

On the *Heteranthus* Section of *Cuphea* (Lythraceae).

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With Plate XI.



HISTORY AND TAXONOMY.

THE section *Heteranthus* was established in 1877 by Koehne (3), who created it to receive his three new species, *Cuphea setosa*, *C. epilobiifolia*, and *C. tetrapetala*, which had this character in common that in each pair of opposite flowers one flower was older. He also placed *C. rigidula*, Benth., doubtfully in the section. In 1881 (5), while giving more detailed descriptions of his three species, he placed *C. rigidula* next to *C. setosa*, omitting all mention of the repeated dichasial branching of *C. rigidula*, which he evidently did not credit. In succeeding years Koehne added four other species, all from Colombia, one of which, *C. Lehmanni*, does not possess the character from which the section takes its name, namely the unequal age of the flowers of each pair. The two new species described in the present paper also alter the character of the section in important details, namely the presence of two petals only, and the occurrence of an erect instead of a deflexed disc. It may, therefore, be

useful to give shortly the principal characters of the section *Heteranthus* as now constituted.

Principal characters. Prophylla 2. (Sub-genus *Eucuphea*.) Flores oppositi, in quovis pari inaequales (exc. *C. Lehmanni*). Bracteae magnae hypsophylloideae, ciliatae. Caulis saepius pilis fuscis, crassis biseriatim obtectus. Folia opposita. Petala 6, 4, vel 2. Stamina 11 alterne inaequalia. Discus saepius deflexus (in *C. tarapotensi* erectus). Ovula 3-10.

Key to the species (mainly from Koehne).

Filamenta inclusa vel parum exserta.

C. setosa, C. rigidula, C. sordida.

Filamenta valde exserta.

I. Petala 6.

C. hispidiflora, C. epilobiifolia, C. Buravii, C. Lehmanni.

II. Petala 4.

C. tetrapetala.

III. Petala 2.

1. Discus erectus.

C. tarapotensis.

2. Discus deflexus.

C. Bombonasae, C. epilobiifolia var. *Caquetae, C. tetrapetala* var. *Cosangae.*

Cuphea tarapotensis, Sprague, sp. nov.

Suffrutex. Caulis (25 cm. circ.) foliaque ut in *C. epilobiifolia*. Pedicelli 3 mm. longi, ad vel infra medium prophylla ovata acuta ciliata gerentes; bracteae late ovatae, longe ciliatae. Calyx (5-5.5 mm.) calcare breviusculo recto munitus, fauce ampliata adscendens, dense breviterque hirsutus, intus infra stamina pilosa; append. lobis breviores, breviter setosae. Petala 2 (dorsalia), quam calyx paullo breviora, ovata

acuminata, ungue longo. Stamina episepala supra lobos $\frac{1}{2}$ exserta, epipetalorum breviorum duo dorsalia calycis sinus fere aequantia. Ovarium ovato-oblongum, villosum. Discus erectus, cylindricus, 1.25 mm. longus, basi pilosus. Ovula 7-8.

R. Spruce, Tarapoto (Peru).

Cuphea Bombonasae, Sprague, sp. nov.

Suffrutex. Caulis (18-35 cm.) foliaque ut in *C. epilobiiifolia*. Pedicelli 2-3 mm. longi, ad vel supra medium prophylla ovata acuta ciliata gerentes; bracteae late ovatae, acutae, longe ciliatae. Calyx (5-6 mm.) calcare longiusculo, leviter curvato munitus, fauce ampliata ascendens, dense hirsutus, intus infra stamina pilosa; append. lobis breviores, brevissime setosae. Petala 2 (dorsalia), calycis $\frac{2}{3}$ - $\frac{4}{5}$ aequantia, oblongo-ovata, apice rotundata, ungue lato. Stamina episepala supra lobos $\frac{1}{2}$ exserta, epipetalorum breviorum duo dorsalia calycis sinus fere aequantia. Ovarium ovatum, pilosum. Discus deflexus, oblique ovoideus, .75 mm. longus. Ovula 6-7.

R. Spruce, in fl. *Bombonasae* ripis inundatis, May, 1857.

Cuphea epilobiifolia, Koehne.

Var. *Caquetae*, Sprague, var. nov.

Prophylla ovato-oblonga. Calyx 6-8 mm. longus, calcare quam in *C. epilobiifolia* typica tenuiore. Petala 2 (dorsalia), late ovata vel suborbicularia, salmonea, ungue .75 mm., lamina 3-3.5 mm. longis. Staminum epipetalorum duo dorsalia calycis sinu breviora. Ovula 6-7.

Sprague, rocky banks of a tributary of the Caquetá (Colombia), April, 1899.

Cuphea tetrapetala, Koehne.

Var. *Cosangae*, Sprague, var. nov.

Pedicelli prophylla ad vel supra $\frac{1}{2}$ gerentes. Petala pro rata 2 (dorsalia), sed etiam 3-4 inveni, ovata. Staminum epipetalorum postica 2 calycis sinus haud aequantia. Ovula 9.

W. Jameson, 775, ad ripas fl. *Cosangae* (Ecuador), 6,000 ped., Jan.

On comparing the descriptions of the species of *Heteranthus*, the first point noticed is the remarkable uniformity in vegeta-

tive characters, and the very numerous differences in floral structure displayed by the different species. The first is obviously correlated with the similarity of habitat which obtains throughout the group, all the members of which grow in gravelly soil among rocks on the upper courses of rivers. As regards the internal classification of the section, the relationships between the several species are too intricate to admit of any satisfactory natural grouping. *C. rigidula* is separated sharply from all the rest by the dichasial branching of its inflorescence, and has perhaps its nearest ally in *C. setosa*.

GEOGRAPHY.

The following table shows at once that the section is characteristic of the Andes (including in this term the Coast Andes of Venezuela), and in fact inhabits the upper parts of Engler's subandine (4) region. The only species occurring outside this limit are *C. rigidula* and *C. setosa*. We have unfortunately no locality for *C. rigidula* more precise than Guiana, but it may fairly be assumed from what we know of the habitats of the other species that *C. rigidula* comes from the mountains of the interior of Guiana, and possibly from the Roraima region. The early isolation of the Guiana mountains would explain the separateness of *C. rigidula*. Taking *C. setosa* (distribn. Andes and Tobago) next into consideration, we find that it is really only an apparent exception to the andine distribution of the section, for it is a well-known fact that both Trinidad and Tobago are geologically related rather to the South American mainland than to the other West Indian islands, and form the continuation eastwards of the Coast Andes of Venezuela. The occurrence of *C. setosa* in Tobago is an excellent illustration of the South American affinity of the flora of that island first remarked by Eggers (6).

The distribution of *C. epilobiifolia* (Andes proper and Venezuelan Coast range) illustrates the truly andine character of the Venezuelan Coast range recently pointed out by

Burkill (7). *C. tetrapetala* is also of wide distribution, occurring in the Andes from Mexico to Ecuador. The area of the remaining species is much more limited. Finally, we may observe that the centre of development of the section is in Colombia, which possesses no fewer than seven out of the ten species, four of them being endemic.

	Mexico.	Central America.	Colombia.	Ecuador.	Peru.	Bolivia.	Venezuela.	Guiana.	West Indies.
<i>C. setosa</i> . . .	*	..	*	..	*	*	..	..	*
„ <i>rigidula</i> . . .	..	..	..	..	..	..	..	*	..
„ <i>sordida</i> . . .	..	..	*	..	..	..	..	..	..
„ <i>hispidiflora</i> . . .	..	..	*	..	..	..	..	..	..
„ <i>epilobiifolia</i> . . .	..	*	*	..	..	..	*	..	..
„ <i>Buravii</i> . . .	..	..	*	..	..	..	..	..	..
„ <i>Lehmanni</i> . . .	..	..	*	..	..	..	..	..	..
„ <i>tetrapetala</i> . . .	*	..	*	*	..	..	..	..	..
„ <i>Bombonasae</i> . . .	..	..	..	*	..	..	..	..	..
„ <i>tarapotensis</i> . . .	..	..	..	..	*	..	..	..	..
Total .	2	1	7	2	2	1	1	1	1

BIOLOGY.

All the species of *Heteranthus* grow among rocks by the side of rivers, and are subjected to periodical inundation ; we find accordingly that they are all perennial and somewhat fruticose, as in such situations annuals would speedily die out unless provided with very special means of propagation. In connexion with the habitat should also be noticed the narrow linear or linear-lanceolate leaves so characteristic of the section.

No observations have been recorded as to the pollination of any of the species, but it is abundantly evident from the structure of the flowers that they are entomophilous ; moreover, their position growing gregariously by riversides is a peculiarly favourable one as regards frequency of insect visitors, which in the dense forest crowd at the top of such

trees as are in flower, and only descend in numbers to the ground in open spaces. The reduction of the petals to two in certain species must be regarded as an adaptation to insect pollination rather than as a step towards total loss of petals, for it is significant that the two remaining petals are always the posterior ones, which are situated one on each side of the entrance to the nectariferous calyx spur; the path to the honey is thus better marked after the loss of the four other petals. The same object is sometimes attained in the six-petalled species of *Cuphea* by having the two posterior petals much larger or differently coloured; in *C. rigidula* they can be distinguished at once by the intense violet colouration of their claws. It is interesting to note that the reduction of petals does not always proceed regularly; it might have been supposed *a priori* that the corresponding petals on each side of the flower would have disappeared simultaneously, but this is not the case, e.g. in *C. tetrapetala*, var. *Cosangae*, several of the flowers had three petals, the two dorsal and one lateral. It may be as well to state here that *buds* were examined in every case, to eliminate risk of error from the fugacious nature of the petals.

The function of the disc needs investigation; formerly it was thought to be the honey-producing part of the flower, and was called the gland, but Kerner (2) showed that this idea was erroneous and that the honey is really secreted by the base of the spur. The only explanation since given is that the disc helps to narrow the entrance to the spur, and thus aids in the exclusion of unbidden guests; while this may be true in some instances, it hardly seems to hold good for all the species of *Cuphea*.

The exclusion of small creeping insects is thoroughly effected in certain species of *Cuphea*, e.g. *C. micrantha*, which has the intersepaline teeth provided with glandular hairs. In the section *Heteranthus* no such efficient protection exists, but the axis of the raceme and the exterior of the calyx of all the species are more or less densely clothed with hairs, *C. hispidiflora* being especially well provided in this respect.

The tufts of hairs on the base of the filaments of *C. rigidula* are doubtless of use in restricting access to the honey.

In the whole genus *Cuphea* a peculiar mechanism exists to aid in the distribution of the seeds. After fertilization a mass of tissue just below the ovary grows rapidly and forces the placenta backwards, so that it splits the ovary wall and calyx tube, and finally projects from the posterior side of the flower bearing the ripening seeds.

The pollination and insect visitors of *C. setosa*, and the question of the occurrence or absence of the section in Trinidad, are points well worth the attention of West Indian botanists.

In conclusion, I must acknowledge a grant made by the Royal Society towards the expenses of the expedition on which the type of *C. epilobiifolia*, var. *Caquetae* was collected.

I am indebted to Professor Koehne for a list of the specimens referred by him to the various species and varieties of the section *Heteranthus*.

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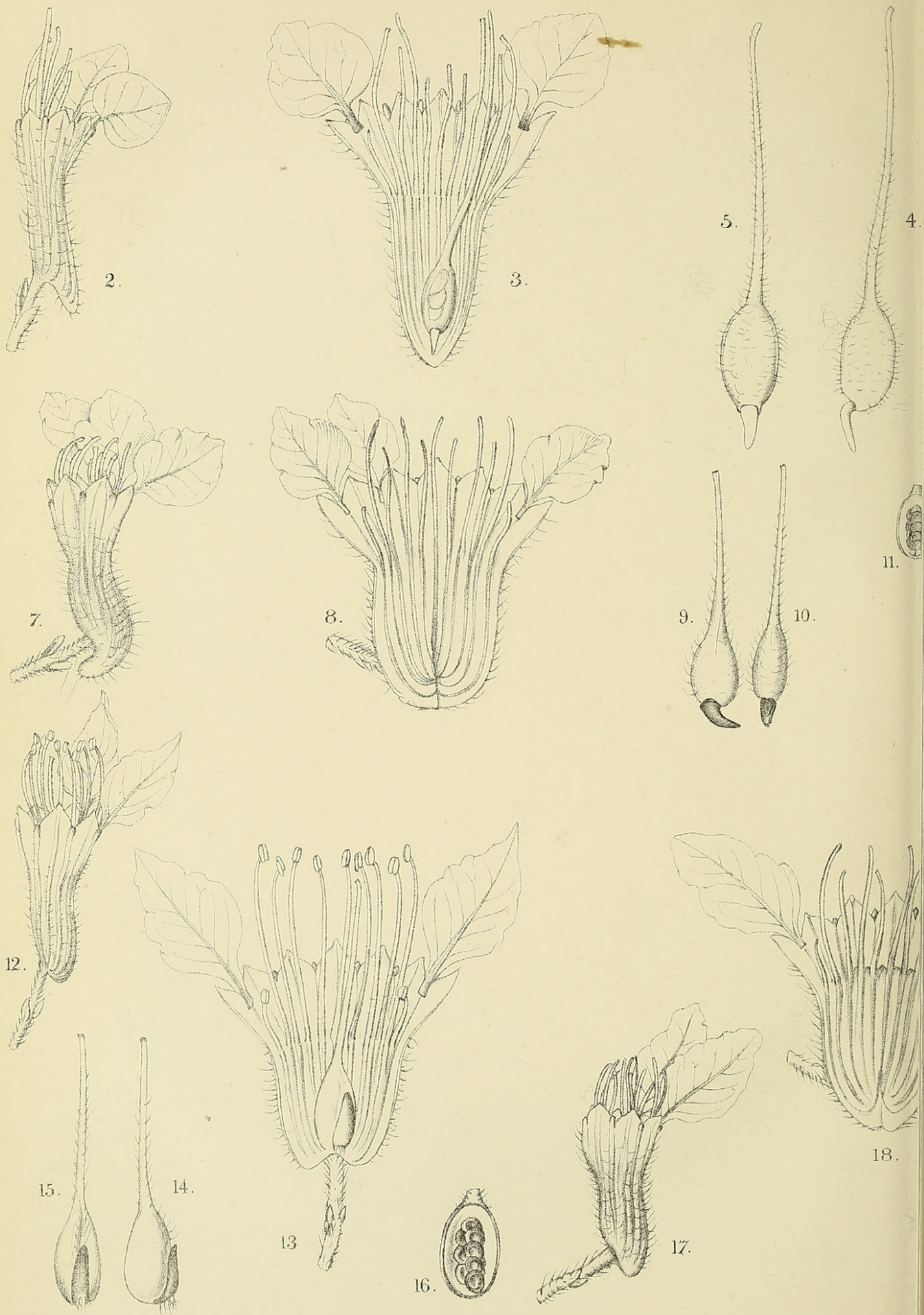
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EXPLANATION OF THE FIGURES IN PLATE XI.

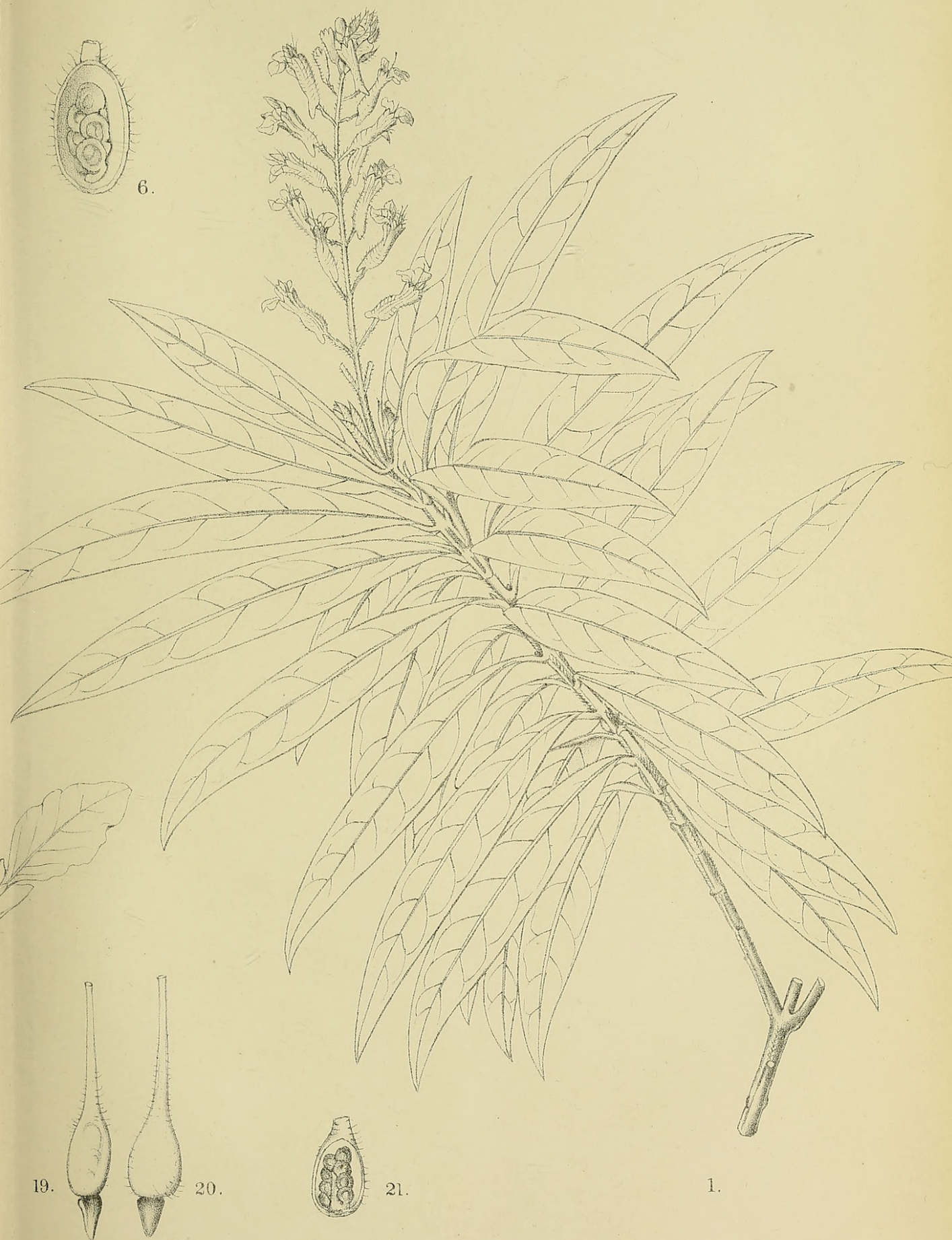
Illustrating Mr. Sprague's paper on *Cuphea*.

- Fig. 1. *C. epilobiifolia*, var. *Caquetæ*. Part of plant. mag. nat.
- Fig. 2. ,, Flower from side. × 3.5.
- Fig. 3. ,, Flower opened at back. × 4.5.
- Figs. 4 and 5. ,, Ovary and disc from side and back. × 6.
- Fig. 6. ,, Ovary opened, showing placenta and ovules. × 6.
- Fig. 7. *C. tetrapetala*, var. *Cosangæ*. Flower from side. × 3.75.
- Fig. 8. ,, Flower opened at back (ovary removed). × 4.5.
- Figs. 9 and 10. ,, Ovary and disc from side and back. × 5.25.
- Fig. 11. ,, Ovary opened, showing placenta and ovules. × 5.25.
- Fig. 12. *C. tarapotensis*. Flower from side. × 5.
- Fig. 13. ,, Flower opened at back. × 6.25.
- Figs. 14 and 15. ,, Ovary and disc from side and back. × 6.5.
- Fig. 16. ,, Ovary opened, showing placenta and ovules. × 6.5.
- Fig. 17. *C. Bombonasæ*. Flower from side. × 5.
- Fig. 18. ,, Flower opened at back (ovary removed). × 6.25.
- Figs. 19 and 20. ,, Ovary and disc from side and back. × 6.5.
- Fig. 21. ,, Ovary opened, showing placenta and ovules. × 6.5.

NOTE.—The artist has represented the flowers in Fig. 1 as they were in the dried specimen; in the living plant the spurs are of course uppermost (posterior)
—T. A. S.



T. A. S. anal.
J. N. Pich. del.





T. A. S. auct.
J. N. Pich. del.

SPRAGUE.—CUPHEA.

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