flowers. As a matter of fact, most of his experiments also indicate an influence of the photoperiod. Curiously enough, Uphof² in his review of cleistogamic flowers overlooked the influence of this ecological factor, although a detailed investigation by Allard³ showed the decisive effect of the photoperiod for the formation of cleistogamic and chasmogamic flowers in the hog peanut (*Falcata comosa*). Garner and Allard⁴ also report on the influence of day-length actually for a species of violet (*Viola fimbriatula*).

Consequently I considered it appropriate to make a detailed study on the influence of the photoperiodical response on wild violets. My assumption has proved correct with regard to flower-formation. I have investigated the effect with the following species: *Viola biflora*, *canina*, *hirta*, *odorata*, *mirabilis*, *palustris*, *riviniana*, *silvestris*. Different species need different lengths of day. As a general rule, however, photoperiods less than twelve hours produce no flowers; with photoperiods between 13 and 15 hours, chasmogamic flowers normally appear; and when the photoperiod exceeds 17 hours, cleistogamic flowers appear. Additional morphological reactions have been observed. The plants have been grown in pots under identical conditions and the various flower types appear regardless of the season. Cleistogamic flower-buds fall off when transferred to a shorter photoperiod. Chasmogamic buds differ in the reaction to prolonged day-lengths. The induction of rejuvenation and everblooming responses are being investigated, and the study will be extended to elucidate the modifying effect of other ecological factors.

These results give a probable explanation of the fact that violets commonly flower for the second time in the autumn, and that cleistogamic flowers occur regularly in the summer. Most likely this photoperiodic reaction accounts partly for the fact that the alpine violets mainly are chasmogamic (Schroeterer⁵), while cleistogamy is a conspicuous feature of the violets in the northern countries and especially in the Scandinavian mountains (Lindman⁶). Other factors, especially the existence of different ecotypes, must however also be taken into consideration.

A detailed account of these experiments will be published later.

GEORG BORGSTRÖM.

Botanical Laboratory,
University of Lund.
July 18.

¹ Bergdolt, E., *Bot. Abh.*, 20 (1932).

² Uphof, J. C. Th., *Bot. Review*, 4 (1938).

³ Allard, H. A., *J. Agric. Res.*, 44 (1932).

⁴ Garner, W. W., and Allard, H. A., *Ann. Report Smiths. Inst.* (1920).

⁵ Schroeterer, C., "Das Pflanzenleben der Alpen". (2nd edit. Zürich, 1926).

⁶ Lindman, C. A. M., *Bot. Centralb.* 30 (1887)

Genetical Proof of the Existence of Coffee Endosperm

In the last few years several opinions have been published regarding the nature of the nutritive tissue of the coffee seed. Houk¹ came to the conclusion that the bulk of the mature coffee seed is perisperm formed by an enlarged nucellus, the scantily formed endosperm being evanescent. In a second paper² the same author puts forward the view that nucellus and integument of the ovule are so intimately fused that they cannot be distinguished from each other. This hypothesis of the 'integument-nucellus' had already been proposed by Lloyd³. Mayne⁴ does not agree

with Houk's assumption, and states that endosperm formation passes through a long rest period shortly after fertilization; meanwhile the nucellar tissue develops, evolving the true endosperm; later on, however, the endosperm begins to grow rapidly, replacing the nucellar tissue, which in the mature seed is represented by the inner layer of the 'silver skin'. Leliveld⁵ confirms von Faber's⁶ opinion, that the coffee ovule contains a very small nucellus "surrounded by a single stout integument". As the seed develops, the nucellar tissue is supposed to be suppressed and the integument enlarges, surrounding the embryo-sac. Endosperm formation is induced later on; it then takes all the space in the seed, the remnants of the integument finally forming the silver skin. The author claims to have determined the triploid nature of the endosperm by actual chromosome counts. Joshi⁷ also agrees with von Faber that the ovule of coffee "has a weakly developed nucellus and a massive integument"; but he seems to agree with Houk that the nutritive tissue of the coffee seed is of maternal origin.

In the present note, we wish to put forward a genetical proof for the existence of true endosperm in the mature coffee seed. A few years ago a new mutant of *Coffea arabica* L. called 'Cêra', which differs from the normal *Coffea arabica* varieties by having yellow seeds, was found in two coffee-growing regions of the State of São Paulo. Cutting through a mature seed, one notes that the whole of its nutritive tissue is of that colour. Yellow seeds are easily distinguished from normal green coffee beans. A genetical analysis of this new character, as yet not complete, furnished the following preliminary results:

- plants grown from yellow 'Cêra' seeds produced seeds of the same colour when the flowers were selfed;
- pollinating flowers of these plants with pollen of normal green seeded individuals (*C. arabica* L.), green hybrid seeds were always produced; the colour of these hybrid seeds cannot be distinguished from that of pure green seeds;
- pollinating flowers of 'Cêra' plants with pollen of *C. excelsa* Chevalier and *C. liberica* Hiern., which also have yellow seeds, hybrid seeds of the same colour were always obtained.

The results of (b) prove that a typical case of xenia occurred, one gene (or genes) for green colour dominating entirely two genes (or more) for yellow colour derived from the polar nuclei of the embryo-sac.

As the production of green hybrid seeds in the crosses between 'Cêra' type and normal green-seeded varieties is not likely to be explained by the occurrence of metaxenia, it is concluded that the bulk of the mature coffee seed is formed by real endosperm.

C. A. KRUG.
A. CARVALHO.

Genetics Department,
Instituto Agronomico do Estado de São Paulo,
Campinas, Brazil.
June 1.

¹ Houk, W. G., *Science*, 83, No. 2159, 464-465 (1936).

² Houk, W. G., *Amer. J. Bot.*, 25, 56-61 (1938).

³ Lloyd, F. E., *Mem. Torrey Bot. Club*, 8, 1-112 (1902).

⁴ Mayne, W. Wilson, *Mysore Coffee Exp. Sta. Bull.*, No. 16, 6 (1937).

⁵ Leliveld, J. A., *Arch. voor de Koffiecultuur in Ned. Indië*, No. 3, 127-164 (1935).

⁶ Faber, F. C. von, *Ann. Jard. Bot. Buitenzorg, Java*, 25, 59-160 (1912).

⁷ Joshi, A. C., *Curr. Sci.*, 7, 236-237 (1938).

⁸ Krug, C. A., Mendes, J. E. T., and Carvalho, A., *Bot. Tecn.*, No. 62 do Inst. Agronomico do Est. de S. Paulo (in the Press).