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The Supposed Dimorphism of *Lithospermum longiflorum*

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THE SUPPOSED DIMORPHISM OF LITHOSPERMUM
LONGIFLORUM.

(*L. ANGUSTIFOLIUM* MICHX. OF GRAY'S SYNOPTICAL FLORA.)

BY PROF. C. E. BESSEY, M.SC., PH.D.

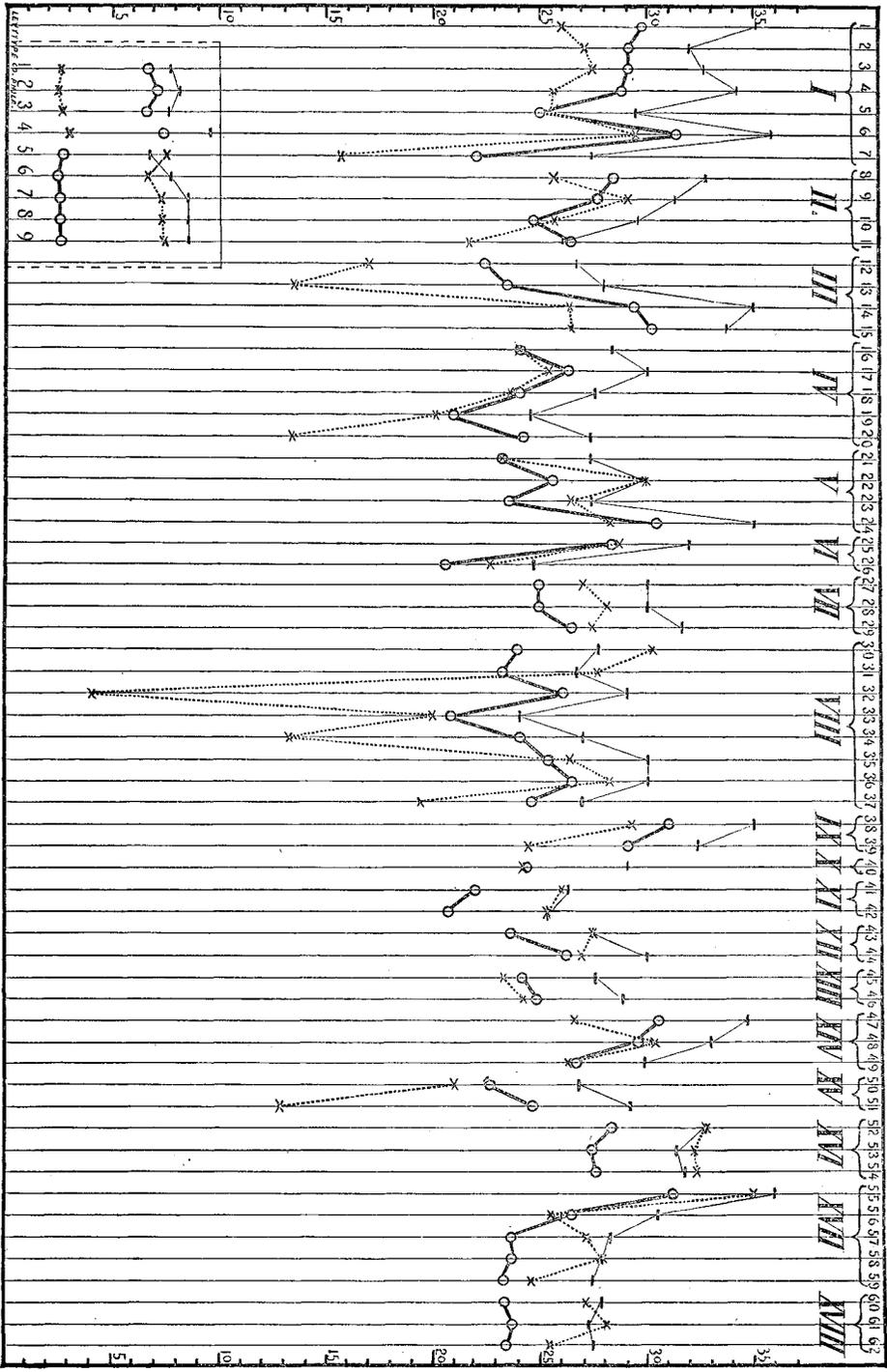
THE plant under consideration is a common herbaceous perennial of the prairies and great plains of North America. In the latter part of April and during the month of May it produces flowers with bright yellow salver-shaped (*hypocraterimorphous*) corollas, whose tubes are about thirty mm. (one and one-fifth inch) long, and from two to three mm. in diameter. About the first of June, in Central Iowa, these large flowers suddenly disappear, and from this time forward until the autumn frosts, they produce only small cleistogamous flowers.¹ The corolla lobes of the latter cohere somewhat, and remain closed, and in this condition the total length of the corolla is from five to seven mm., the tube itself being no more than three to five mm. long. Both kinds of flowers produce seeds, and I have not observed any difference in their relative fertility, although there are actually at least ten times as many seeds produced during the season by the small flowers as by the large ones, for the reason, however, that there are many more of the former flowers than of the latter. Of the small flowers I will have somewhat to say at another time; what I wish particularly to notice at this time is the relative position of stamens and stigma in the large early flowers.

An examination of a number of flowers shows that in some the anthers are higher than the stigma, while in others they are lower, and unless careful measurements are made, one is led to consider this as a case of dimorphism of the sexual organs (the heterogonous dimorphism of Dr. Gray, and heterostyly of Hildebrand, Darwin and others), a supposition which is rendered still more probable by the well-marked dimorphism of the flowers of the nearly allied *Lithospermum canescens* Lehm. However, after making a large number of very careful measurements, I have no hesitation in saying that in the plants as they occur in Central Iowa there is no dimorphism whatever, but that we have here a case of great and irregular variability in the length of the style and of the corolla tube, and that upon the varying length of the latter depends the varying position of the stamens.

In the following table the flowers of the first ten plants were measured May 4, 1878; those of the next five, May 19, 1877; and those of the remaining three, May 26, 1877.

¹ First noticed by M. S. Bebb. See AMERICAN NATURALIST, Vol. VII, p. 691.

Plant Numbers.	Flower Nos.	Length of Corolla Tube.	Height of Anthers.	Height of Stigma.
Plant No. 1.	1	35.0 mm.	29.8 mm.	26.0 mm.
"	2	31.8 "	29.0 "	27.0 "
"	3	32.5 "	29.0 "	27.4 "
"	4	34.0 "	28.6 "	25.4 "
"	5	29.3 "	25.0 "	25.4 "
"	6	35.7 "	31.2 "	29.4 "
"	7	27.3 "	22.0 "	15.8 "
Plant No. 2.	8	32.8 "	28.4 "	25.7 "
"	9	31.3 "	27.8 "	29.0 "
"	10	29.6 "	24.8 "	25.8 "
"	11	26.0 "	26.3 "	21.8 "
Plant No. 3.	12	26.8 "	22.7 "	17.0 "
"	13	28.0 "	23.7 "	13.2 "
"	14	35.0 "	29.4 "	26.3 "
"	15	33.8 "	30.2 "	26.4 "
Plant No. 4.	16	28.2 "	24.0 "	24.0 "
"	17	30.0 "	26.2 "	25.4 "
"	18	27.6 "	24.0 "	23.7 "
"	19	24.5 "	21.0 "	20.0 "
"	20	27.4 "	24.2 "	13.2 "
Plant No. 5.	21	27.4 "	23.2 "	23.2 "
"	22	30.0 "	25.8 "	30.0 "
"	23	27.4 "	23.6 "	26.4 "
"	24	35.0 "	30.4 "	28.2 "
Plant No. 6.	25	32.0 "	28.2 "	28.4 "
"	26	24.8 "	20.8 "	22.6 "
Plant No. 7.	27	30.0 "	25.0 "	27.0 "
"	28	30.0 "	25.0 "	28.0 "
"	29	31.6 "	26.4 "	27.2 "
Plant No. 8.	30	27.8 "	24.0 "	30.3 "
"	31	26.8 "	23.3 "	27.8 "
"	32	29.0 "	26.0 "	4.0 "
"	33	24.4 "	21.0 "	20.0 "
"	34	27.0 "	24.0 "	13.4 "
"	35	30.0 "	25.4 "	26.4 "
"	36	30.0 "	26.5 "	28.3 "
"	37	27.0 "	24.8 "	19.4 "
Plant No. 9.	38	35.0 "	31.0 "	29.2 "
"	39	32.4 "	29.0 "	24.4 "
Plant No. 10.	40	29.0 "	24.4 "	24.2 "
Plant No. 11.	41	26.4 "	22.0 "	26.0 "
"	42	25.4 "	20.8 "	25.4 "
Plant No. 12.	43	27.4 "	23.6 "	27.4 "
"	44	29.9 "	26.1 "	26.9 "
Plant No. 13.	45	27.6 "	24.1 "	23.3 "
"	46	28.9 "	24.8 "	24.1 "
Plant No. 14.	47	34.7 "	30.4 "	26.6 "
"	48	33.0 "	29.7 "	30.2 "
"	49	29.9 "	26.6 "	26.1 "
Plant No. 15.	50	26.9 "	22.8 "	21.0 "
"	51	29.2 "	24.6 "	12.9 "
Plant No. 16.	52	32.7 "	28.2 "	32.7 "
"	53	31.4 "	27.4 "	32.2 "
"	54	31.7 "	27.4 "	32.2 "
Plant No. 17.	55	36.0 "	31.2 "	35.0 "
"	56	30.4 "	26.4 "	25.6 "
"	57	28.2 "	23.6 "	27.1 "
"	58	27.9 "	23.6 "	27.9 "
"	59	27.4 "	23.3 "	24.6 "
Plant No. 18.	60	27.9 "	27.1 "	23.6 "
"	61	27.1 "	28.2 "	23.8 "
"	62	27.4 "	23.3 "	25.4 "



These measurements are more readily compared when presented in a diagrammatic form (see Plate). In this the length of the corolla tubes is indicated by the length of the vertical line measured from the bottom line to the mark —, the height of the anther by o, and of the stigma by ×. For greater distinctness the similar points in all the flowers of each plant are connected by lines; the fine line thus indicates the variation in length of corolla tubes, the heavy one of the position of the anthers, and the dotted one, of the stigmas. The scale is magnified three times.

The remarkably short style of flower No. 32, bore a distinctly two-lobed stigma, which under a lens was seen to be papillated. I think it was functional. In the case of flower No. 51, there is some doubt as to whether or not the stigma was functional; the shortness of the style may have been due to injury. In all other cases there were no reasons for supposing the stigmas functionless.

As it is well known that in cases of heterogonous dimorphism the pollen grains of the two forms differ in size, I made many careful measurements of the pollen of flowers from seven different plants, and found considerable variation in size. The grains when dry are considerably elongated, being prolate-spheroidal in shape, but when wet they swell up and become spherical. The following measurements show the variations:

Flowers 1 to 7, pollen dry, prolate-spheroidal....	.025 × .035 mm.	
“ 15, pollen dry, prolate-spheroidal.....	.025 × .035 “	
“ 16 to 20, pollen dry, prolate-spheroidal...	.025 × .035 “	
“ 21, pollen wet, spheroidal.....	.035 “	
“ 22, pollen dry, prolate-spheroidal.....	.025 × .035 “	
“ 23, pollen wet, spheroidal.....	.035 “	
“ 52, pollen wet, spheroidal.....	.042 “	
“ 53, pollen wet, spheroidal.....	.039 “	
“ 54, pollen wet, spheroidal.....	.038 “	
“ 55 to 59, pollen wet, spheroidal.....	.039 “	
“ 60 to 61, pollen wet, spheroidal.....	.039 “	
“ 62, pollen wet, spheroidal.....	.042 “	

It will be difficult to see, in these measurements, any evidence of dimorphism as to the pollen grains. It may be interesting to note here that the spherical pollen grains of the cleistogamous flowers have a diameter of only .025 to .027 mm.

If now we compare the foregoing measurements with similar

ones of *Lithospermum canescens* Lehm., we may see how far *L. longiflorum* is from showing dimorphism:

Plant Nos.	Flower Nos.	Length of Corolla Tube.	Height of Anthers.	Height of Stigma.	Pollen.
Plant No. 1	1	7.8 mm.	6.8 mm.	2.8 mm.	Pollen grains ovoidal, slightly constricted in the middle. $.019 \times .03$ mm.
"	2	8.1 "	7.1 "	2.5 "	
"	3	7.6 "	6.6 "	2.8 "	
Plant No. 2	4	9.6 "	7.3 "	3.0 "	Pollen grains oblong, much constricted in the middle. $.01 \times .019$ mm.
Plant No. 3	5	6.8 "	2.8 "	7.6 "	
"	6	7.8 "	2.5 "	6.8 "	
"	7	8.6 "	2.7 "	7.3 "	
"	8	8.6 "	2.7 "	7.3 "	
"	9	8.6 "	2.7 "	7.3 "	

These measurements are entered upon the diagram (Plate) at the lower left hand corner, upon the same scale as those of *L. longiflorum*.

The following facts are clearly shown above in the case of *L. longiflorum*:

- 1st. The length of the corolla is exceedingly variable.
- 2d. The distance from the anthers to the top of the corolla tube is approximately uniform, so that the position of the anthers is largely dependent upon the length of the corolla tube.
- 3d. The length of the style is even more variable than that of the corolla tube.

Have we here a case of incipient heterostyly; or has this species but recently (since falling into cleistogamy) abandoned its former heterostylous form and habits? Probably there is some connection between the cleistogamy of the later flowers and the irregularity of the earlier ones.