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OCCURRENCE OF (+)- AND (-)-GOSSYPOL IN SEED FROM WILD SPECIES OF GOSSYPIUM

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Abstract

Glanded cottonseed contains a toxic compound called gossypol. This compound occurs in two enantiomeric forms that are designated as (+)- or (-)-gossypol. The biological activity of these enantiomers differs significantly. Notably, the (+)-enantiomer appears to have little, if any, detrimental effect on chickens when it is incorporated into their feed, while (-)-gossypol significantly reduces weight gain. Thus, it might be possible to utilize cottonseed that contains almost exclusively the (+)-enantiomer in feed for non-ruminant animals. Interestingly, the (-)-enantiomer shows anti-cancer activity, is active against HIV, and is an antiamoebic agent. The variations in the (+)- to (-)-gossypol ratio have been reported in Upland and Pima cottons. In most commercial U.S. Upland cottons (*Gossypium hirsutum*), the ratio of (+)- to (-)-gossypol is approximately 3:2. However, some cultivars of the *marie-galante* variety of *G. hirsutum* grown in Brazil (i.e., moco) have more than 97% (+)-gossypol. In Pima cottons (*G. barbadense*), this ratio may be reversed with a (+)- to (-)-gossypol ratio as low as 31:69. We now report the results of an investigation of the (+)- to (-)-gossypol ratios and concentration of gossypol in seed from wild species of *Gossypium* that are held in the U.S. Cotton Germplasm Collection in College Station, Texas. Previously, only *G. barbadense* cultivars were reported to produce an excess of (-)-gossypol. We now report that accessions of *G. darwinii*, *G. sturtianum*, *G. harknessii*, *G. areysianum*, *G. longicalyx*, and *G. costulatum* also produce an excess of this enantiomer. Of these, the *G. longicalyx* and *G. darwinii* accessions produce the highest ratios of (-)-gossypol in conjunction with a respectable amount of total gossypol [i.e., 62% (-)-gossypol (1.3% total gossypol) and 59% (-)-gossypol (2.3% total gossypol), respectively]. We also identified species with very high levels of (+)-gossypol {*G. mustelinum* [94% (+)-gossypol, (0.31% total gossypol)]; *G. anomalum* [98% (+)-gossypol (0.25% total gossypol)]; *G. capitisviridii* [96% (+)-gossypol (0.10% total gossypol)]; and *G. gossypioides* [94% (+)-gossypol (0.15% total gossypol)]}. Incorporation of the high (+)-gossypol trait into commercial cottons could provide a seed suitable as feed for non-ruminant animals. Alternatively, incorporation of the predominant (-)-gossypol trait into cottonseed could provide seed from which the biologically active (-)-enantiomer could be extracted and used for medicinal purposes.