

Key words ; ; *Helicoverpa armigera*; *Microplitis mediator*;

Helicoverpa armigera (Hübner)

(gas chromatography-electroantennographic detection, GC-EAD) (gas chromatography-mass spectrometry, GC-MS)

1992 50% 1/3^[1]

Microplitis mediator (Haliday)

1994

1993

,1993

[1]

1 解析棉花三级营养化学通讯,开创棉花害虫防控研究新篇章

,1995

[2]

1997

3,4- , CSP2 -2- ,
 、 、3,4- 、 PBP1 PBP2
 , CSP3 TMTT、DMNT、 Z11-16:Ald, RNA (RNA interference,
 、 、 3 PBP1 PBP2 RNAi) PBP1 PBP2 ,
 (Z11-16:OH,Z11-16:Ald,E11-14:Ac) 50% [36]。
 ,NPC2a 4- 、3,4- RNAi
 、β 7 ,
 [44,49-50] 。 RNAi
 OBP19 、 。
 OBP19 , 3,7- -1,3,
 [51] 。 6- 20.22%^[8]。
 、 60
 。 3,7- -1,3,6-
 (Z)-3-
 [53] , ,

3 设计昆虫化学通讯行为调控新技术,谋划棉花害虫绿色防控新方向

- -
 , 7
 7
 , *Coccinella septem-*
punctata (Z)-3-
Deraeocoris punctulatus
 [54] 。
 ,
 , *GhTPS12* -
 , *GhTPS12* -
 。 51.5% ,
 , *GhTPS12* *Hippodamia variegata*
 [55-68] ,
 , - -
 [13-16] 。
 ,
 , *Orco* ,
Orco dsRNA , *Orco* ,
 , 、RNAi,
 ,
 [52] 。 PBP

参考文献

- [1] . [M]. : , 1998: 1-321o2817².
- [2] , . [J]. , 1995, 21(5): 33-35.
- [3] , , . [J]. , 1997, 40(S1): 66-72.
- [4] , , , . Bt [J]. , 2001, 21(12): 2051-2056.
- [5] , , , . *Micropplitis mediator* [J]. , 2006, 12(6): 809-813.
- [6] , , , . [J]. , 2007, 18(4): 859-864.
- [7] , , , . [C]// 2004: 192-195.
- [8] YU Huilin, ZHANG Yongjun, WYCKHUYS K A, et al. Electrophysiological and behavioral responses of *Micropplitis mediator* (Hymenoptera: Braconidae) to caterpillar-induced volatiles from cotton [J]. *Environmental Entomology*, 2010, 39(2): 600-609.
- [9] , , , . [J]. , 2011, 54(4): 437-442.
- [10] , , , . [C]// 2011 , 2011: 765.
- [11] , , , . [C]// 2011 . : , 2011: 764.
- [12] HUANG Xinzheng, CHEN Jieyin, XIAO Haijun, et al. Dynamic transcriptome analysis and volatile profiling of *Gossypium hirsutum* in response to the cotton bollworm *Helicoverpa armigera* [J/OL]. *Scientific Reports*, 2015, 5: 11867. DOI: 10.3390/insects10030080.
- [13] , , , . *GhTPS1* [J]. , 2012, 49(4): 831-838.
- [14] HUANG Xinzheng, XIAO Yutao, KÖLLNER T G, et al. Identification and characterization of (*E*)- β -caryophyllene synthase and α/β -pinene synthase potentially involved in constitutive and herbivore-induced terpene formation in cotton [J]. *Plant Physiology and Biochemistry*, 2013, 73: 302-308.
- [15] HUANG Xinzheng, XIAO Yutao, KÖLLNER T G, et al. The terpene synthase gene family in *Gossypium hirsutum* harbors a linalool synthase GhTPS12 implicated in direct defence responses against herbivores [J]. *Plant, Cell & Environment*, 2018, 41: 261-274.
- [16] LIU Danfeng, HUANG Xinzheng, JING Weixia, et al. Identification and functional analysis of two P450 enzymes of *Gossypium hirsutum* involved in DMNT and TMTT biosynthesis [J]. *Plant Biotechnology Journal*, 2018, 16(2): 581-590.
- [17] , , . “-” [C]//“ ”- . : , 1995: 188-195.
- [18] , , . [J]. , 2002, 35

[J]. , 2009, 52(7): 728 - 735.

- [28] , , . 2 cDNA
、 [J]. , 2009, 42
(7): 2359 - 2365.
- [29] , , . HarmC-
SP6 [J].
2011, 54(6): 615 - 622.
- [30] ZHANG Tiantao, GU Shaohua, WU Kongming, et al. Construction and analysis of cDNA libraries from the antennae of male and female cotton bollworms *Helicoverpa armigera* (Hübner) and expression analysis of putative odorant-binding protein genes [J]. Biochemical and Biophysical Research Communications, 2011, 407(2): 393 - 399.
- [31] SU Honghua, WANG Guirong, ZHANG Yongjun, et al. Screening of proteins interacting with Gq α by yeast two-hybrid technique in the antenna of *Helicoverpa armigera* (Lepidoptera: Noctuidae) [J]. Acta Entomologica Sinica, 2010, 53 (12): 1339 - 1344.
- [32] ZHANG Tiantao, MEI Xiangdong, FENG Jinian, et al. Characterization of three pheromone-binding proteins (PBPs) of *Helicoverpa armigera* (Hübner) and their binding properties [J]. Journal of Insect Physiology, 2012, 58(7): 941 - 948.
- [33] ZHANG Tiantao, WANG Weixuan, ZHANG Ziding, et al. Functional characteristics of a novel chemosensory protein in the cotton bollworm *Helicoverpa armigera* (Hübner) [J]. Journal of Integrative Agriculture, 2013, 12(5): 853 - 861.
- [34] ZHANG Tiantao, WANG Weixuan, GU Shaohua, et al. Structure, binding characteristics, and 3D model prediction of a newly identified odorant-binding protein from the cotton bollworm, *Helicoverpa armigera* (Hübner) [J]. Journal of Integrative Agriculture, 2012, 11(3): 430 - 438.
- [35] LIU Yang, GU Shaohua, ZHANG Yongjun, et al. Candidate olfaction genes identified within the *Helicoverpa armigera* antennal transcriptome [J/OL]. PLoS ONE, 2012, 7(10): e48260. DOI: 10.1371/journal.pone.0048260.
- [36] DONG Kun, SUN Liang, LIU Jingtao, et al. RNAi-induced electrophysiological and behavioral changes reveal two pheromone binding proteins of *Helicoverpa armigera* involved in the perception of the main sex pheromone component Z11-16: Ald [J]. Journal of Chemical Ecology

[53] , , .

[J].

, 2011, 27(2): 157 - 164.

[54] YU Huilin, ZHANG Yongjun, WU Kongming, et al. Field-testing of synthetic herbivore-induced plant volatiles as attractants for beneficial insects [J]. *Environmental Entomology*, 2008, 37(6):

acterization and target gene analysis of microRNAs in the antennae of the parasitoid wasp *Microplitis mediator* [J]. *Insect Science*, 2021, 28(4): 1033 - 1048.

- [79] WANG Qi, XIAO Yong, AN Xingkui, et al. Functional characterization of a candidate sex pheromone receptor AlinOR33 involved in the chemoreception of *Adelphocoris lineolatus* [J]. *Journal of Agricultural and Food Chemistry*, 2021, 69(24): 6769 - 6778.
- [80] XIAO Yong, SUN Liang, WANG Qi, et al. Host plants transfer induced regulation of the chemosensory genes repertoire in the alfalfa plant bug *Adelphocoris lineolatus* (Goeze) [J/OL]. *Comparative Biochemistry and Physiology Part D: Genomics and Proteomics*, 2021, 38: 100798. DOI: 10.1016/j.cbd.2021.100798.
- [81] TENG Dong, LIU Danfeng, KHASHAVEH A, et al. Biosynthesis of artemisinic acid in engineered *Saccharomyces cerevisiae* and its attractiveness to the mirid bug *Apolygus lucorum* [J]. *Journal of Integrative Agriculture*, 2022, 21(10): 2984 - 2994.
- [82] HUANG Xinzheng, KOU Junfeng, JING Weixia, et al. Transcriptomic and metabolomic reprogramming in cotton after *Apolygus lucorum* feeding implicated in enhancing recruitment of the parasitoid *Peristenus spretus* [J]. *Journal of Pest Science*, 2022, 95(1): 249 - 262.
- [83] KHASHAVEH A, AN Xingkui, SHAN Shuang, et al. The

microRNAs in the antennae of *Apolygus lucorum* (Hemiptera: Miridae): expression propert