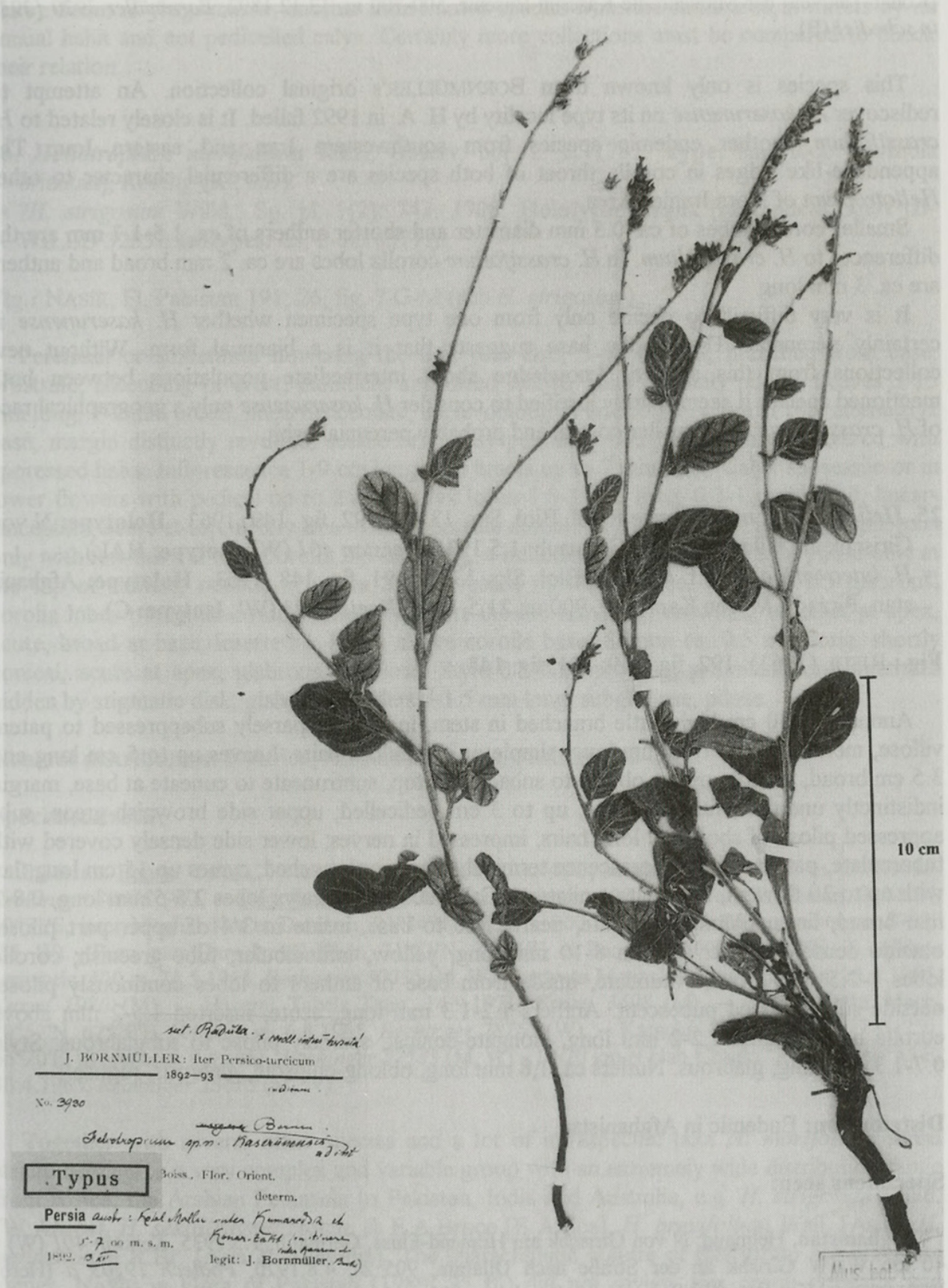


Plate 13: *H. kaserunense* Bormm.: Bormmüller 3930 (holotype).

Specimen seen:

Iran. Fars: steile felsige Hänge des Passes Kotal Mallu zwischen Kumaredsch und Konar-zakht [Konar-Takhteh] der Marschroute Kaserun-Buschir, 500-700 m, 13.12.1892, *Bornmüller 3920 [3930 in schedis]* (B).

This species is only known from BORNMÜLLER's original collection. An attempt to rediscover *H. kaserunense* on its type locality by H. A. in 1992 failed. It is closely related to *H. crassifolium* another endemic species from southwestern Iran and eastern Iraq. The appendage-like ridges in corolla throat of both species are a differential character to other *Heliotropium* of Flora Iranica Area.

Smaller corolla lobes of ca. 0.5 mm diameter and shorter anthers of ca. 1.5-1.7 mm are the differences to *H. crassifolium*. In *H. crassifolium* corolla lobes are ca. 2 mm broad and anthers are ca. 3 mm long.

It is very difficult to decide only from one type specimen whether *H. kaserunense* is certainly perennial. The woody base suggests that it is a biannual form. Without new collections from this area or knowledge about intermediate populations between both mentioned species it seems hardly justified to consider *H. kaserunense* only a geographical race of *H. crassifolium* with smaller corolla and probably perennial habit.

25. *Heliotropium macrolimbe* Riedl, Biol. Skr. 13 (4): 192, fig. 149. 1963. **Holotype:** N von Girischk am Hilمند-Fluss, Germaub, 1.5.1935, *Kerstan 401* (W!; **Isotype:** HAL).
= *H. luteo-viride* Rech.f. & Riedl, Biol. Skr. 13(4): 191, fig. 148. 1963. **Holotype:** Afghanistan, Pirzada, W von Kandahar, 900 m, 21.5.1948, *Koeie 2093* (W!; **Isotype:** C).

Fig.: RIEDL (1963): 192, fig. 149; 191, fig. 148.

Annual, 15-30 cm high, little branched in stem, indument sparsely subappressed to patent villose, mixed with up to 2 mm long, simple or glandulose hairs. Leaves up to 5 cm long and 3.5 cm broad, broadly ovate, obtuse to subacute at top, subtruncate to cuneate at base, margin indistinctly undulate, little revolute, up to 3 cm pedicelled; upper side brownish-green, subappressed pilose of short and long hairs, impressed in nerves; lower side densely covered with tuberculate, patent hairs. Inflorescence terminal, simple or branched; cymes up to 15 cm long, lax with up to 30 flowers, uniseriate, unilateral. Calyx subsessile; calyx lobes 2.5-5 mm long, 0.8-1 mm broad, linear-oblong, subacute, nearly free to base, inside in 3/4 of upper part pilose, outside densely villose. Corolla 8-10 mm long, yellow, infundibular, tube greenish; corolla lobes 1-2.5 mm broad, rotundate, inside from base of anthers to lobes continuously pilose, outside subappressed pubescent. Anthers 1.2-1.3 mm long, acute, inserted 1.5-2 mm above corolla base. Stigma 1.2-2 mm long, elongate-conical, sparsely pilose to subglabrous. Style 0.7-1.3 mm long, glabrous. Nutlets ca. 1,8 mm long, oblong-ellipsoid, glabrous, rugose.

Distribution: Endemic in Afghanistan.

Specimens seen:

Afghanistan. Helmand: N von Girischk am Hilمند-Fluss, Germaub, 1.5.1935, *Kerstan 401* (W) - 40 km WNW Girishk an der Straße nach Dilaram, 905 m, 4.8.1970, *Podlech 19203 a* (Herb. PODLECH). -- **Kandahar:** Pirzada, W von Kandahar, 900 m, 21.5.1948, *Koeie 2093* (C, W).

H. macrolimbe is a very little known species too which is only known from type collection, the type specimen of the synonymous *H. luteo-viride* and one more specimen.

Superficially it looks similar to *H. griffithii*, but is easily distinguished by its infundibular corolla with broad lobes, the elongate stigma and simple hairs (in *H. griffithii* corolla is tubular with very small lobes, stigma is shortly conical and leaves' indument consists of multicellular hairs). From *H. fragillimum*, another little known species from the same area, it differs by its annual habit and not pedicelled calyx. Certainly more collections must be compared to check their relation.

26. *Heliotropium marifolium* Retz., Observ. bot. 2: 8. 1781. **Type:** sine loco [in India orientali], Koenig (K!, LD).

= ?*H. strigosum* Willd., Sp. pl. 1(2): 743. 1798. **Holotype:** Ghana [in Guinea], Isert (B-WILLD 3253!; **Isotypes:** C!, P-JU 6571!).

Fig.: NASIR, Fl. Pakistan 191: 26, fig. 7 G-M (sub *H. strigosum*).

Perennial or sometimes flowering the first year also, 5-40 cm tall, branched from base, prostrate, ascending or erect; indument appressed villose, hairs minutely pilose. Leaves 3-15 mm long, 1-2 mm broad, linear-lanceolate, linear-oblong or lanceolate, acute at top, attenuate at base, margin distinctly revolute, sessile or shortly petiolate, both sides densely covered with appressed hairs. Inflorescence 1-9 cm long with bracts up to 7 mm long. Calyx subsessile or in lower flowers with pedicel up to 2 mm; calyx lobes 1.5-3 mm long, 0.3-1 mm broad, linear-lanceolate, acute at top, nearly free to base, outside densely appressed hairy, inside subglabrous only with few hairs at top. Corolla 2-3 mm long, $\pm$ infundibular or tubular, inside pilose only at the top of anthers, outside in upper 2/3 appressed upwards pilose, in lower 1/3 glabrous; corolla lobes triangular-ovate, $\pm$ acute. Anthers 0.6-0.8 mm long, crowding together at apex, acute, broad at base, inserted $\pm$ 1 mm above corolla base. Stigma ca. 0.5 mm long, shortly conical, acute at apex, glabrous or pilose. Style 0.1-0.2 mm long, prominent or sometimes hidden by stigmatic disk, glabrous. Nutlets 1-1.5 mm long, subglobose, pilose.

General distribution: E Africa, Arabian Peninsula, Pakistan and India.

Specimens seen:

Pakistan. Bannu: Tutaki, 50 km N Bannu, 33°00'N, 70°40'E, substr. arenaceo, 700 m, 24.5.1965, *Rechinger* 30093 (W). -- Dera Ismail Khan: Montes Sulaiman, 100 km E Fort Sandeman, 31°21'N, 69°31'E, inter Mughal Kot et Daraban, 31°44'N, 70°22'E, 900-700 m, 21.5.1965, *Rechinger* 29977 (M, W) - Pezu inter Dare Ismail Khan, 31°51'N, 70°56'E, et Bannu, 33°00'N, 70°40'E, in collibus arenaceis, 400 m, 24.5.1965, *Rechinger* 30035 (M, W) - between Moghal Kot and Daraban, 21.5.1965, *Kazmi* 1970 (M). -- Hazara: Tabela Dam, 14.9.1971, *Kazmi* 3698 (M). -- Quetta: Infra Mach, 29°52'N, 67°20'E, 600-800 m, 6.5.1965, *Rechinger* 28765 (W). -- Karachi: 12 km W Bela, 26°12'N, 66°20'E, in arenosis, 9.4.1965, *Rechinger* 27583 (M, W) - 10-20 km N Hab Chauki, 25°05'N, 66°55'E, 30.4.1965, *Rechinger* 28618 (M, W).

Together with several other species and a lot of infraspecific taxa *H. marifolium* sensu strictu belongs to a very complex and variable group with an extremely wide distribution range from Africa, the Arabian Peninsula to Pakistan, India and Australia, e.g. *H. strigosum* Willd. [W Africa], *H. sessilistigma* Hutch. & E.A.Bruce [E Africa], *H. brevifolium* Wall. [Asia], *H. paniculatum* R.Br. [Asia & Australia]. The characteristic feature of this group are bracteate cymes. NASIR in Flora of Pakistan (1989: 25 ff.) did not review this group critically and followed the treatment of KAZMI (1970) nearly without changes. For the material cited by him under the name *H. zeylanicum* subsp. *paniculatum* see note under *H. zeylanicum* (see p. 269). VERDCOURT in Flora of Tropical East Africa (1991: 73) discussed this problem only for

eastern Africa without referring to *H. marifolium*. We have not found any constant character to sort our material into more than one species, but of course Flora Iranica Area covers only a small part of the whole distribution range of this complex. Therefore due to few material and difficulties in studying all the concerning types we used the name *H. marifolium* in wider sense not only as the oldest one but also as a name described from a neighbouring area.

The report from Kuhe Genou north of Bandar Abbas (Rechinger & Wendelbo, 1985) is a misidentification of *H. rariflorum*.

27. *Heliotropium micranthum* (Pall.) Bunge, Beitr. Kenntn. Fl. Russl.: 233. 1852 (et in Mém. Acad. Imp. Sci. St.-Pétersbourg Divers Savans 7: 399. 1854) = *Onosma micranthos* Pall., Reise russ. Reich. 2 (2): 485 nomen, 734 descr., tab. L. 1773 = *Tournefortia micranthos* (Pall.) A.DC. in DC., Prodr. 10: 67. 1846 = *Beruniella micrantha* (Pall.) Zakirov & Nabiev, Consp. fl. asiae mediae 8: 98 et 169. 1986. **Holotype**: sub *Onosma micranthos*: in arenis ad Irtin & in deserto arenoso inter Iaikum et Volgam sito, VII, Pallas (Archiv Acad. St. Petersburg!).⁵⁾

Fig.: PALLAS (1773): tab. 50; LÉONARD (1985): 23, fig. 2 A-B; 25, fig. 3 A-B.

Psammophytic annual, 10-20 cm high, simple or branched, lower branches subopposite, sparsely hairy, more dense in upper parts, hairs 0.5-1 mm. Leaves 10-25 mm long, 7-10 mm broad, ovate, oblong-ovate or oblong-elliptic, acute or subobtuse at top, rounded or cordate at base, petiole 10-30 mm, margin entire to subrevolute; upper side very sparsely pilose, patent or subappressed; lower side somewhat densely patent, with tuberculate hairs. Inflorescence laxe, subpaniculate, with 3-7 flowers; pedicel of flowers long, as much as 4 times of calyx length. Calyx lobes in flowers 1.5-2.5 mm long, 0.4-1 mm broad, enlarging at time of fruiting and then 4-4.5 mm long, 1-1.3 mm broad, oblong-lanceolate, acute. Corolla 2-3 mm long, tubular, inside glabrous, outside downwards appressed pilose, sometimes with very short intercalary teeth; corolla lobes very minute, ca. 0.2-0.4 mm broad, acute. Anthers 0.7-1.1 mm long, inserted 0.9-1.2 mm above corolla base. Stigma 0.6-0.7 mm long, conical, at the apex pilose. Style 0.5-0.8 mm long, subglabrous. Nutlets 2-4.5 mm long, 1-1.3 mm broad, two times longer than broad, oblong-ellipsoid, covered by long silky hairs.

General distribution: Central Asia, Iran.

Specimens seen:

Iran. Khorassan: Est du Dashte-Lut, a l'est des grandes dunes, 59°52'E, 30°42'N, 13.5.1977, Léonard 6184 (BR, W) - Sabzevar, zwischen Deh-e Bala und Oghz, IV.1976, s. coll. 56 (TARI). -- **Semnan:** 2.5 km N of Darbahang, at old road to Rezaabad, 900 m, 13.5.1978, Freitag 15/326 (KAS) - Touran Protected Area, in arenosis mobilis prope Darb-Ahang, 35°50'N, 56°37'E, 18 km NNE Ahmadabad, 800 m, 29.4.1975, Rechinger 50671 (W) - 5-10 km S Ahmadabad, 35°46'N, 56°36'E, versus Zamanabad, 35°46'N, 56°47'E, in arenosis, 900-950 m, 30.4.1975, Rechinger 50715 (W).

This species was splitted from *Heliotropium* to the monotypic genus *Beruniella* by ZAKIROV & NABIEV (1986: 169) only on base of its habit, the racemos inflorescence, the long

⁵⁾ The type of this species is not in LE. The archive of the Academy of St. Petersburg holds a handwritten, not published manuscript of PALLAS which contains drawings of plants together with their exact appertaining specimens. Only some of the pictures were really published (like in our case *Onosma micranthos* in PALLAS, Reise 2(2): tab. 50) and the plants described as new!

pedicelled flowers and the enlarged calyx at fruiting time. In *Heliotropium* these characters are not very common, but e.g. many other species have the potential to develop pedicelled flowers at least in the lower part of inflorescences too. Therefore this separation to an own genus is not accepted here and the species integrated under *Heliotropium* again.

See also note under *H. acutiflorum* Kar. & Kir. (see p. 269).

28. *Heliotropium noeanum* Boiss., Diagn. pl. orient., 2. ser., 3: 132. 1856. **Lectotype** (hoc loco designatus): in subalpinis Haneky [Khanag, 9.1851], Noë [981] (G-BOIS!; **Isotypes**: GOET!, LE!, P!).
- = *H. haussknechtii* Vatke, Z. Gesamte Naturwiss. (Halle) 45: 128. 1875, non Bunge 1869, nom. illegit. **Lectotype** (hoc loco designatus): in monte Asmirdagh pr. Sulimanieh Kurdistaniae, 4000', 7.1867, *Haussknecht* 667 (JE!; **Isotypes**: LE!, M!, P!, W!).
- = *H. noeanum* var. *edentulum* Boiss., Fl. or. 4: 128. 1879. **Syntypes**: in cultis vallis Chyrsan Susianae, pr. Bebehan, VIII.1868, *Haussknecht* (BM!, G-BOIS!, JE!, P!); in ruderatis montes Avroman et Schahu et circa Sulimanieh, 3000-6000', 7.1867, *Haussknecht* (G-BOIS!, JE!, K!); Darrian ad ped. Schahu, 5000', 7.1867, *Haussknecht* (JE, M!, P!); ? Masibin, 7000', 8.1867, *Haussknecht* (JE!); in valle fl. Chyrsan prope Bors, 8.1868, *Haussknecht* (JE, LE!, P!, W!).
- = *H. schahpureense* Bornm., Beih. Bot. Centralbl. 61 (2): 88. 1941. **Syntypes**: Persia in ditone Khischt [S-Persien: Prov. Farsistan], in arvis Lesoni prope Schahpur (unweit Kaserun), VII.10.1902, *Alexeenko* 900 (B!, photo W!, LE); Persia in ditone Khischt in collibus gypsaceis prope p. Kumaridsch, 7.10.1902, *Alexeenko* 897 (B!, LE!, M!). **Lectotype** (hoc loco designatus): Persia in ditone Khischt [S-Persien: Prov. Farsistan], in arvis Lesoni prope Schahpur (unweit Kaserun), 7.10.1902, *Alexeenko* 900 (B!: photo W!; **Isotype**: LE).
- = *H. borasdjunense* Rech.f., Ann. Naturhist. Mus. Wien 55: 6. 1947. **Holotype**: In der Sah'ra von Borasdjun [Borazjan], 23.4.1885, *Stapf* 587 (W!; **Isotype**: K!).

Fig.: plate 7 e, page 235.

Annual, rarely perennial (especially in southern distribution range), 20-50 cm high, erect or ascending, branched from base, stem divaricately branched; indument whitish villose to subtomentose, usually patent, hairs up to 1 mm long. Leaves 10-35 mm long, 7-30 mm broad, ovate, obtuse to slightly acute at top, subtruncate to rounded at the base, margin $\pm$ simple, sessile or with short petiole up to 5 mm; nerves in upper side impressed, in lower one prominent. Inflorescence single or branched of two cymes, terminal and lateral; each cyme up to 20 cm long, with 20-50 flowers, unilateral and uniseriate, rarely biseriate. Calyx easily dropping; calyx lobes 1.7-3 mm long, 0.5 -1 mm broad, lanceolate, subacute to obtuse, nearly free to base, both sides villose. Corolla 3-4.5 (-5) mm long, subhypocrateriform, strongly plicate, inside glabrous, outside appressed downwards pilose; lobes rotundate, 0.4-2 mm broad, margin entire or indistinctly crenulate, intercalary lobes usually present, triangular-subulate, broadened at base. Anthers 1.2-1.5 (-1.6) mm long, apex obtuse, obscurely emarginate, inserted 0.9-1.4 mm above corolla base. Stigma 0.6-1.1 mm long, elongate-conical, apex pilose. Style (0.2-) 0.3-0.7 mm long, pilose. Nutlets ovate, almost glabrous, surface rugose.

General distribution: Western and southwestern Iran and northeastern Iraq.

Specimens seen:

Iraq. Kirkuk: in monte Asmirdagh pr. Sulimanieh Kurdistaniae, 4000', 7.1867, *Haussknecht* 667 (JE, LE, M, P, W) - in ruderatis montes Avroman et Schahu et circa Sulimanieh, 3000-6000', 7.1867,

Haussknecht s.n. (G-BOIS, JE, K, LE) - Darrian ad ped. Schahu, 5000', 7.1867, *Haussknecht* s.n. (M, P) - in subalpinis Haneky [Khanaqin, 9.1851], *Noë* [981] (G-BOIS, GOET, LE, P) - in desertis ad confines iranicos prope Khanaqin, 18.8.1937, *Rechinger* 2146 (W) - dto., 5 km meridiem versus, 27.8.1957, *Rechinger* 15491 (W) - 45 km southeast of Kirkuk, Kirkuk Liwa, 31.8.1963, *Brahim* 6124 (W) - 10 km north of Kirkuk, Kirkuk Liwa, 1.9.1963, *Brahim* 6150 (W). -- Mosul: Ad confines Turciae. Kakari, inter Dohuk et Amadiya, ab amadia ca. 15 km occidentem versus, substr. arenaceo, ca. 1000 m, 10.-12.7.1957, *Rechinger* 11633 (M, W, Herb. PODL.) - dto., in faucibus ab Amadiya, ca. 3 km occident. versus, 1000 m, *Rechinger* 11946 (W). -- Solaimaniya: Halabja, in agris incultis, ca. 700 m, 15.6.1957, *Rechinger* 10128 (M, W) - Montes Avroman ad confines Persiae, in ditione pagi Tawilla, 1200 m, 15.-18.6.1957, *Rechinger* 12396 (W). -- Arbil: Montes Qandil, in quercetis saxosis infra Pushtashan versus Shahidan, ca. 1000 m, 8.-9.8.1957, *Rechinger* 11938 (W) - dto., ca. 36°30'N, 45°E, Pushtashan, in glareosis, ca. 1100 m, 28.7.-1.8.1957, *Rechinger* 11048 (W) - in saxosis calc. jugi inter Dokan et Mirza Rustam, ca. 1200 m, 28.7.1957, *Rechinger* 10992 (M, W) - in lapidosis calc. faucium infra Rowanduz, ca. 700 m, 8.-9.8.1957, *Rechinger* 11236 (M, W) - in faucibus inter Rowanduz et Bersorin, in fissuris rupium calc., ca. 700 m, 8.-9.8.1957, *Rechinger* 11271 (M, W) - Rowanduz, 680 m, 3.8.1947, *Gillett* 9443 (W) - in valle inter Rayat et Haji Omran, ca. 1100-1400 m, 8.-9.8.1957, *Rechinger* 11277 (W). -- Diyala: Jabal Hamrin inter Sharaban et Jalaula, substr. arenaceo., 12.6.1957, *Rechinger* 9963 (M, W).

Iran. Kordestan: in saxosis et ad versuras 47 km W Bijar, versus Divandareh, 2000 m, 2.7.1971, *Rechinger* 42690 (W) - Kowleh, 65 km N Sanandaj versus Divandareh, 1950 m, 29.6.1974, *Rechinger* 48516 (W) - in declivibus saxosis (Tonschiefer) inter Hoseynabad et Divandarreh, 60-70 km N Sanandaj, 1850 m, 2.7.1971, *Rechinger* 42700 (W) - 5 km to Divandarreh from Sanandaj, 1650 m, 7.7.1994, *Chehregani & Zarre* 17858 (M, TEH, Herb. Förther) - ad lacum prope Marivan (Dezh Shahpur), 1300 m, 6.7.1971, *Rechinger* 42968 (M, W) - Montes Chehel Cheshmeh, in quercetis (*Quercus brantii*) 15 km E Marivan, 1400 m, 6.7.1971, *Rechinger* 42980 (W) - Bijar area, Chehel-Amiran village, *Assadi* 61002 (TARI) - in subalpinis Persicae Kurdistan, sept. 1851, *Noë* 32 (P) - inter Sanandaj et Saez, 4 km NW Iranshahr, 30.8.1957, *Rechinger* 14752 (W) - Sanandaj, 28.10.1960, *Brown* 3375 (IRAN). -- Hamadan: Nahavand, Borzol, Sarab-e-gian, Kuhe-Garrin, 1950-2700 m, 14.7.1988, *Mozaffarian* 65070 (TARI) - Ganjnameh to Tuyserkan, 28 km Tuyserkan, 2050 m, 13.10.1977, *Termeh & Matin* (IRAN) - Hamadan to Nahavand, 35 km N Nahavand, 1450 m, 15.7.1974, *Termeh & Matin* (IRAN). -- Kermanshahan: inter Qasre-Shirin et Kermanshah, in collibus arenosis prope Sare Pol, 7-20 km E Qasr Shirin, 28.8.1957, *Rechinger* 14601 (W) - inter Kermanshah et Sanandaj, 73 km NW Taq-i Bostan, in saxosis serpent, 29.8.1957, *Rechinger* 14667 (M, W) - Taq-i Bostan prope Kermanshah, 29.8.1957, *Rechinger* 14632 (M, W) - Tagh-e Bostan to Parrow mts., 10 km on the sandy road after military station, 1500-1600 m, 6.7.1994, *Chehregani & Zarre* 17815 (M, TEH, Herb. Förther) - between Qasre-Shirin and Eslamabad (previous Shahabad), 15.6.1965, 1470 m, *Seraj* 24857 (TARI) - Road of Paveh-Doab, woodland next to the brooklet, 22.9.1987, *Hamzehee* 1873 (TARI) - between Bakhtaran [Kermanshah] to Mahidasht, 1 km to Police, 1400 m, 25.7.1987, *Hamzehee & Mirabdali* 1524 (TARI) - 43 km N of Bakhtaran [Kermanshah], above the village Maimoonabad, Parro Mountains, 1810-1880 m, 27.7.1987, *Hamzehee & Hatami* 1555 (TARI) - N of Bakhtaran [Kermanshah], Varleh, Chiamaran, 1350-1500 m, 25.8.1987, *Fattahi & Hamzehee* 1667 (TARI) - inter Kermanshah et Sanandaj, 30 km NW Taqi-Bostan, in saxosis calc. 29.8. 1957, *Rechinger* 14634 (M, W) - Rijab to Sarabe-Eskandar, 22.6.1968, *Iranshahr & Dezfulian* (IRAN) - Rijab, 20.6.1968, *Iranshahr & Dezfullian* 16234 (IRAN) - Sareh, Ab-Barik, 8.7.1976, *Nouri* 35061 (IRAN). -- Ilam: 16 km SW of Ilam, in the road of Mehran, 1100-1550 m, 3.8.1989, *Akhani* 5433 (MMTT) - ca. 22 km SE of Mehran, in the road towards Dehloran, Pole-Changouleh, ca. 300 m, 3.8. 1989, *Akhani* 5450 (MMTT) - ca. 40 km NE of Mehran, in the road towards Ilam, 700 m, 3.8.1989, *Akhani* 5434 (MMTT) - ca. 15 km NE of Mehran, Konjancham, ca. 350 m, 3.8.1989, *Akhani* 5441 (MMTT, Herb. PODL.) - ca. 56 km NW of Dehloran, in the road to Mehran, 450 m, 3.8.1989, *Akhani* 5459 (MMTT, Herb. PODL.) - ca. 40-45 km NE of Mehran in the road towards Ilam, 800 m, 16.10.1993, *Akhani* 9008 (Herb. AKHANI) - ca. 35 km NE of Mehran in the road towards Ilam, 16.10.1993, *Akhani* 9019 (Herb. AKHANI, Herb. PODL.) - in valle Chyrsan prope Bors, 8.1868, *Haussknecht* (JE, LE, P, W) - in cultis vallis Chyrsan Susianae, pr. Bebehan, 8.1868, *Haussknecht* s.n. (BM, G-BOIS, JE, P). Lorestan: 46 km S of Malavi, 82 km N of Andimeshk, 500 m, 3.7.1964, *Grant* 15/927 (W). Fars: in ditione Khischt [Khiochf], in arvis Lesoni prope Schahpur (unweit Kaserun), 7.10.1902, *Alexeenko* 900 (B) - in ditione Khischt in collibus gypsaceis prope p. Kumaridsch

[Kamarizsh], 7.10.1902, *Alexeenko* 897 (B, LE, M) - Kazeroun, Parishan Lake, 830 m, 27.4.1972, *Foroughi* 3590 (TARI) - Kazeroun, 23 km Bushehr road, 880, 25.4.1973, *Riazi* 9274 (TARI) - 25 km SE of Fasa, Salou village, Kuhe-Qaz, 1600-2200 m, 5.6.1983, *Mozaffarian* 46798 (TARI) - 18 km from Chenar-Shahijan towards Kaseroun, ca. 2 km after Bishapur, ca. 750 m, 19.11.1991, *Akhani* 7922 (Herb. AKHANI) - N Famur (Parishan) Lake, around Environmental Protection Station, 820 m, 19.11.1991, *Akhani* 7935 (Herb. AKHANI) . -- Khuzestan: ca. 35 km W of Andimeshk, in the road to Dehloran, ca. 150 m, 4.8.1989, *Akhani* 5483 (MMTT) - 70 km from Ahvaz to Ramhormoz, near Marbacheh, 130 m, 15.11.1985, *Mozaffarian* 58492 (TARI) - Andimeshk, Hoseiniech, 420 m, 14.11.1985, *Mozaffarian* 58428 (TARI) - Izeh, Soussan, 500 m, 27.5.1973, *Iranshahr & Moussavi* 16834 (IRAN). -- Bushehr: Near Borazjan, on road to Genaveh, 70 m, 4.10.1974, *Bokhari et al.* 14779 (TARI) - in der Sah'ra von Borasdjün [Borazjan], 23.4.1885, *Stapf* 587 (W) - 2-3 km NE of Khormuj, 150 m, 4.3.1978, *Runemark & Mozaffarian* 27155 (TARI) - Kazeroun, 1000 m, 9.9.1955, *Remaudiere* 75 (W) - Dalaki, in wastelands of the village, 20.11.1991, *Akhani* 7953 (Herb. AKHANI).

H. noe anum is a frequent species in the foothills of Zagros Mountains around the roads, as weed in arable land and wastelands, and in the gypsum and calcareous hills. In its most southern distribution area as well annual as perennial forms appear probably caused by the warmer climatic situation. Such forms have been previously described under various species like *H. borasdjunense* and *H. schahpurense*. During field studies at their type localities in October it was found that the plants are basically annual, but within the populations there are also some forms outlasting more than one season.

The type locality of *H. schahpurense* in Flora Iranica (RIEDL 1967: 34) from Azerbaijan is certainly incorrect. Both in original description (BORNMÜLLER 1941: 88) as on herbarium label BORNMÜLLER has mentioned Fars near Kaseroun (see above). Shahpur is a small village between Kaseroun and Komaraj. The name of Shahpur in Azerbaijan is a new name for Salmas given during Pahlavi Regime. The previous at the time of Qajar when ALEXEENKO has travelled and the actually name again of this city is Salmas. (Thanks for this information and discussion to Dr. M. IRANSHAHR).

29. *Heliotropium ophioglossum* Boiss., Fl. or. 4: 145. Syntypes: Sindh [Jemidar ka Landa near Kurrachi], 1861, *Stocks* (E, G!, G-BOIS?, K!, LE!, W!); in Beluchistan, 1857, *Frere* in Herb. *Stocks* 466 [sub *H. ditricho*]. **Lectotype** (hoc loco designatus): in Beluchistan, 1857, *Frere* in Herb. *Stocks* 466 [sub *H. ditricho*] (K!; **Isotype:** K!).

Fig.: NASIR, Fl. Pakistan 191: 22, fig. 6 M-P.

Perennial, up to 45 cm tall, woody and branched from base, obliquely branched in stems, plants appearing leafy throughout, indument villose of short thin hairs mixed with long strigose and tuberculate hairs up to 1.5 mm length. Leaves 1-4 cm long, 0.3-1 (-1.3) cm broad, narrowly elliptic to lanceolate, subacute at top, angustate and narrowing at base into a petiole-like organ, margin in younger leaves distinctly undulate, in older leaves thick and $\pm$ plane, both sides villose mixed with long strigose tuberculate hairs. Inflorescence terminal, rarely lateral, simple or with two branches; cymes ca. 15 cm long with up to 30 flowers, unilateral, uniseriate. Calyx sessile, easily dropping; calyx lobes 3-4.5 mm long, 0.6-0.8 mm broad, linear-oblong, nearly free to base, inside pubescent to subglabrous at base, outside densely with long strigose hairs. Corolla 4-6 mm long, hypocrateriform, plicate, inside glabrous, outside at the middle sparsely pilose; corolla lobes ca. 1 mm broad, rotundate, imbricate, sometimes with short intercalary teeth. Anthers ca. 2 mm long, emarginate, inserted 1-2 mm above corolla base. Stigma 4-5 mm long, elongate-subulate, exerting corolla tube, apex prominently bifid recurved, glabrous. Style ca. 0.1-0.5 mm, glabrous, $\pm$ inconspicuous. Nutlets 1.3-1.5 x 0.8-1 mm large, ovoid to subglobose, black, papillose, slightly rugose.

General distribution: Endemic in South Pakistan.

Specimens seen:

Pakistan. Karachi: Sindh [Jemidar ka Landa near Kurrachi], 1861, *Stocks* (E, G, K, LE, W) - Karachi University Campus, 21.4.1974, *Kazmi* 5458 (M) - Malir Cantonment, 15.7.1963, *Abid* 35 (M) - 10-20 km N Hab Chauki, 25°05'N, 66°55'E, 30.4.1965, *Rechinger* 28617 (M, W). -- Not exactly to localize: in Beluchistan, 1857, *Frere* in Herb. *Stocks* 466 (K).

H. ophioglossum is a typical species easily distinguished by its long exerting stigma of 4-5 mm length. Its distribution in Flora Iranica Area is limited to the very southeastern part.

30. *Heliotropium rariflorum* Stocks, J. Bot. (Hooker) 4: 174. 1852. **Type:** Hills of Scinde and Lower Beloochistan. **Lectotype** (hoc loco designatus): Scinde, Jemadar Ka Landa near Kurrachi, 1851, *Stocks* 492 (K!; **Isotypes:** G-BOIS!, K!).⁶⁾

Fig.: plate 7 f, page 235; NASIR, Fl. Pakistan 191: 26, fig. 7 A-F.

Suffrutescent perennial, 10-40 cm high, bushy branched, indument appressed, ± strigose. Leaves 5-25 mm long, 2.5-4 mm broad, linear-lanceolate, acute at top, broadened at the base, slightly constricted above swollen base, margin revolute; covered on both sides with appressed hairs. Inflorescence terminal, simple or branched, with 2-4 mm long bracts; cymes up to 5 cm long with 4-9 flowers, which are sessile or with short pedicel up to 0.5 mm. Calyx ± persistent; calyx lobes 2-2.5 mm long, 0.5-0.7 mm broad. Corolla 2-2.5 mm long, campanulate, inside sparsely pilose, outside in upper 1/3 pilose; corolla lobes ca. 1 mm broad, rounded, without intercalary lobes. Anthers ca. 0.6 mm long, acute, inserted 0.8-1.2 mm above corolla base, with distinct filament attached to base of anthers. Stigma ca. 0.5 mm long, glabrous. Nutlets 4.

General distribution: Eastern and southeastern Africa, Arabian Peninsula, South Iran, South Pakistan.

Specimens seen:

Iran. Hormozgan: Kuhe Genou, S side, stony slope, 280-700 m, *Wendelbo & Foroughi* 15324 (TARI).

Pakistan. Karachi: Jemadar Ka Landa, 1851, *Stocks* 492 (G-BOIS, K) - Damloti, 1.3.1965, *Tasneef* (M).

Generally this species is easily to distinguish from *H. marifolium* by its campanulate corolla with scattered hairs inside, clavate stigma and anthers not crowding at apex. In *H. marifolium* corolla is more or less infundibular to tubular with hairs inside restricted to a zone above anthers, stigma is conical and anthers are crowded at the apex.

31. *Heliotropium remotiflorum* Rech.f. & Riedl in Rech.f., Fl. Iranica 48: 35. 1967.

Holotype: W Pakistan, Makran: Suntsar versus Kikki, 17.4.1965, *Rechinger* 27990 (W!; **Isotypes:** B!, G!, K!, LE!, M!, TARI!, fragm. BR!).

⁶⁾ The declaration Holotype in VERDCOURT (1991: 70) is not correct because there are at least three specimens of *Stocks* 492 in the Herbarium of Kew without specification of type by STOCKS himself.

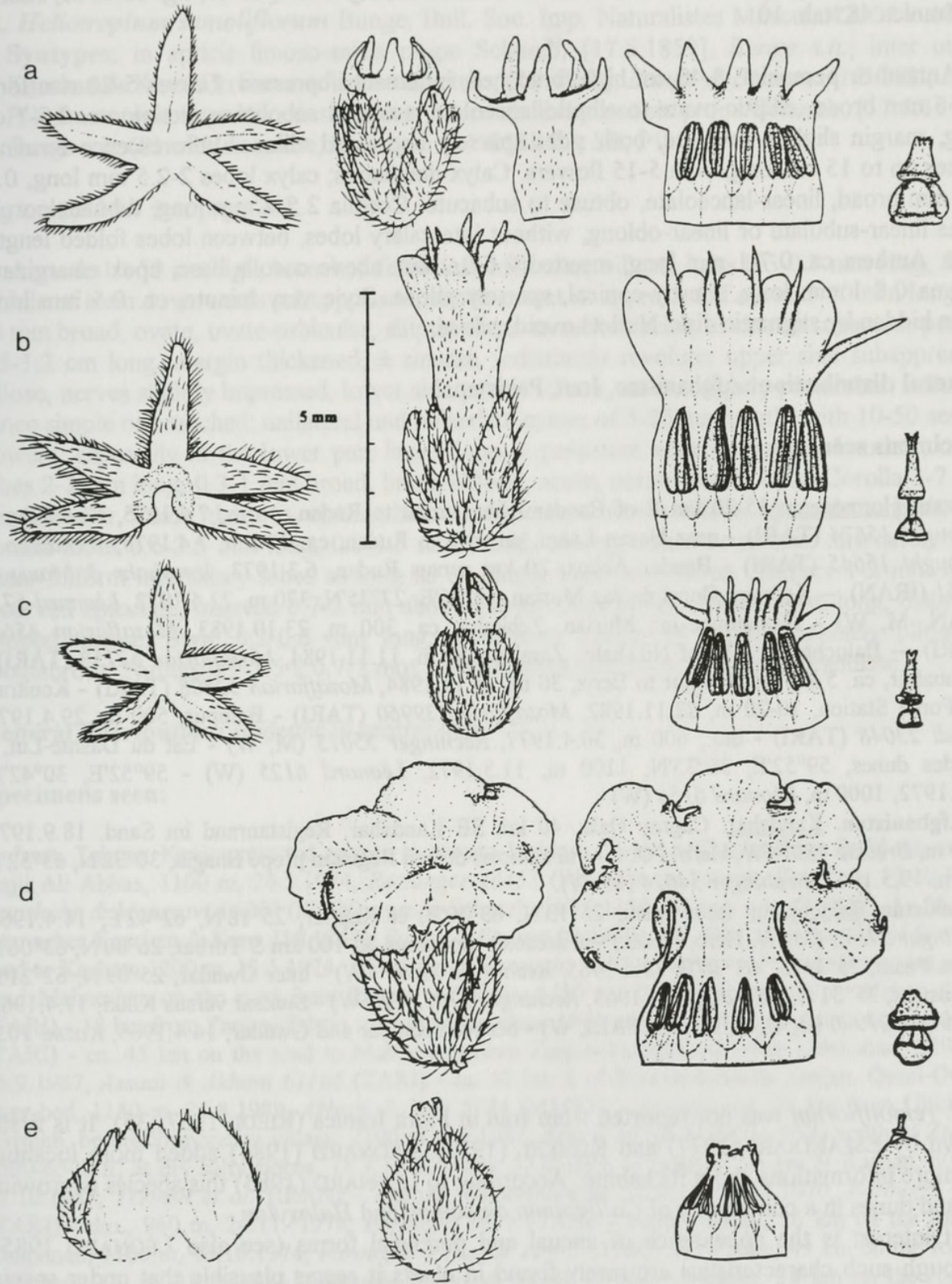


Plate 14: a) *H. remotiflorum* Rech.f. & Riedl (Iranshahr & Moussavi 16251); b) *H. samoliflorum* Bunge (Wendelbo et al. 14433); c) *H. samoliflorum* Bunge (Assadi & Akhani 61131); d) *H. suaveolens* M.Bieb. (Mozaffarian 64270); e) *H. supinum* L. (Akhani 88/150).

= *H. alii* Y.J.Nasir, Candollea, 42: 553, fig. 1. 1987. **Holotype:** Pakistan: S Makran, 8 miles from Sunstar, Turbat road, *Ali, Faruki & Abedin 1101* (KUH non vidi).

Fig.: plate 14 a, page 261; NASIR, Fl. Pakistan 191: 29, fig. 8 L-Q & 47, fig. 13 K-M; RIEDL, Fl. Iranica 48: tab. 10.

Annual or perennial, 8-40 cm high, branched, indument impressed. Leaves 5-20 mm long, 2.5-6 mm broad, elliptic-ovate to elliptic-lanceolate, acute or subobtusate, petiole ca. 0.5-1 cm long, margin slightly revolute, both sides sparsely impressed villose. Inflorescence terminal; cymes up to 15 cm long, with 5-15 flowers. Calyx deciduous; calyx lobes 2-2.5 mm long, 0.5-0.7 mm broad, linear-lanceolate, obtuse to subacute. Corolla 2.5-4 mm long, tubular; corolla lobes linear-subulate or linear-oblong, without intercalary lobes, between lobes folded lengthwise. Anthers ca. 0.7-1 mm long, inserted 0.6-0.9 mm above corolla base, apex emarginate. Stigma 0.8-1 mm long, shortly-conical, sparsely pilose. Style very minute, ca. 0.5 mm long, often hidden by stigmatic disk. Nutlets ovoid, pilose.

General distribution: Afghanistan, Iran, Pakistan.

Specimens seen:

Iran. Hormozgan: 15-20 km E of Bandar Abbas, road to Rudan, 40 m, 7.4.1975, *Wendelbo & Foroughi 15674* (TARI) - near Hasan Langi, on road to Rudan, ca. 100 m, 7.4.1975, *Wendelbo & Foroughi 15645* (TARI) - Bandar Abbas, 20 km versus Rudan, 6.3.1973, *Iranshahr & Moussavi 16251* (IRAN). -- Kerman: Ouest du Jaz Murian, 58°35'E, 27°35'N, 370 m, 22.4.1972, *Léonard 5726* (IRAN, M, W) - Hammoune-Jaz Murian, Zehkalat, ca. 300 m, 23.10.1983, *Mozaffarian 45612* (TARI). -- Baluchestan: SW of Nikshahr, Zarabad, 50 m, 11.11.1984, *Mozaffarian 52758* (TARI) - Chahbahar, ca. 5 km from Negur to Beris, 30 m, 13.11.1984, *Mozaffarian 52808* (TARI) - Konarak, Air Force Station, 10-20 m, 22.11.1982, *Mozaffarian 39960* (TARI) - Bampur, 500 m, 29.4.1977, *Assadi 23048* (TARI) - dto., 600 m, 30.4.1977, *Rechinger 55013* (M, W) - Est du Dashte-Lut, a grandes dunes, 59°52'E, 30°35'N, 1100 m, 11.5.1972, *Léonard 6125* (W) - 59°52'E, 30°42'N, 12.5.1972, 1000 m, *Léonard 6158* (W).

Afghanistan. Kandahar: Cagray Qala, 40 km SE Kandahar, Registanrand im Sand. 18.9.1976, 1050 m, *Breckle 4827* (W, Herb. PODL.) - in arenosis deserti Registan prope Bhagat, 30°32'N, 63°52'E, 600 m, 19.5.1967, *Rechinger 34614* (M, W).

Pakistan Baluchistan: inter Pasni, 25°13'N, 63°30'E, et Kappar, 25°18'N, 62°42'E, 14.4.1965, *Rechinger 27875* (M, W, Herb. PODL.) - in arenosis mobilibus 90-100 km S Turbat, 26°00'N, 63°06'E, versus Pasni, 25°13'N, 63°30'E, 13.4.1965, *Rechinger 27847* (W) - inter Gwadar, 25°09'N, 62°21'E, et Sunstsar, 25°31'N, 62°02'E, 17.4.1965, *Rechinger 27972* (M, W) - Sunstsar versus Kikki, 17.4.1965, *Rechinger 27990* (B, G, K, LE, M, TARI, W) - between Kappar and Gwadar, 14.4.1965, *Kazmi 1036* (M).

H. remotiflorum was not reported from Iran in Flora Iranica (RIEDL 1967: 35). It is firstly known by ESFANDIARI (1977) and KUNKEL (1977). LÉONARD (1984) added more localities and more informations about its habitat. According to LÉONARD (1985) this species is growing on sand dunes in a community of *Calligonum amoenum* and *Haloxylon*.

Of interest is the appearance of annual and perennial forms (see also LÉONARD 1985). Although such characteristics are rarely found in plants it seems plausible that under special climate without any real winter some annual plants may thrive another next year because there is no real obligatory natural interruption in their life cycles.

RIEDL (1967: 35) described *H. remotiflorum* with hairy corolla inside, but the examination of the holotype, isotypes and other material from Iran and Pakistan showed a glabrous corolla inside. NASIR (1987: 553) published *H. alii* as a new species from Pakistan with location near to the type locality of *H. remotiflorum*. He has distinguished his "new species" from *H.*

remotiflorum by its glabrous corolla inside. Based on his description, illustration of corolla and collection locality there is no doubt that both are identical.

32. *Heliotropium samoliflorum* Bunge, Bull. Soc. Imp. Naturalistes Moscou 42: 314. 1869.

Syntypes: in apricis limoso-salsis prope Schurab, [17.5.1859], *Bunge s.n.*; inter urbes Kaschan & Kum, Persiae mediae occidentalis, [10.1868], *Bunge & Bienert* (G-BOIS!, LE!, P!). **Lectotype** (hoc loco designatus): in apricis limoso-salsis prope Schurab, [17.5.1859], *Bunge s.n.* (P! with diagnose; **Isotypes:** G-BOIS!, K!, M!, P!).

Fig.: plate 14 b + c, page 261.

Annual, 10-50 cm high, branched from base and stem; villose, hairs 0.5-0.7 mm long, from middle of stem downwards subappressed, above patent or appressed. Leaves 5-40 mm long, 2-28 mm broad, ovate, ovate-orbicular, elliptic-ovate to suborbicular, obtuse to subacute, petiole 0.5-1.2 cm long, margin thickened, $\pm$ sinuate, indistinctly revolute; upper side subappressed villose, nerves slightly impressed, lower side patent villose, nerves slightly prominent. Inflorescence simple or branched; unilateral und uniseriate cymes of 5-25 cm length, with 10-50 sessile flowers, especially in the lower part laxe. Calyx $\pm$ persistent after dropping of nutlets; calyx lobes 2-3 mm long, 0.3-1 mm broad, linear-oblong, acute, nearly free to base. Corolla 3-7 mm long, tubular, inside glabrous, outside below middle downwards villose, upwards subglabrous; corolla lobes 0.6-2.5 mm long, 0.3-1.5 mm broad, oblong, acute or obtuse, alternately with linear-filiform intercalary lobes as long as or longer than main lobes. Anthers 1-2 mm long, recurved apiculate, inserted 0.7-2 mm above corolla base. Stigma 0.9-1.7 mm long, distinctly bilobed, pilose. Style 0.2-0.8 mm long, sometimes hidden by stigma, sparsely pilose to subglabrous. Nutlets 0.9-1.5 x 0.7-1 mm, ovoide, black, glabrous, obscurely granulate.

General distribution: Endemic in central Iran.

Specimens seen:

Iran. Tehran: Kavir protected region, in deserto lapidoso 34 km a Chashmeh-ye Safid Ab versus Hajji Ali Abbas, 1100 m, 26.5.1974, *Rechinger 46457* (W) - Kavire-Namak, Kushkuh, 13.10.1972, *Iranshahr & Moussavi 16238* (IRAN) - prope Schurab, [17.5.1859], *Bunge s.n.* (G-BOIS, K, M, P) - inter urbes Kaschan & Kum, [10.1868], *Bunge & Bienert* (G-BOIS, LE, P) - ca. 40 km SE of Qom, on road to Kashan, 1200 m, 13.5.1974, *Wendelbo & Foroughi 11400* (TARI). -- **Zanjan:** Beginning of the road Mahneshan on the road from Zanjan to Tabriz, 1450 m, 28.9.1987, *Assadi & Akhani 61131* (TARI) - 18 km from Zanjan-Tabriz road to Mahneshan, 1800 m, 28.5.1987, *Assadi & Akhani 61147* (TARI) - ca. 45 km on the road to Mahneshan from Zanjan-Tabriz road, after Lulakabad, 2100 m, 28.9.1987, *Assadi & Akhani 61166* (TARI) - ca. 57 km S of Mianeh towards Zanjan, Qezel-Owzan river bed, 1150 m, 26.8.1989, *Akhani & Lari 5724* (MMTT) - Zanjan area, 28 km from Ghidar to Garmab, before Pirmarzban village, 2100 m, 7.9.1987, *Assadi 60996* (TARI) - Hills south of Zanjan, 4500-6500 ft, at dry salty slopes, 18.7.1962, *Furse 3238* (W). -- **Esfahan:** 15 km N Kashan, 800 m, 27.10.1987, *Termeh et al.* (IRAN) - Kashan, Khorramdasht, 1120 m, 23.11.1970, *Foroughi 1060* (TARI) - dto., 960 m, 24.11. 1970, *Foroughi 1053* (TARI) - Nain, Anarak, 16 km on the road to Chupanan, 1100 m, 13.10.1974, *Foroughi & Assadi 15145* (TARI, W) - Nain, 49 km on the road to Ardestan, 970 m, 14.10.1974, *Foroughi & Assadi 15159* (TARI) - Natanz, 38 km on the road to Kashan, 1080 m, 15.10.1974, *Foroughi & Assadi 15178* (TARI, W) - 17-20 km from Kashan on the road to Qom, 850 m, 5.8.1974, *Wendelbo et al. 14433* (TARI) - Ardestan, 30 km of Anarak road, 1100 m, 11.10.1972, *Riazi 6383* (TARI).

Although this species is very variable in size of leaves and flowers, it is easily to recognize by its characteristical, long intercalary corolla lobes.

33. *Heliotropium suaveolens* M.Bieb., Fl. taur.-cauc. 3: 116. 1819 $\equiv$ *H. europaeum* L. var. *suaveolens* (M.Bieb.) Fiori & Paol., Fl. anal. Ital. 2: 382. 1902 $\equiv$ *H. europaeum* subsp. *suaveolens* (M.Bieb.) Litard. in Briq., Prodr. fl. Corse 3(2): 88. 1955. **Holotype:** in aceruis circa templum oppido transbosphorani Taman, 1818, *Steven* (LE!; **Isotypes:** B!, H 1611474!, K!).
- = *H. confertiflorum* Boiss. & Noë in Boiss., Diagn. pl. orient., 2.ser., 3: 132. 1856 $\equiv$ *H. boissieri* Gürke in Engl. & Prantl, Nat. Pflanzenfam. 4(3a): 96. 1893 nom. illegit. **Holotype:** in subalpinis pr. Haneky [Khanaqin, 9.1851], *Noë* (G-BOIS!; **Isotypes:** GOET!, LE, P!).

Fig.: plate 14 d, page 261.

Annual, 10-60 cm high, erect, stem usually branched; indument of tuberculate and $\pm$ hollow and sometimes glandulose hairs, up to 1.5 mm long. Leaves 1-4 cm long, 0.8-3 cm broad, ovate to elliptic, acute or obtuse, at base $\pm$ truncate, margin entire or slightly sinuate, petiole up to 2.5 cm long; upper side subappressed villose, nerves slightly impressed, lower side densely covered with tuberculate patent hairs, nerves prominent. Inflorescence lateral and terminal, simple or branched; biseriate cymes 2-10 (-20) cm long with 20-50 flowers. Calyx sessile, persistent after dropping of nutlets; calyx lobes free to base, linear-lanceolate, 2-3 mm long, 0.3-0.6 mm broad, acute or obtuse, on both sides villose, inside only in upper part. Corolla 4-7 mm long, tube 2-3 mm long, outside with empty tuberculate and sometimes glandulose hairs, inside glabrous; corolla lobes 1.5-3 mm broad, broadly rotundate, mainly entire, rarely obscurely crenulate, without distinct intercalary teeth. Anthers 0.8-1 mm long, inserted 0.8-1 mm above corolla base. Stigma 0.4-0.6 (-0.7) mm long, shortly conical to cape-shape, pilose, apex bilobed. Style only 0.1-0.2 mm long, glabrous, usually hidden by stigma. Nutlets 1.2-1.5 x 0.9-1.2 mm large, ovate, rugose, glabrous.

General distribution: Balkan, Armenistan, Azerbaijan, Turkey, Iraq and Iran.

Specimens seen:

Iraq. Kirkuk: in subalpinis pr. Haneky [Khanaqin, IX.1851], *Noë* (G-BOIS, GOET, LE, P) - ad confines Persiae, Khanaqin, 5 km meridiem versus, in glareosis, 27.8.1957, *Rechinger 15489* (W) - Mosul Liwa, 13.11.1964, *Barkley & Haddad 9161* (W).

Iran. Azarbajjan: between Khoda-Afarin and Parsabad, 41 km from Safarlu to Aslanduz, 200 m, 6.10.1987, *Assadi & Akhani 61596* (TARI) - Khoda-Afarin, 150 m, 28.8.1987, *Mozaffarian, 64270* (TARI) - 50 km from Kaleybar to Khoda-Afarin, 500 m, 28.8.1987, *Mozaffarian 64274* (TARI) - Dashte-Moghan, in collibus aridis inter Alireza-abad-e Jadid et Sarband, 39°35'N, 47°50'E, 200 m, *Rechinger 40226* (TARI, W) - Alireza-abad, 21.5.1971, *Iranshahr* (IRAN) - Uromieh, Ghooshchi pass, 11.7.1981, *Tarighi & Amini 764* (TARI) - Meshkinshahr, Fakhrabad, 1250 m, *Foroughi 5991* (TARI) - Moghan, Nour-Mamad, 5.5.1965, *Damanabi 33105* (IRAN) - inter Khoy et Maku, 15 km N Khoy, in incultis, 3.9.1957, *Rechinger 14936* (W) - 20' NW of Khoy, 5000 ft, 2.8.1962, *Furse 3527* (W) - 20 km SW of Khoy, 1400 m, 6.7.1968, *Petrovitz 167* (W) - Persiae borealis, *Szovits s.n.* (P). -- Kordestan: in montibus calcareis Avroman et Shahu, 1867, *Haussknecht* (P). -- Ilam: ca. 15 km NE of Mehran, Konjancham river bed, ca. 350 m, 3.8.1989, *Akhani 5443* (MMTT) - dto., 7.8.1989, *Akhani 5591* (MMTT) - ca. 22 km SE of Mehran, in the road towards Pole-Changouleh, ca. 300 m, 3.8.1989, *Akhani 5449* (MMTT) - ca. 56 km NW of Dehloran, in the road to Mehran, 450 m, 3.8.1989, *Akhani 5455* (MMTT) - ca. 20 km W of Dehloran, ca. 4 km E of Barzieh, ca. 200 m, 5.8.1989, *Akhani 5511* (MMTT) - 40-45 km from Dehloran towards Mehran, 17.10.1993, *Akhani 9055* (Herb. AKHANI). -- Lorestan: Sheshom, 33°15'N, 47°48'E, 800-1000 m, 5.6.1963, *Jacobs 6780* (W).

H. suaveolens is distributed mainly in Mediterranean area and penetrates into eastern Irano-Turanian region as well. Morphological variation of this species in Europe was discussed by

BRUMMITT (1971). *H. confertiflorum* which was described from Iraq near the border to Iran has no reasonable differences from *H. suaveolens*. GÜRKE (1893) has named it incorrectly *H. boissieri* Gürke because he probably missed that the spelling of *H. confertifolium* (Torr.) A.Gray for a Mexican species is little different.

34. *Heliotropium supinum* L., Sp. pl.: 130. 1753 $\equiv$ *Piptoclaina supina* (L.) G.Don, Gen. hist. 4: 364. 1837. **Lectotype** (VERDCOURT 1987): in Monspelii in littore maris, *Burser Herbarium* vol. 14(2): 2 (UPS).

Fig.: plate 14 e, page 161.

Annual, prostrate, stems up to 50 cm long, much branched from base and stem, indument appressed tomentose, mixed with long patent hairs of 1-1.3 mm length. Leaves 1.5-2 (-3) cm long, 1-2 cm broad, ovate to elliptic-orbicular, acute or obtuse, cuneate at the base, entire or slightly undulate at margin, petiole up to 1 cm; nerves impressed on upper side, prominent on lower one. Cymes lateral and terminal, relatively short, up to 6 cm long, with up to 20 flowers, uniseriate, unilateral. Calyx dropping together with nutlet; calyx lobes in flowering time ca. 2 mm, in fruiting time 3-5 mm long, obtuse, connate to 3/4 of length. Corolla ca. 2-3 mm long, tubular, expanded at the base, inside glabrous, outside appressed downwards pilose; corolla lobes minute, ca. 0.2-0.3 mm broad, ovate-oblong, obtuse, intercalary lobes missing or if present extremely minute. Anthers ca. 0.8 mm long, acute, inserted 1 mm above corolla base. Stigma ca. 0.5 mm long, apex pilose. Style ca. 0.2-0.3 mm long, pilose. Fruit only of a single one-seeded nutlet of 4-5 mm in diameter, glabrous, thickened at edges.

General distribution: Southern Europe, Africa, Arabia, Syria, Iraq, Iran, Russia, Central Asia, Pakistan, India.

Specimens seen:

Iraq. Kut al-Imara: Kut to Baghdad, 12.4.1957, *Rechinger* 9698 (W). -- Baghdad: Flood banks of Tigris River, Baghdad, in Baghdad Liwa, 15.11.1958, *Agnew & Shawqi* 174 (W) - Zafraniya near Baghdad, Tigris River Bank, 20.10.1956, *Rechinger* 8029 a (W) - Daurah, Baghdad-Hillah-Road, 27.10.1956, *Rechinger* 8107 (W). -- For more localities see RIEDL (1967: 52).

Iran. Mazandaran: 7 km from Behshahr towards Zaghmarz, near a stream, 22.6.1987, *Zehzad* 87/255 (SBUH). -- Gilan: 8 km to Loushan, on the road from Manjil, 300 m, 8.10.1987, *Assadi & Akhani* 61686 (TARI). -- Azərbayjan: Bonab, N of the village Akhund-Gheshlagh, 1400 m, 2.10.1987, *Assadi & Akhani* 61362 (TARI) - Uroumieh Lake, towards Uromieh, road of Talatappeh, Khodaverdikhan village, 1170 m, 27.7.1990, *Izadpanah & Taheri* 68321 (TARI). -- Lorestan: Borujird, 4.10.1941, *Koelz* 18560 (W). -- Khuzestan: Hure-Bamdezh, Tavana Canal, on the clay soils on bed of Shavor stream, 8.8.1988, *Akhani* 88/150 (SBUH) - Khairabad River, 20 km E Behbahan, 400 m, 30.6.1964, *Grant* 15/907 (W). -- Khorassan: Khaf, Salami Dam, 500 m, 14.5.1984, *Ayatollahi & Mahran* 11045 (MUH).

Pakistan. Sind: Inter Amri, 26°09'N, 68°02'E, et Laki, in inundatis ad ripas Indus fluminis, 4.5.1965, *Rechinger* 28680 (W). [For more localities see NASIR (1989: 23)].

H. supinum is readily distinguished by its prostrate habit, the fruit consisting of a single one-seeded nutlet and the caducous, gamosepaluous, fruit-enclosing calyx. The species is usually collected in river beds (sometimes with *Tamarix* shrubs), on alluvial-clay and sandy soils.

35. *Heliotropium szovitsii* (Steven) Schtscheglow, Bull. Soc. Imp. Naturalistes Moscou 26: 328. 1853 $\equiv$ *Bucanion szovitsii* Steven, Bull. Soc. Imp. Naturalistes Moscou 24(2): 586. 1851. **Holotype:** in lapidosis siccis circa Nachitschevan Armeniae rossicae, [18.6.1829], *Szovits* [428] (H 1060812!; **Isotypes:** G-BOIS!, GOET!, LE!, P!).

Fig.: plate 15 a-c, page 267.

Annual, usually erect, 10-50 cm high, stem divaricately branched, rarely branched from base, covered by usually appressed, upwards standing and tuberculate hairs, tubercles colourless or milky-white. Leaves 1.5-7 cm long, 1-4 cm broad, elliptic, ovate or elliptic-ovate, subacute at top, attenuate, rotundate or truncate at base, margin slightly thickened, obscurely revolute, often with long petiole 0.5-3.5 cm; upper side subglabrous or with few appressed and tuberculate hairs, lower side sparsely subappressed or densely covered with long patent hairs. Inflorescence lateral and terminal, often branched; cymes 2-20 cm long, unilateral, uniseriate, with about 10-30 almost sessile flowers. Calyx lobes 2-4 mm long, 0.5-1.3 mm broad, linear-lanceolate to linear-oblong, acute, nearly free to base, on both sides hairy. Corolla 6-13 mm long, infundibular; corolla lobes 0.75-2.5 mm long, 0.8-1.5 mm broad, oblong, ovate-oblong, triangular to rounded, rarely acute, margin often entire, without or with intercalary teeth. Anthers 1.1-1.8 mm long, inserted 0.5-1.5 mm above corolla base. Stigma 0.8-1.5 mm long, elongate-conical, pilose, apex bilobed. Nutlets 1.3-2 x 1-1.2 mm large, ovate, smooth, glabrous.

General distribution: Iran, Armenistan and Azarbayjan.

Specimens seen:

Iran. Azarbayjan: Ghezel-Gheshlagh, near Aras Dam, 750 m, 25.6.1991, *Akhani* 7829 (MMTT) - 10 km W of Ghezel-Gheshlagh, near Aras Dam Lake, 780 m, 25.6.1991, *Akhani* 7825 (MMTT) - 15 km S of Jolfa towards Marand, slopes near Dare-Diz, 1150 m, 26.6.1991, *Akhani* 7849 (MMTT) - between Marand and Jolfa, Kuhe Darediz, 1100-1500 m, 26.7.1971, *Termeh* 16220 (IRAN) - 32 km E of Maku, 2 km W of Shavat, 1050 m, 24.6.1991, *Akhani* 7726 (MMTT) - between Marand & Maku, 55 km from Evoghli towards Maku, 1250 m, 24.6.1991, *Akhani* 7723 (MMTT, Herb. PODL.) - 10 km S of Khoy, 1200 m, 23.6.1991, *Akhani* 7650 (MMTT) - Khoy, Ghotur, 17.7.1974, *Zehzad* 74/657 (SBUH) - in valle fluvii Qotur W Khoy in saxosis (Tonschiefer), 1600-1900 m, 17.7.1974, *Rechinger* 49539 (W) - Road of Khoy-Ghotur, 7 km Sarjardeh village, 1280 m, 30.7.1990, *Izadpanah & Taheri* 68403 (TARI) - 94 km N Khoy, 38°32'N, 45°02'E, inter Shahabad et Maku, 1000 m, 2.8.1965, *Rechinger* 32718 (M, W) - 30 km E of Khoy, 1300 m, 1.8.1965, *Rechinger* 32653 (M, W) - in argillosis salsis 42-55 km W Marand versus Evoughli, 31.7.1971, *Rechinger* 43842 (TARI, W) - inter Khoy et Maku, 11 km N khoy, in incultis, 3.9.1957, *Rechinger* 14925 (M, W) - between Khodaafarin and Parsabad, 9 km Safarlu to Aslanduz, 200 m, 6.10.1987, *Assadi & Akhani* 61592 (TARI).

H. szovitsii is one of the very variable species where recent collections in Iran revealed more informations about its distribution and morphological variations. In Flora Iranica only very few material was cited. One specimen, *Manuchehri & Aellen* 5356, was recently transferred to the newly described species *H. esfandiarii* (AKHANI & RIEDL 1991: 615) which is easily distinguished by its tubular corolla and villose surface of leaves.

The form of corolla lobes and presence or absence of intercalary lobes is very variable in this species. Although corolla lobes are in most cases obtuse there are specimens with distinctly acute corolla lobes (e.g. *Termeh* 16220). Although intercalary lobes are in most cases present, sometimes intercalary lobes are missing or developed only as very short teeth.

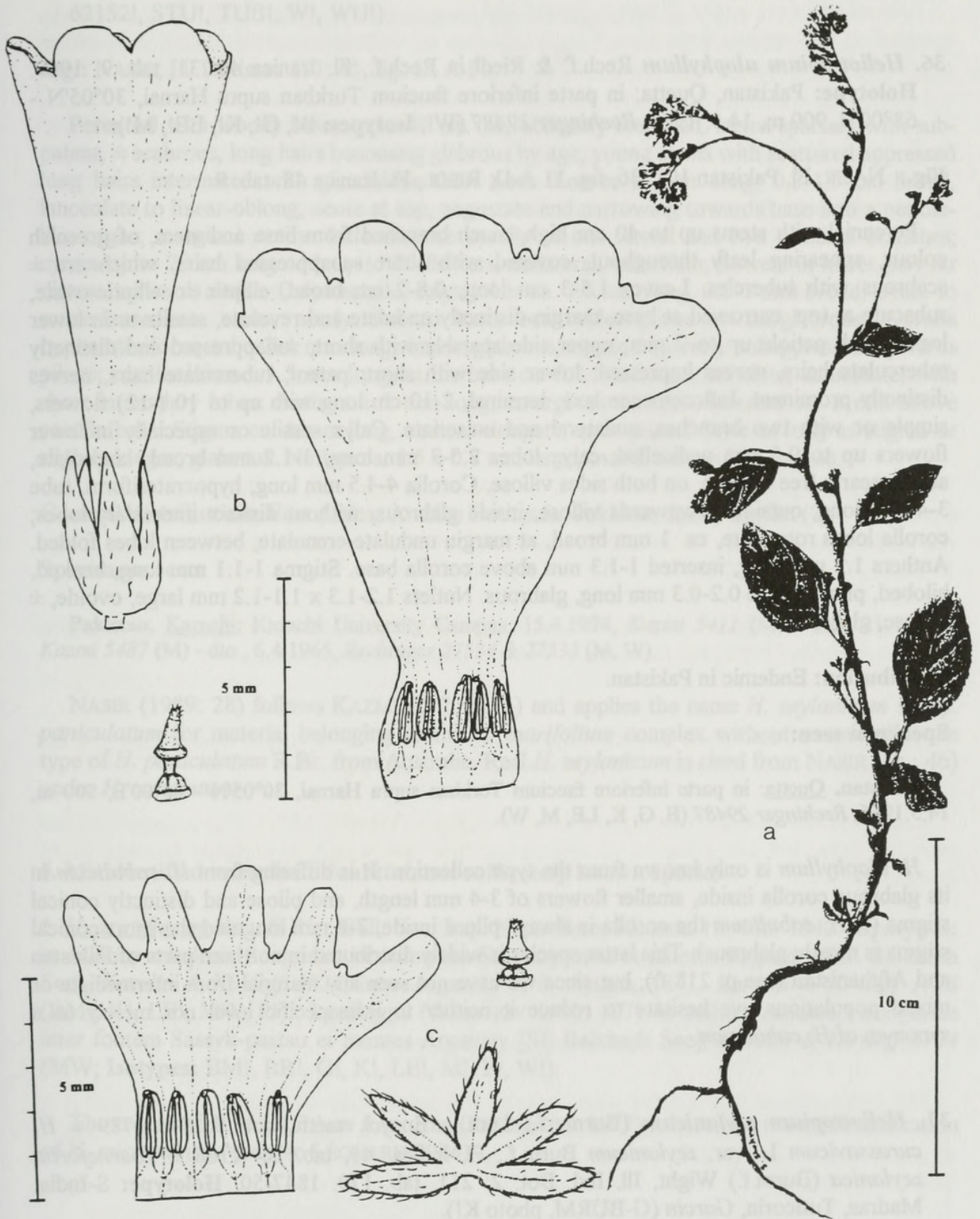


Plate 15: *H. szovitsii* (Stev.) Schtschegl.: a) habit (Akhani 7723), b) flower (Rechinger 32718), c) flower (Termeh 16220).

In contrast to POPOV (1953: 135) we follow the opinion of BUNGE (1869) and keep *H. kowalenskyi* identical with *H. szovitsii*. Characters like length of corolla and indument are not stable within this species.

36. *Heliotropium ulophyllum* Rech.f. & Riedl in Rech.f., Fl. Iranica 48: 31, tab. 9. 1967.

Holotype: Pakistan, Quetta: in parte inferiore faucium Torkhan supra Harnai, 30°05'N - 68°00'E, 900 m, 14.5. 1965, *Rechinger 29487* (W!; **Isotypes:** B!, G!, K!, LE!, M!).

Fig.: NASIR, Fl. Pakistan 191: 36, fig. 11 A-D; RIEDL, Fl. Iranica 48: tab. 9.

Perennial with stems up to 40 cm high, much branched from base and stem, of greenish colour, appearing leafy throughout, covered with short subappressed hairs, which are ± scabrous with tubercles. Leaves 1.5-3 cm long, 0.8-2 cm broad, elliptic to elliptic-ovate, subacute at top, narrowed at base, margin distinctly undulate and revolute, sessile or in lower leaves with petiole up to 7 mm; upper side sparsely with short, subappressed and distinctly tuberculate hairs, nerves impressed; lower side with short, patent, tuberculate hairs, nerves distinctly prominent. Inflorescence laxe, terminal, 2-10 cm long with up to 10 (-12) flowers, simple or with two branches, unilateral and uniseriate. Calyx sessile or especially in lower flowers up to 0.5 mm pedicelled; calyx lobes 2.5-3 mm long, 1-1.2 mm broad, lanceolate, acute, nearly free to base, on both sides villose. Corolla 4-4.5 mm long, hypocrateriform, tube 3-4 mm long, outside downwards villose, inside glabrous, without distinct intercalary lobes; corolla lobes rotundate, ca. 1 mm broad, at margin undulate-crenulate, between lobes folded. Anthers 1.2 mm long, inserted 1-1.3 mm above corolla base. Stigma 1-1.1 mm long, beaked, bilobed, pilose. Style 0.2-0.3 mm long, glabrous. Nutlets 1.2-1.3 x 1.1-1.2 mm large, ovoide, ± rugose, glabrous.

Distribution: Endemic in Pakistan.

Specimen seen:

Pakistan. Quetta: in parte inferiore faucium Torkhan supra Harnai, 30°05'N - 68°00'E, 900 m, 14.5.1965, *Rechinger 29487* (B, G, K, LE, M, W).

H. ulophyllum is only known from the type collection. It is differing from *H. cabulicum* in its glabrous corolla inside, smaller flowers of 3-4 mm length, and pilose and distinctly conical stigma (in *H. cabulicum* the corolla is always pilose inside, 7-8 mm long and the short conical stigma is mostly glabrous). This latter species is widely distributed in northern parts of Pakistan and Afghanistan (see p. 218 f.), but since we have not seen any material from intermediate or mixed populations, we hesitate to reduce it neither to infraspecific level nor merely to a synonym of *H. cabulicum*.

37. *Heliotropium zeylanicum* (Burm. f.) Lam. , Encycl. méth. bot. 3: 94. 1789 ≡ *H. curassavicum* L. var. *zeylanicum* Burm.f., Fl. indica: 41, tab. 16. 1768 ≡ *Tournefortia zeylanica* (Burm.f.) Wight, Ill. Ind. Bot. 2: 211, tab. 170. 1847-50. **Holotype:** S-India, Madras, Tuticorin, *Garcin* (G-BURM, photo K!).

= *Tournefortia subulata* A.DC. in DC., Prodr. 9: 528. 1845 ≡ *H. subulatum* (A.DC.) Vatke, Linnaea 43: 316. 1881 ≡ *H. zeylanicum* (Burm.f.) Lam. var. *subulatum* (A.DC.) Chiov., Fl. Somalia 3: 140. 1936. **Syntypes:** Senegal, 1828, *Perrottet* [526] (BM!, P!, W!); Senegal, Kouma, [?1837], *Heudelot* 469 (BM?, G, M!, P!); [Ethiopia, Semien], in agris prope

Sabram, 11.3.1840, *Schimper 1285* (B+, BM!, BR!, K!, L!, LE!, M!, P!, STU!, TUB!, WAG!); [Sudan], in lapidosis et arenosis faucium montes Cordofani Arasch-Cool, 11.10.1839, *Kotschy 163* (BM!, BP!, BR!, GOET!, K!, L!, LE!, M!, P!, PRC!, REG 62152!, STU!, TUB!, W!, WU!).

Fig.: NASIR, Fl. Pakistan 191: 45, fig. 12 A-F.

Perennial with woody base, up to 80 cm tall, obliquely branched, stems sparsely with subpatent, $\pm$ scabrous, long hairs becoming glabrous by age, young stems with scattered appressed long hairs intermixed with glandulose short ones. Leaves 2-7 cm long, 0.3-1.5 cm broad, lanceolate to linear-oblong, acute at top, angustate and narrowing towards base into a petiole-like organ, margin $\pm$ entire. Inflorescence usually of one lateral and two terminal branches; cymes up to 20 cm long with up to 70 flowers, unilateral, uniseriate; flowers in lower part far distant, upwards dense. Calyx sessile; calyx lobes ca. 1.5 mm long, 0.8-1 mm broad, ovate to ovate-lanceolate, acute, nearly free to base, both sides pilose to subglabrous. Corolla hypocrateriform; tube 3-4 mm long, inside glabrous, outside sparsely subappressed upwards pilose; corolla lobes 1-1.5 mm long, at the base ca. 0.2 mm broad, subulate, acuminate, with short intercalary lobes. Anthers $\pm$ 1 mm long, emarginate at apex, inserted ca. 2 mm above corolla base. Stigma ca. 1 mm long, conical-elongate, apex pilose. Style as long as stigma or slightly longer, glabrous. Nutlets ca. 1.5 x 0.8 mm large, ovoid, tuberculate-rugose.

General distribution: East Africa, Arabian Peninsula, Pakistan, India, Ceylon (?).

Specimens seen:

Pakistan. Karachi: Karachi University Campus, 15.4.1974, *Kazmi 5411* (M) - dto., 21.4.1974, *Kazmi 5487* (M) - dto., 6.4.1965, *Rechinger 27534 & 27533* (M, W).

NASIR (1989: 28) follows KAZMI (1970: 155) and applies the name *H. zeylanicum* subsp. *paniculatum* for material belonging to the *H. marifolium* complex without examination the type of *H. paniculatum* R.Br. from Australia. Real *H. zeylanicum* is cited from NASIR (l.c.: 46) under *H. subulatum*.

6. Misidentified records or doubtful, not sufficiently known species

* *H. acutiflorum* Kar. & Kir., Bull. Soc. Imp. Naturalistes Moscou 15: 406. 1842. **Syntypes:** in collibus sabulosis Songoriae inter fontem Sassyk-pastau et montes Arganaty [SE Balkhash See], *Karelin & Kiriloff 1724*; inter Arganaty et fl. Ajagus, 1841, *Karelin & Kiriloff 1723* (BM!, K!, LE!, MW, P!). **Lectotype** (GUBANOV 1993: 107): in collibus sabulosis Songoriae inter fontem Sassyk-pastau et montes Arganaty [SE Balkhash See], *Karelin & Kiriloff 1724* (MW; **Isotypes:** BM!, BR!, G!, K!, LE!, M!, P!, W!).

The record of *H. acutiflorum* from Iran (RECHINGER 1977) is based on the misidentification of *H. micranthum* (see also LÉONARD 1984).

* *H. albo-villosum* Riedl, Flora Iranica 48: 44, tab. 6, fig. 1. 1967.

This is a nomen invalidum because no Holotype was declared by RIEDL (1967). The authors were not able to examine the only known record from Iraq, Mosul, Dihok, *Haines 1220* (E, K), but according to the description it probably is a synonym of *H. bovei*.

* *H. arbainense* Fresen., Mus. Senckenberg 1 (= Beitr. fl. aegypt. & arab.): 168. 1834. **Holotype**: Sinai: Thal Arbain, 5000', [13.5.1831], *Rüppell* (FR!).

According to the paper of RIEDL (1979) and personal communication he has not seen any material of this species from Iran. The record was taken based on a misidentified specimen cited in ANNANDALE & CARTER (1919).

* *H. flavum* Griff., Itin. pl. Khasyah mts.: 322. 1848.

See note under *H. biannulatum* (see p. 212).

* *H. fartakense* O. Schwartz, Mitt. Inst. Allg. Bot. Hamburg 10: 207. 1939 $\equiv$ *H. bacciferum* Forssk. subsp. *lignosum* (Vatke) Kazmi var. *fartakense* (O. Schwartz) Kazmi, J. Arnold Arbor. 51: 163. 1970. **Syntypes**: In Arabien im Küstengebiet von Hadramaut, auf Dünensand bei Râs Fartak, 1899, *Paulay* (HBG, fragm. K!, W!); Nischtaun bei Râs Fartak, 1899, *Paulay* (HBG?, W!); el Hami, 4.1881, *Schweinfurth* 162 (B+, P?).

* *H. ferugineo-griseum* Nábelek, Spisy Prir. Fak. Masarykovy Univ., No. 70: 16, t. 3. 1926. **Syntypes**: Mesopotamia superiore (Gebel et Tur, Tur Abdin) ad monasterium Dêr el-Ahmar dit. Midiat, ca. 1000 m, 7.7.1910, *Nábelek* 613 (SAV); in Kurdistania Turcica ad pagum Mar Jakub dit. S'ert, ca. 920 m, 18.7.1910, *Nábelek* 66 (SAV).

This species was described from Turkish Kurdistan. It was doubtfully reported from Iran in HELLER & HEYN (1986), but the authors have not seen its type specimens.

* *H. gossypii* Ponert, Folia Geobot. Phytotax. 8: 337, f. 1. 1973. **Type**: Shah Passand, 2 km versus meridiem ab oppido, 10.7.1970, *Ponert* 37792/2 (BATU?).

This species was described as a weed in cotton fields (PONERT 1973). The authors have not seen the type, but according to its description and distribution it probably belongs to *H. europaeum* s.l.

* *H. myosotoides* Banks & Sol. in Russel, Nat. hist. Aleppo ed. 2, 2 (chap. 5): 245. 1794. **Type**: non indicatus; **Lectotype** (hoc loco designatus): Syrie, prope Aleppo, *Russell* (BM!). = *H. aleppicum* Boiss., Diagn. pl. orient. 11: 88. 1849. **Holotype**: in planitie elata inter littora Syriae et urbem Aleppum sita, 7.1846, *Boissier* (G-BOIS!).

No specimens of this species were seen by the authors for Flora Iranica Area and it is questionable whether its distribution reaches so far. By that reason it is only accepted as a doubtful record cited in RIEDL (1967: 45) without having seen by himself based on a note of ZOHARY (1950).

Acknowledgements

We want to record our sincere thanks to the directors and to the herbarium and library staff of all cited institutions for access to specimens and various facilities.

The plant habits of the plates 2-6, 8 & 15 were drawn by Mr. SHOKRAVI (Tehran), that of plate 9 by Mr. MORADI (Tehran). Illustrations of the flowers and flower dissections were prepared by AKHANI (extracted from AKHANI 1991 ined.). Photos of herbarium specimens for the plates 10-13 were provided by Mr. LIEDL (München).

The work of H. AKHANI in Iran was partly supported by the Natural History Museum of Iran (Department of the Environment) and by Tehran University with a grant for foreign travels. The previous director of this Museum Mr. KH. AMMARLOI and the present one Mr. M. AYATOLLAHI and the director of the Department of the Environment Dr. H. MANAFI are much appreciated. Providing parts of the illustrations, especially habits of some species, SH. SHOKRAVI is gratefully acknowledged.

The work of H. Förther was supported by the "Institut für Systematische Botanik der Universität München" and "Deutsche Forschungsgemeinschaft".

7. References

- AKHANI, H. 1991 (M.Sc. thesis, ined.): Revision of subfamily *Heliotropioideae* (*Boraginaceae*) in Iran. Tehran University.
- 1991a: *Heliotropium disciforme* (*Boraginaceae*) a new species from northeast of Iran. Linzer Biol. Beitr. 23(2): 569-573.
 - 1993: Adaptation and distribution of perennial species of the genus *Heliotropium* in desertic areas of Iran. Proceedings of the seminar on the problems of Iranian Deserts and Kavirs (May 17-20, 1992, Yazd) 1: 524-545. Iranian Desert Research Center, University of Tehran. (in Farsi).
- AKHANI, H. & H. RIEDL, 1991: *Heliotropium esfandiarii* (*Boraginaceae*), a new species from north-central Iran. Linzer Biol. Beitr. 23(2): 615-620.
- ANNANDALE, N. & H.G. CARTER, 1919: Notes on the vegetation of Sistan. J. & Proc. Asiat. Soc. Bengal 15: 267-297.
- BOISSIER, E. 1879: Flora Orientalis, vol. 4. Geneve & Basel.
- BOISSIER, E. & F. BUHSE, 1860: Aufzählung der auf einer Reise durch Transkaukasien und Persien gesammelten Pflanzen. Nouv. Mém. Soc. Imp. Naturalistes Moscou 12: 1-264.
- BORNMÜLLER, J. 1941: *Boraginaceae*, in Iter Persico-Turcicum 1892-1893. Beiträge zur Flora von Persien, Babylonien, Assyrien, Arabien, Teil IV. Beih. Bot. Centralbl. Abt. B, 61: 85-104.
- BRUMMITT, R.K. 1971: The diagnostic characters of the European *Heliotropium* species. Bot. J. Linn. Soc. 64: 60-67.
- 1972: *Heliotropium*. In: TUTIN, T.G. et al (eds.), Flora Europaea, vol. 3: 84-86. Cambridge.
- BUNGE, A.A. von 1869: Über die *Heliotropien* der mittelländisch-orientalischen Flor. Bull. Soc. Imp. Naturalistes Moscou 42: 279-332.
- DAVIS, P.H. (ed.) 1978: Flora of Turkey, vol. 6. Edinburgh.
- DECANDOLLE, A. 1845: *Boragineae*. In: Prodrum systematis naturalis regni vegetabilis, 9: 466-559. Paris.
- EICHWALD, E. 1831: Plantarum novarum vel minus cognitarum quas in itinere caspio-caucasico observavit, fasc. 1. Vilnae & Lipsiae.
- ESFANDIARI, E. 1977: *Boraginaceae*. Liste des plantes de l'Herbier d'Evin. Institut de Recherches Entomologique et Phytopathologique d'Evin. Depart. de Botanique. No. 11. Tehran.
- FEDTSCHENKO, B.A. 1915: Notes sur plantes nouvelles ou rares 1-3. Izv. Imp. S.-Peterburgsk. Bot. Sada 15: 1-3.
- FEINBRUN, N. 1978: Flora Palaestina. vol. 3. Jerusalem.
- GUBANOV, I.A. 1993: Catalogue of authentic specimens of vascular plants of Moscow State University Herbarium (MW). Moscow.
- GÜRKE, M. 1893: *Boraginaceae*. In: ENGLER A. & K. PRANTL (eds.), Die natürlichen Pflanzenfamilien 4(3a): 71-96. Leipzig.
- HELLER, D. & C.C. HEYN 1986: Conspectus Florae Orientalis, vol. 3. Jerusalem.
- HILGER, H.H. 1987: Fruchtbiologische Untersuchungen an *Heliotropioideae* (*Boraginaceae*), I. Die Ontogenie der monospermen Früchte von *Heliotropium supinum* L. Flora 179: 291-303.
- JARVIS, C.E. 1993: A list of Linnean generic names and their types. Regnum Veg. 127: 1-100.
- JOHNSTON, I.M. 1928: Studies in the *Boraginaceae* VII: The south American species of *Heliotropium*. Contr. Gray Herb. 81: 1-83.
- KAZMI, S. 1970: A revision of the *Boraginaceae* of west Pakistan and Kashmir I. J. Arnold Arbor. 51: 133-184.
- KUNKEL, G. 1977: The vegetation of Hormoz, Qeshm and neighbouring Islands (southern Persian Gulf area). Vaduz.

- LÉONARD, J. 1984: Contribution à la connaissance de la flore de l'Iran, VII. Note sur deux *Heliotropium* (Boraginaceae). Bull. Jard. Bot. Nat. Belg. 54: 498-500.
- 1985: Contribution à l'étude de la flore et de la végétation des déserts d'Iran, fasc. 5. Meise.
- NÁBELEK, F. 1926: Iter Turcico-Persicum III. Spisy Prir. Fak. Masarykovy Univ. 70: 1-75.
- NASIR, Y. 1987: A new species of *Heliotropium* L. (Boraginaceae) from Pakistan. Candollea 42: 553-554.
- 1989: *Heliotropium*. In: NASIR, E. & S.I. ALI (eds.), Flora of Pakistan 191: 18-50. Karachi.
- PALLAS, P.S. 1773: Reise durch verschiedene Provinzen des russischen Reichs, Bd. 2. St. Petersburg.
- PONERT, J. 1973: Species nova Iranica generis *Heliotropium*. Folia Geobot. Phytotax. 8: 337-338.
- POPOV, M.G. 1953: *Heliotropium*. In: SHISHKIN, B.K. (ed.), Flora SSSR, 19: 115-154. Moskva-Leningrad.
- RECHINGER, K.H. 1948: Ergebnisse einer botanischen Reise nach dem Iran 1937, Teil 5. Ann. Naturhist. Mus. Wien 56: 200-245.
- 1977: Plants of the Touran Protected Area, Iran. Iranian J. Bot. 1(2): 155-180.
- 1989. Fifty years of botanical research in the Flora Iranica Area. In: TAN, K. (ed.), Plant taxonomy, phytogeography and related subjects: The Davis & Hedge Festschrift, pp. 301-349. Edinburgh.
- RECHINGER, K.H. & P. WENDELBO, 1976: Plants of the Kavir Protected Region, Iran. Iranian J. Bot. 1(1): 23-56.
- RECHINGER, K.H. & P. WENDELBO, 1985: Die Flora des Kuh-e Genu in Süd Iran und ihre phytogeographische Stellung. Flora 176: 213-229.
- RIEDL, H. 1963: *Boraginaceae*. In: KOEJE, M. & K.H. RECHINGER (eds.), Symbolae Afghanicae V. Biol. Skr. 13 (4): 183-252.
- RIEDL, H. 1967: *Boraginaceae*. In: RECHINGER, K.H. (ed.), Flora Iranica 48. Graz.
- 1978: *Heliotropium*. In: DAVIS, P.H. (ed.), Flora of Turkey and the east Aegean Islands, vol. 6: 248-255. Edinburgh.
- 1979: *Heliotropium lasianthum* (Boraginaceae), a new endemic species from Iraq. Kew Bull. 33(3): 517-520.
- RIEDL, H. & E. ESFANDIARI, 1976: Zwei neue Arten von *Boraginaceae* aus dem Herbarium Ministerii Iranici Agriculturae (Evin). Bot. Abteil. Pl. Pests Diseases Res. Inst. No. 8: 1-5. Tehran.
- SARKISOVA, S.A. 1986: *Heliotropium* & *Piptoclaina*. In: VVEDENSKY, A. I. (ed.), Opredelitelj rasteeij srednej asii 8: 92-99 (= Conspectus Florae Asiae Mediae 8). Tashkent.
- VERDCOURT, B. 1987: On the typification of *Heliotropium supinum* L., Kew Bull. 42: 710.
- 1991: *Boraginaceae*. In: POLHILL, R.M. (ed.), Flora of tropical East Africa. Rotterdam.
- ZOHARY, M. 1950: The flora of Iraq and its phytogeographical subdivision, in Dep. Agr. Iraq Bull. 31: 1-201. [1946 printed].

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Akhani, Hossein and Förther, Harald. 1994. "The genus *Heliotropium* L. (Boraginaceae) in Flora Iranica Area." *Sendtnera : Mitteilungen der Botanischen Staatssammlung und des Instituts für Systematische Botanik der Universität München* 2, 187–276.

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