









target of miRNA-938, were 2.8 times lower in the resistant strains [109]. The CpCPR5 protein plays an important role in the formation of the cuticle. It is postulated that the protein may render the cuticle permeable to deltamethrin [110]. Likewise, miR-92a that targets *CpCPR4*, another cuticle protein, was found unregulated in deltamethrin resistant *C. pipiens* [111]. Many other miRNAs are differentially expressed between deltamethrin sensitive and resistant *C. pipiens* strains. For instance, a 2014 study found that cpp-miR-71 is considerably under-expressed in the deltamethrin resistant strains. cpp-miR-7 targets *CYP325BG3*, a cytochrome P450 gene involved in detoxification [112]. Lately, miR-278-3p [113] and miR-285 [114] were implicated in pyrethroids resistance in *C. pipiens* via post-transcriptional regulation of *CYP6AG11* and *CYP6N23*, respectively. Both these genes are also members of the cytochrome P450 family.

The Asian corn borer (*Ostrinia furnacalis*) is a pest of corn in South and South-East Asia. The pest has caused devastating losses in corn fields, such as eighty per cent in the Philippines, ninety-five per cent in Taiwan, and a hundred per cent in the Marianas [115]. Asian corn borer feeds on almost all parts of the plant, especially kernels. Mostly, bio control methods, such as *B. thuringiensis*-based Cry toxins, are used to eradicate the pest. However, in recent decades, the pest developed strong resistance to them [116]. Globally, Cry1Ab is the most widely commercialized Cry toxin for *B. thuringiensis* corn and Asian corn borer has developed a strong resistance to it. In a recent study, Xu *et al* found 22 miRNAs (21 known and 1 novel) that were differentially expressed in the resistant and sensitive pest strains. Half of the miRNAs were overexpressed in the resistant and half in the sensitive strains. The transcriptome profiling revealed that most of these miRNAs targeted *B. thuringiensis* toxin receptor genes, for example, amino peptidase N and cadherin-like protein. The other miRNAs targeted amino peptidases, chymotrypsin-like enzyme, alkaline phosphatases, ATP-binding cassette transporters, and trypsin-like enzyme. In the resistant strains, expression of amino peptidases 1 to 4 was unregulated and miRNAs targeting them, Ofu-miR-3851c-5p, Ofu-miR-963-3p, Ofu-miR-927-3p, and Ofu-miR-2731, was down regulated. Amino peptidases metabolize Cry toxins. Likewise, expression of trypsin-like serine protease and chymotrypsin-like protease was high in the resistant strains and Ofu-miR-6038 and Ofu-miR-3897-3p, which target them respectively, was low [117].

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