











COBL2	Arabidopsis	functions during buildup of crystalline cellulose into diverse secondary cell wall structures during seed coat epidermal cell distinction and crystalline cellulose installation in the epidermal cells seed coat [23]
acc. TM-1	Gossypium	have varied expression designs in developing fibers, vegetative tissues and floral tissues [24]
HbCOBL	<i>Heveabrasiliensis</i>	show noteworthy variances of expression in bark but not in latex telling that these genes may be concerned with differentiation of laticifers [26]
SbBC1	Sorghum	takes part in the manufacture of cellulose in the secondary cell wall and has impact on the mechanical asset of sorghum plants [28]

## Conclusion

The cobra-like gene family found in plants plays crucial roles in their life cycles. They play chief role in cell wall deposition which is very essential component of plant cell. These genes have been found in enormous plants comprising rice, maize and Arabidopsis and their indispensable roles in these plants suggest that these are essential part of plant life. Owing to their crucial roles, these genes have yet to be discovered in other plants

## Acknowledgment

The authors wish to thank Dr. Zia urRehmanMashwani for their help and support in writing this review.

## References

1. Roudier, F., et al., *COBRA, an Arabidopsis extracellular glycosyl-phosphatidyl inositol-anchored protein, specifically controls highly anisotropic expansion through its involvement in cellulose microfibril orientation*. 2005. 17(6): p. 1749-1763.
2. Roudier, F., et al., *The COBRA family of putative GPI-anchored proteins in Arabidopsis. A new fellowship in expansion*. 2002. 130(2): p. 538-548.
3. Sindhu, A., et al., *Maize Brittle stalk2 encodes a COBRA-like protein expressed in early organ development but required for tissue flexibility at maturity*. 2007. 145(4): p. 1444-1459.
4. Brady, S.M., et al., *Combining expression and comparative evolutionary analysis. The COBRA gene family*. 2007. 143(1): p. 172-187.
5. Schindelman, G., et al., *COBRA encodes a putative GPI-anchored protein, which is polarly localized and necessary for oriented cell expansion in Arabidopsis*. 2001. 15(9): p. 1115-1127.
6. Li, Y., et al., *BRITTLE CULM1, which encodes a COBRA-like protein, affects the mechanical properties of rice plants*. 2003. 15(9): p. 2020-2031.
7. Ching, A., et al., *Brittle stalk 2 encodes a putative glycosylphosphatidylinositol-anchored protein that affects mechanical strength of maize tissues by altering the composition and structure of secondary cell walls*. 2006. 224(5): p. 1174-1184.
8. Cruz-García, F., et al., *Cloning and characterization of a COBRA-like gene expressed de novo during maize germination*. 2003. 13(3): p. 209-217.
9. Vogel, J.J.C.o.i.p.b., *Unique aspects of the grass cell wall*. 2008. 11(3): p. 301-307.
10. Hochholdinger, F., et al., *The maize (Zea mays L.) roothairless3 gene encodes a putative GPI-anchored, monocot-specific, COBRA-like protein that significantly affects grain yield*. 2008. 54(5): p. 888-898.
11. Ye, X., et al., *The COBRA gene family in Populus and gene expression in vegetative organs and in response to hormones and environmental*

stresses. 2009. 58(2): p. 211-223.

12. Dai, X., et al., *Molecular characterization, expression pattern, and function analysis of the OsBC1L family in rice*. 2009. 71(4-5): p. 469.
13. Thumma, B.R., et al., *Identification of a cis-acting regulatory polymorphism in a eucalypt COBRA-like gene affecting cellulose content*. 2009. 183(3): p. 1153-1164.
14. Zhang, D., et al., *Expression and nucleotide diversity of the poplar COBL gene*. 2010. 6(2): p. 331-344.
15. Sato, K., et al., *The carbohydrate-binding module (CBM)-like sequence is crucial for rice CWA1/BC1 function in proper assembly of secondary cell wall materials*. 2010. 5(11): p. 1433-1436.
16. Hobson, N., M. Roach, and M.J.R.J.o.P.P. Deyholos, *Gene expression in tension wood and bast fibres*. 2010. 57(3): p. 321-327.
17. Dai, X., et al., *OsBC1L4 encodes a COBRA-like protein that affects cellulose synthesis in rice*. 2011. 75(4-5): p. 333-345.
18. Cao, Y., et al., *Functional characterization of a tomato COBRA-like gene functioning in fruit development and ripening*. 2012. 12(1): p. 211.
19. Cao, Y., X. Tang, and Y.J.B.o.B.R. Liu, *Cloning, expression pattern and bioinformatics analyses of COBRA gene in tomato (Solanum lycopersicum)*. 2012. 32(3): p. 304-310.
20. Li, S., et al., *Arabidopsis COBRA-LIKE 10, a GPI-anchored protein, mediates directional growth of pollen tubes*. 2013. 74(3): p. 486-497.
21. Gao, Y., et al., *Expression of a conifer COBRA-like gene CICOBL1 from Chinese fir (Cunninghamia lanceolata) alters the leaf architecture in tobacco*. 2013. 70: p. 483-491.
22. Liu, L., et al., *Brittle Culm1, a COBRA-like protein, functions in cellulose assembly through binding cellulose microfibrils*. 2013. 9(8): p. e1003704.
23. Ben-Tov, D., et al., *COBRA-LIKE2, a member of the glycosylphosphatidylinositol-anchored COBRA-LIKE family, plays a role in cellulose deposition in Arabidopsis seed coat mucilage secretory cells*. 2015. 167(3): p. 711-724.
24. Niu, E., et al., *Comprehensive Analysis of the COBRA-Like (COBL) Gene Family in Gossypium Identifies Two COBL s Potentially Associated with Fiber Quality*. 2015. 10(12): p. e0145725.
25. Maleki, S.S., K. Mohammadi, and K.-s.J.T.S.W.J. Ji, *Characterization of cellulose synthesis in plant cells*. 2016. 2016.
26. Putranto, R.-A. and I. Martiansyah. *Differential In Silico Expression of Hevea brasiliensis COBRA Transcripts*. in 2018 1st International Conference on Bioinformatics, Biotechnology, and Biomedical Engineering-Bioinformatics and Biomedical Engineering. 2018. IEEE.
27. Ben-Tov, D., et al., *The role of COBRA-LIKE 2 function, as part of the complex network of interacting pathways regulating Arabidopsis seed mucilage polysaccharide matrix organization*. 2018. 94(3): p. 497-512.
28. Li, P., et al., *Brittle Culm 1 encodes a COBRA-like protein involved in secondary cell wall cellulose biosynthesis in Sorghum*. 2019. 60(4): p. 788-801.