

ACHENE MORPHOLOGY: AN AID TO TAXONOMY OF INDIAN PLANTS.

1. COMPOSITAE, LIGULIFERAE

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ABSTRACT

The morphology of achenes of liguliferous compositae of India has been discussed with special reference to their use in identification of taxa. A key to the genera based on achene characters is presented. Diagnostic characters of the species found in India are also given. A representative sample of each genus is illustrated.

INTRODUCTION

Plasticity is an attribute of nature which enables living beings to survive over discrepancies of environment. The main aim of taxonomy has been to sort out least plastic characters so as to form the basis of classification. The somatic bodies are more plastic as compared to gametic bodies and as such latter have been greatly exploited for taxonomic purposes. The characters of seed and fruit, in this connection, have received more attention in most of the families of flowering plants. In the proposed series, of which the present treatise is the first communication, the detailed morphological characters of achene are being exploited for taxonomic studies independent of other characters. This in addition, may serve to identify the seeds of the concerned plants.

Compositae, easily the largest family of flowering plants, embraces nearly 20,000 species distributed in about 950 genera (Lawrence, 1951). In all of them, excepting

drupaceous *Chrysanthemoides* of Africa, fruit is an achene, and shows sufficient consistency within a species and diversity of characters in different taxa; yet reliance merely on achene structure for such a large group would obscure the very value of characters. This is, however, a valuable tool in regional floras. In fact, characters of achene supplemented by other characters have been extensively used in several taxonomic works dealing with Compositae (Hooker, 1872-97; Rydberg, 1954; Ferris, 1960; Gupta, 1968, etc).

Indian Compositae are represented by ca 697 species (Datta, 1965). Though treated variably, there is general agreement in recognizing two subdivisions in the family: Tubiflorae with ca 12 tribes and Liguliflorae with a single tribe Cichorieae. The latter characterised by presence of only ligulate florets and milky latex is so distinct from other Compositae that some authors prefer to remove the ligulate genera into a separate family, Cichoriaceae (Rydberg, 1954). It is represented in India by ca 22 genera with nearly 80 species, barring numerous species of *Taraxacum* recognised

by Von Soest (1963).

Twenty two liguliferous Compositae genera are studied for their achene characters. To determine the range of flexibility if any of achene structure large number of fresh as well as herbarium specimens were examined. The representative species are described in detail and illustrated, for other Indian species only distinguishing characters are given. The characters which were most static were selected for diagnosis of taxa. In a very few cases where actual specimens were not available for examination help was taken from literature.

KEY TO SEEDS OF THE INDIAN LIGULIFERAE

1. Pappus absent2
Pappus present3
2. Achene straight or slightly curved but not sickle shaped, without prickles...
..... *Lapsana*
Achene strongly curved and sickle shaped, with rows of strong prickles
..... *Koelipinia*
3. Pappus plaeaceous4
Pappus hairy5
4. Achene short straight..... *Cichorium*
Achene curved almost sickle shaped .
..... *Garhadiolus*
5. Hairs plumose6
Hairs not plumose, simple10
6. Beak (at least on inner achene) conspicuous.7
Beak absent or inconspicuous (less than a mm long).....8
7. Outer achenes beakless, inner with a very slender beak, pappus hairs attached individually *Hypochaeris*
All achenes beaked, beak gradually narrowed from body and stout, pappus hairs forming a deciduous ring.....
..... *Tragopogon*
8. Pappus multiseriate, achenes almost straight9
Pappus uniseriate achenes slightly curved upwards and narrowed into inconspicuous (less than a mm) beak *Picris*.
9. Achenes short, 5-6 mm long usually broader *Epilasia*
Achenes longer than 8 mm, usually narrow..... *Scorzonera*
10. Achenes beaked conspicuously...11
Achenes beakless or inconspicuously so (beak less than a mm)20
11. Achenes with toothed ring below the beak *Chondrilla*
Achenes without a toothed ring below the beak.....12
12. Achenes echinate near apex, strongly 4-5 angled. (at least lower ones are so) *Taraxacum*
Achenes not echinate above13
13. Achenes less than 4 mm long (incl. beak)14
Achenes more than 4 mm long (incl. beak)15
14. Achenes usually smooth..... *Ixeris*
Achenes usually with muricate ribs *Lactuca* (pp)
15. Achenes strongly compressed.....16
Achenes terete or slightly compressed and 4 angled *Crepis* (pp)
16. Achenes with beak less than 0.75 the length of body.....17
Achenes with beak more than 0.75 the length of body18
17. Achenes usually more than 5 mm long *Cicerbita* (pp)
Achenes usually less than 5 mm long *Lactuca* (pp)
18. Body of achenes cleft at top into which base of beak fits in19
Body of achene entire at top, continuous into beak *Lactuca* (pp)
19. Beak more than 1.5 times the length of body *Lactuca* (pp)
Beak almost equalling or shorter than

- body *Cicerbita* (pp)
20. Achenes strongly compressed, faces usually strongly 3 ribbed....*Sonchus*
Achenes terete or angled or slightly compressed21
21. Pappus uniseriate, rigid, brittle, persistent, usually tawny, achenes dark coloured.....*Hieracium*
Pappus multiseriate, hairs usually soft, deciduous silvery22
22. Pappus hairs forming a deciduous ring 23
Pappus hairs individually deciduous 24
23. Achenes 4 angled, constricted above, ribs 4 strong.*Picridium*
Achenes subterete or slightly compressed, ribs 4-5, usually not constricted above.....*Launea*
24. Achenes slightly compressed, narrowed at both ends, pappiferous disc distinct25.
Achenes not compressed, terete or angled, pappiferous disc not distinct. 26
25. Achenes narrowly linear, less than 5 mm long.....*Youngia*
Achenes narrowly oblong usually more than 4 mm long.*Prenanthes*
26. Achenes very slender, curved, broader towards base*Phaeacasium*
Achenes slender, straight, narrowed towards both ends, usually narrowly linear.....*Crepis* (pp).

BRIEF DESCRIPTIONS OF SPECIES

Lapsana.—*Lapsana communis* Linn. (Fig. 1).—Achenes pale brown, glabrous ellipsoid to obvoid straight or slightly curved, compressed, 3-5 mm long, 1-1.5 mm broad, much narrowed towards base, broadest just above middle. Ribs 10-13 on each face, faint but conspicuous near apex which is narrowed to form a rounded

collar. Pappus absent.

Koelpinia.—*Koelpinia linearis* Pall. (Fig. 2).—Achenes curved sickle shaped, 1.2-1.8 cm long, cylindrical, faintly ribbed, dorsal surface with prickles arranged in rows. Prickles 1.5-3 mm long, hooked at apex, those at apex of achene spreading stellately, 6-9 in number. Achene glochidiate all over. Pappus absent.

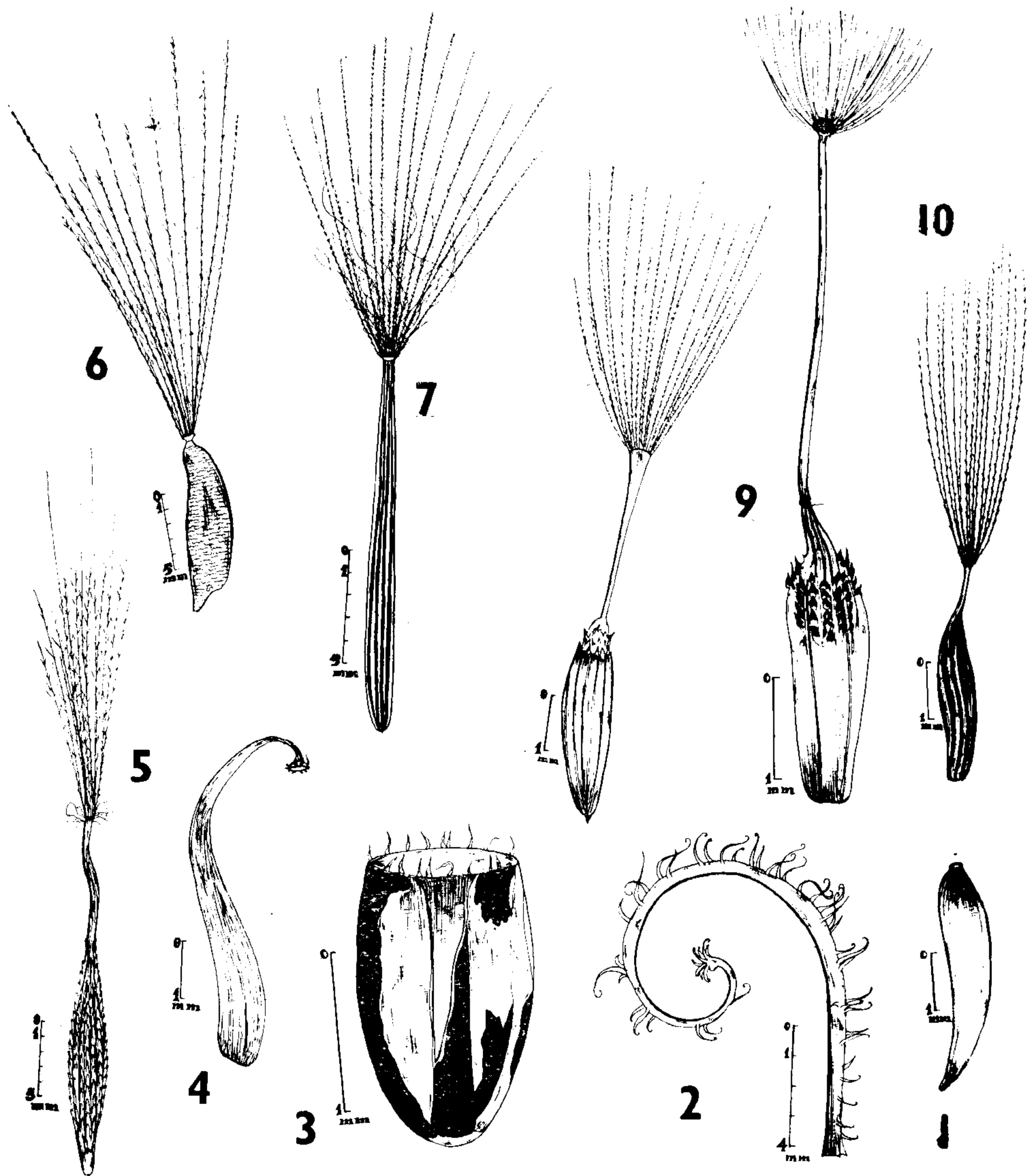
Cichorium.—*Cichorium intybus* Linn. (Fig. 3).—Achene short, 2-3 mm long ca 1.5 mm broad, mottled, 5-angled, angles dark-greyish. Achenes broadest near apex which is truncate, gradually narrowed towards base. Pappus paleaceous, pales 2-3 seriate, few, 0.4-0.6 mm long.

Garhadiolus.—*Garhadiolus minutissima*.—(Bunge) Kit. (Fig. 4).—Achenes 5-9 mm long, curved, cylindrical. Outer achenes glabrous gradually narrowed, above from the base, enclosed in involucre bracts. Inner with more prominent pappus than in outer achenes. Pappus palaeaceous, pales fringed, usually less than a mm long. All achenes faintly ribbed.

Hypochaeris.—*Hypochaeris glabra* Linn.—Achenes of two types: outer 4-5 mm long, nearly 1 mm broad, linear oblong, truncate, beakless, pappus plumose shortly exceeding the achene; inner 7-10 mm long, beaked, beak slender longer than the body, pappus as long as beak.

Tragopogon.—*Tragopogon kashmiriana* Singh (Fig. 5).—Achenes with beak. 2-3 cm long including the beak, body narrowly lanceolate oblong, gradually narrowed above to a shorter or as long beak, ribs muricate. Inner achenes smoothly ribbed; pappus 2-3 cm long, plumose, hairs rigid connate at base into a deciduous ring, a few hairs much longer than others and with simple tips, tawny, hairs ashy.

T. gracile D. Don.—Achenes hardly 1.2 cm long (incl. beak), smooth and with very short beak. *T. porrifolius* Linn. has more



FIGS. 1-10. Achenes of liguliferous Compositae of India,. Fig. 1. *Lapsana communis*. Fig. 2. *Koelipinia linearis*. Fig. 3. *Cichorium intybus*. Fig. 4. *Garhadiolus minutissima*. Fig. 5. *Tragopogon kashmiriana*. Fig. 6. *Picris hieracoides*. Fig. 7. *Scorzonera divaricata*. Fig. 8. *Chondrilla graminea*. Fig. 9. *Taraxacum officinale*. Fig. 10. *Ixeris polycephala*.

strongly muricate achenes with beak much longer than body.

Picris.—*Picris hieracoides* Linn. (Fig. 6).—Achenes almost cylindrical, narrowed at both ends, more so and curved near apex into an inconspicuous beak, achenes 2.5-4 mm long, dark brown, ribbed, ribs transversely rugose, pappus deciduous, white soft and plumose, 8-12 mm long.

Epilasia—*Epilasia ammophila* Bge.—Achenes short almost cylindrical, 5-6 mm long, sometimes turbinate and as broad, closely nearly 20 ribbed, glabrous, tip raised and dome shaped within the pappus, pappus dark brown, multiseriate, hairs plumose, a few with simple tips.

Scorzonera.—*Scorzonera divaricata* Turcz. (Fig. 7).—Achenes linear, 1.5-2 cm long, cylindrical or angled, many ribbed, pale brown, equally broader throughout or slightly narrowed above, pappus less than 1 cm long, mutiseriate, hairs unequal, plumose, tips usually simple.

In *S. purpurea* Linn. achenes are shorter than pappus.

In *S. stewartii* Hook. f. achenes are winged with echinate ribs.

Chondrilla.—*Chondrilla graminea* M. Bieb. (Fig. 8).—Achenes oblong-lanceolate, 3-5 mm long, narrowed towards both ends, more so towards base; prominently 10-16 ribbed, pale coloured with 1-2 rings of teeth below the beak. Beak very slender, nearly equalling the body, broader towards two ends, pappus 5-8 mm long, white, persistent, soft, simple.

Achenes are more strongly toothed in *C. setulosa* C. B. Clarke.

Taraxacum.—*Taraxacum officinale* Wigg. (Fig. 9).—Von Soest (1963) has isolated many species from this complex Indian plant.

Achenes narrowly ovoid, 4-5 angled, greyish or greenish brown. Body of achene 3-5 mm long, strongly ribbed, ribs echi-

nate above. Beak capillary, nearly 8-14 mm long, broadened above into a pappiferous disc. Pappus 5-9 mm long, soft white, pappus hairs simple.

I. wattii Hook f. has white achenes with the beak shorter than body.

Ixeris.—*Ixeris polycephala* Cass. (Fig. 10).—Achenes with beak 2.5-3.5 mm, long, body lanceolate, glabrous, narrowed into as long or shorter beak, brownish. Ribs 4-5 on each face, strong, paler than rest of the body which is reddish brown. Pappus silvery equalling the achenes. Hairs soft, simple.

I. sagittarioides (Clarke) Stebbins has smaller (ca 2.5 mm long) achenes with white beak; while *I. gracilis* (DC.) Stebbins has pale red smaller achenes (ca 2 mm long) and dirty white pappus.

Lactuca.—*Lactuca serriola* Linn. (Fig. 11).—Achenes oblanceolate, pale brown, strongly compressed, 3-5 mm long excluding beak, faces many ribbed, ribs scabrid. Beak very slender, white, directly continuous from body and nearly equalling it. Pappus soft, silvery, 4-7 mm long, pappiferous disc prominent.

Other species with similar achenes are: *L. longifolia* DC. (Fig. 12) with dark brown achenes, 3-5 ribbed, base of beak white; *L. brevirostris* Champ. with black achenes having a strong midrib and other slender ribs on each face, base of beak black; *L. clarkei* Hook. f. with black achenes having a coloured beak with pale tip.

L. dissecta Don (Fig. 13).—Achenes oblanceolate, 5-8 mm long (incl. beak), strongly compressed, faces 3 ribbed, margins slightly thickened, scabrid, tip of body cleft to accommodate base of the beak. Beak capillary, white, twice the length of body, broader towards two ends, thickened above into a pappiferous disc. Pappus soft, silvery, 3-6 mm long, simple.

L. undulata Ledeb.—With similar ache-

nes has larger sized achenes, (13-18 mm long), and beak 3-4 times as long as body.

Shorter beaked species fall into two categories: (a) with smooth achenes in *L. orientalis* Boiss., pappus equalling the achene; *L. tartarica* Mey., pappus twice the length of achenes (b) with muricate ribs of achenes in *L. heyneana* DC., achenes 2-3 mm long, pappus twice as long; *L. ramotifolia* DC., achenes 3-5 mm long, pappus as long.

Cicerbita.—*Cicerbita decipiens* (Hk. f. & T. ex Clarke) Beauv. (Fig. 14).—Achenes 7-10 mm long (incl. beak), elliptic to lanceolate, strongly compressed, dark brown, dorsal face with several faint ribs, ventral with a strong midrib and faint lateral ribs, slightly undulating, puberulus. Beak 2.5-3.5 mm long, upper part slightly whitish, apex enlarged into a pappiferous disc. Pappus 6-9 mm long, soft, white, hairs simple individually deciduous.

Another long-beaked species, *C. cyanea* (Don) Beauv. has apex of body cleft as in some species of *Lactuca* accommodating the base of the beak, which nearly equals the body.

Rest of the species have a very short beak, usually less than 0.75 the length of body. *C. rapunculoides* (DC.) Beauv. has slender, 7-9 mm long achenes with slender ribs. *C. macrorhiza* (Royle) Beauv. has 4-6 mm long achenes, black in colour.

Crepis.—*Crepis sancta* (L.) Bab. subsp. *bifida* (Vis.) Thell ex. Bab. (Fig. 15).—Achenes narrowly linear, 3-5 mm long, less than a mm broad, slightly narrowed at two ends, pale brown, many ribbed, pappiferous disc not distinct. Pappus soft, white, simple, almost equalling or smaller than achenes.

C. sibirica Linn.—achenes 10-15 mm long, ribs slender.

C. kashmirica Bab.—achenes 7-10 mm long, ribs strong.

C. multicaulis Ledeb. subsp. *congesta* (Rgl.) Bab.—achenes narrowly fusiform, 4-6 mm long, red brown.

C. glomerata Dcne., *C. himalaica* Kit., *C. thomsoni* Bab., *C. naniforma* Bab. have essentially similar achenes.

C. foetida Linn. has achenes unlike the rest species; they have a beak (at least the inner one) almost equalling the body.

Sonchus.—*Sonchus asper* Vill. (Fig. 16).—Achenes ellipsoid, 2-3 mm long, strongly compressed, narrowed above but not beaked, edges serrulate, brownish, faces strongly 3-ribbed, obscurely rugose on ribs and intervals. Pappus soft, white, multiserial. Hairs few, 8-14 mm long, simple.

S. oleraceus Linn.—achenes 2 mm long, strongly transversely rugose.

S. arvensis Linn.—achenes 2.5-3.5 mm long, transversely rugose.

S. maritimus Linn. has midrib much thicker than the laterals.

Hieracium.—*Hieracium vulgatum* Koch. (Fig. 17).—Achenes 2.2-3 mm long, cylindrical, black, shining, ribbed, narrowed towards base, truncate above. Pappus uniserial of rigid tawny coloured hairs latter puberulus nearly equalling the achenes.

H. viosum Pall. has similar red brown achenes while species listed below, have larger achenes.

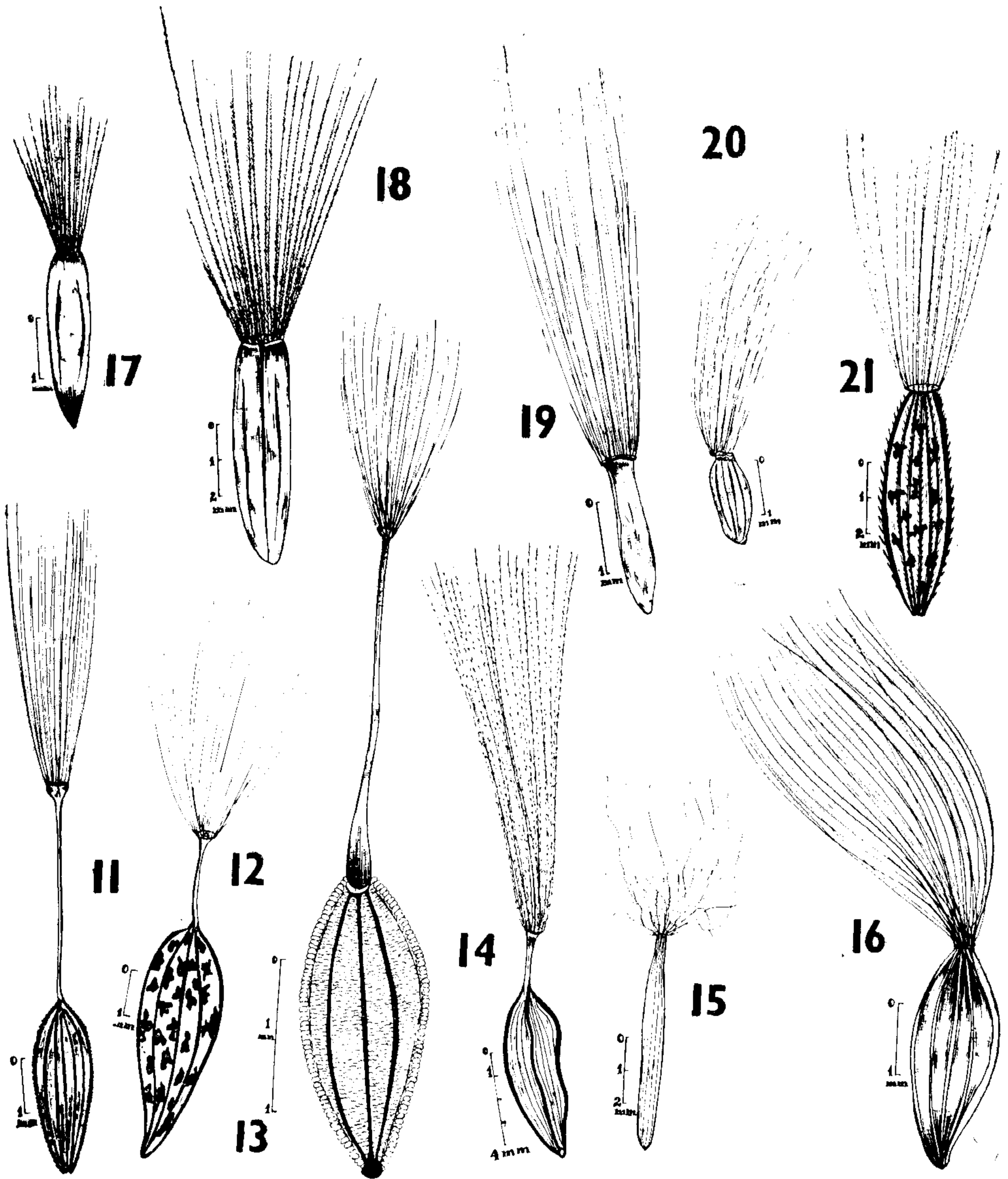
H. crocatum Fries (Fig. 18)—achenes 4-5 mm long, black, faintly ribbed.

H. prenanthoides Vill.—achenes 4-5 mm long, red brown, strongly ribbed.

H. umbellatum Linn.—achenes 3-3.5 mm long, reddish.

Picridium.—*Picridium tingitanum* Desf.—Achenes oblong, 4 angled 2-3 mm long, pale, truncate at both ends., slightly constricted towards apex. Ribs 4, rugose; pappus multiserial, soft, white, connate below into a deciduous ring, pappus 10-15 mm long.

Launea.—*Launea fallax* (Jaub. et spach



FIGS. 11-21. Achenes of liguliferous Compositae of India. Fig. 11. *Lactuca serriola*. Fig. 12. *L. longifolia*. Fig. 13. *L. dissecta*. Fig. 14. *Cicerbita decipiens*. Fig. 15. *Crepis sancta*. Fig. 16. *Sonchus asper*. Fig. 17. *Hieracium vulgatum*. Fig. 18. *H. crocatum*. Fig. 19. *Launea fallax*. Fig. 20. *Youngia tenuifolia*. Fig. 21. *Prenanthes brunoniana*.

Ktze. (Fig. 19).—Outer achenes often compressed, inner cylindrical narrowly, 2-5 mm long, truncate at both ends. Ribs 4-5 stout. Upper end of achenes suddenly broadened into a pappiferous disc. Pappus multiseriate, soft, white 10-15 mm long, hairs simple, connate below into a deciduous ring.

Other species having same sized achenes are *L. asplenifolia* DC., pappus 4-6 mm long; *L. sarmentosa* (Willd.) Alston, pappus 6-8 mm long; *L. secunda* Clarke, achenes ca 3 mm pappus as long. *L. microcephala* Hk. f., achenes ca 3 mm long, pappus 2 mm or less.

L. chondrilloides DC. has larger (5-6 mm long, pappus 10-15 mm long) achenes. Achenes of *L. glomerata* Cass. are different in being winged, ca 4 mm long with 5-6 mm long pappus.

Youngia.—*Youngia tenuifolia* (Willd.) Babc. and Stebbins (Fig. 20).—Achenes small dark brown, 2.5-4 mm long, narrowed at both ends, more so above, enlarged above into a pappiferous disc, ribs distinct. Pappus soft, nearly 1.5-2 times the length of achene, hairs simple white, individually deciduous.

Y. glauca Edgew.—achenes 4-5 mm long, pale, obscurely scabrid, pappus white.

Y. gracilis (Hk. f. ex Benth.) Hook. f. . achenes 3-4 mm long, brown, minutely scabrid, pappus grey.

Y. depressa (Hk. f. and T.) Babc. and Stebbins.— achenes ca 5 mm long, dark

brown, glabrous, pappus white; achenes larger.

Y. silhetensis (DC.) Babc. and Stebbins has achenes 2-3 mm long, pale brown, pappus brown; achenes smaller.

Y. japonica (Linn.) DC. has achenes nearly 2 mm long, glabrous, red brown pappus white; achenes smaller.

Y. gracilipes (Hook. f.) Babc. and Stebbins.

Y. racemifera (Hook. f.) Babc. and

Y. nilgiriensis Babc. are other Indian species of the genus. Their achenes were not available for study.

Prenanthes.—*Prenanthes brunoniana* Wall. (Fig. 21).—Achenes narrowly oblong 4-5 angled, 4-6 mm long, slightly compressed, dark brown, minutely pubescent, ribs strong, achenes more prominently narrowed towards base, obscurely so above, pappus 2-3 seriate, hairs soft, white, 7-9 mm long, individually deciduous, puberulous.

Achenes in the rest of the species are similar sized, being very narrow in *P. scandens* Hook. f., less so in *P. violaefolia* Dcne., *P. khasiana* Clarke., broader more darker in *P. hookeri* Clarke.

P. sikkimensis Hook. f. has larger nearly 6 mm long achenes which are more narrowed above.

Phaegasium.—*Phaegasium lampanoides* Cass.—Achenes 4-6 mm long, terete, broadest towards base, very slender, slightly curved, pappus soft, white, multiseriate, hairs simple, deciduous, shorter than achenes.

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