In mating system using sex pheromone, female moths produce and emit the pheromone, while male moths find a conspecific female by using it as a cue. This simple system drives a reproductive isolation of moths. However, it is reported that a sex pheromone gland of some species includes so-called “behavioral antagonistic compound”, which inhibits mating behavior of a same or the other species male. This article reviewed a behavioral antagonist and its function on well-studied Ostrinia species.

Female pheromone gland of European corn borer moth (ECB), Ostrinia nubilalis contains (E)-11-tetradecenyl acetate (E11-TDA), (Z)-11-tetradecenyl acetate (Z11-TDA), (Z)-9-tetradecenyl acetate (Z9-TDA) and tetradecyl acetate. Two components of these four, E11-TDA and Z11-TDA were reported to be a sex pheromone (Klun et al. 1975). Z9-TDA suppressed a sex attraction behavior of males (Klun et al. 1979). This is the first report of a behavioral antagonist. In N.Y., there are two strains of ECB, (E)- and (Z)-races utilizing 1:99 (E)- and (Z)-11-TDA and 98:2 (E)- and (Z)-11-TDA, respectively. Additionally, the female pheromone gland of these two strains contains 1% of following compounds, (E)-9-dodecenyl acetate, (Z)-9-dodecenyl acetate, (E)-11-tetradecenyl acetate and Z9-TDA. Male response to each component with ECB pheromone in wind tunnel test found that Z9-TDA produces dramatic reduction in complete flights to a pheromone source (Glover et al. 1989). These reports indicate that female pheromone gland contains not only sex pheromone but also non-pheromonal components like pheromone antagonist.

In cases of two or more species use similar a sex pheromone or occur in sympatric, a combinational use of pheromone lures was often used for economizing. ECB and Sesamia nonagrioides are sympatric species and both species infest cornstalks. Pheromones of these species were attempted to use together, however the activity of ECB pheromone lure was greatly decrease. Then the male of ECB response to each component of S. nonagrioides was examined by addition of the component to ECB pheromone, resulting inhibitive activity in ECG response to (Z)-11-hexadecenal (Z11-16:Ald). Further EAG cross-adaptation test suggested that Z11-16:Ald is received by the different receptor with ECB pheromone (Gemeno et al. 2006). (Z)-race ECB in N.Y. population showed the similar result in wind tunnel tests. The cross-adaptation test in single-sensillium recording suggested that Z11-16:Ald is received by same receptor with Z9-TDA (Linn et al. 2007). These studies suggested that a pheromone antagonistic pathway is different with a pheromone pathway and antagonism could be involved by a chemicals that is not a member of suite compounds, if that chemicals binds to the antagonist receptor.

What is a biological significance of behavioral antagonist? Asian corn borer (ACB), O. furunacalis uses (E)-12-tetradecenyl acetate (E12-TDA) and (Z)-12-tetradecenyl acetate (Z12-TDA) as a sex pheromone. Z9-TDA is also a behavioral antagonist in ACB. In addition, ECB pheromone is received by both ACB
pheromone and the antagonist receptors (Takanashi et al. 2006). Domingue et al. (2007) focused on a response of a “rare male” of ACB. A majority of ACB males are attracted to ACB pheromone only (“normal male”), but a minority of them could be attracted to ECB pheromone (“rare male”). Then the antennal sensitivity of each ACB males was recorded. In the antenna of normal ACB male, both of the pheromone and the antagonist receptors were stimulated by ECB pheromone. In contrast, pheromone receptor of rare male respond to ECB pheromone, but antagonist receptor was not stimulated by that pheromone. This paper showed that behavioral antagonistic compound functions as barrier between congener species.

Pheromone antagonistic compounds of sex pheromone inhibit the sex attraction behavior of male moth with a small amount. In many cases, some of pheromone compounds that a female produced inhibit the behavior of the others species male. Therefore it is sex pheromone for conspecific male, but is allelochemicals for the other species. The antagonist likely to be played a role of avoiding hybridization between congener species, but there were no direct evidences. To clarify the function of the behavioral antagonistic compound, the role of the compound in sympatric species using a similar sex pheromone needs to be studied.

References