IPPC Webinar on Fall Armyworm (FAW) – 9th December 2020

Fall Armyworm prevention under the Framework of FAO Global Action on FAW control

Q&A Session

Biology of the pest and technical questions

Q1: What is the host range of FAW?

[1] **A:** FAW is extremely polyphagous. A recent review suggests that the FAW has been recorded on over 350 host species from more than 75 families although it has a preference for monocots, mainly Poaceae, but also for Asteraceae and Fabaceae (Montezano[1] *et al.* 2018).

[2] However it is not clear that all 350 species can support full development of FAW. A detailed host list is provided by EPPO at https://gd.eppo.int/taxon/LAPHFR/hosts.

[3] FAW is a serious pest of corn, rice, sorghum, cotton, soybean and sugarcane around the world and its range extends to potatoes, tomatoes and cucurbits and a number of other vegetable and fruit crops (Casmuz[2] *et al.* 2010).

Q2: Is there any chances of damage and attack of the FAW maize strain to other crops like vegetables, cash crops? If yes then what precaution we have to take?

[4] **A:** There are two FAW "strains" on the basis of the host plant preference, either 'rice-preferred' (Sfr) or 'corn-preferred' (Sfc). There are no distinguishable morphological characters to differentiate between Sfc and Sfr and identification is currently achieved via molecular diagnostics.

[5] FAW that is currently detected in the Old World is a 'mix' / hybrid of Sfr and Sfc FAW. You can read more of it here: https://www.biorxiv.org/content/10.1101/2020.06.12.147660v3.full

[6] FAW is highly polyphagous and will attack multiple crops, regardless of it being Sfc or Sfr strain. However most of the reports from Africa and Asia thus far seemed to come from maize.

Q3: What is the present status of FAW on rice crop?

[7] **A**: There has been sporadic reports from rice across Asia. However, a large scale and significant damage on rice due to FAW has not been reported.

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1 **Montezano DG, Specht A, Sosa-Gómez DR, Roque-Specht VF, Sousa-Silva JC, Paula-Moraes SV, Peterson JA & Hunt T**. 2018. Host plants of Spodoptera frugiperda (Lepidoptera: Noctuidae) *in* the Americas. African Entomology 26, 286-300pp.

2 **Casmuz A, Juárez ML, Socías MG, Murúa MG, Prieto S, Medina S, Willink E. & Gastaminza G**. 2010. Review of the host plants of fall armyworm, Spodoptera frugiperda (Lepidoptera: Noctuidae). *Revista de la Sociedad Entomológica Argentina* 69, 209–231 (in Spanish).

Q4: What are the list of countries infested by FAW on rice crop?

[8] **A:** In some South East Asian countries, FAW has been detected on rice crop but the damage is not as great as on maize. There is not an official list of countries infested by FAW on rice, although in Vietnam the US Department of Agriculture on its Global Agriculture Information Network report (USDA GAIN report VM2019-0017[3]) mentioned FAW being detected in paddy rice fields in Nam Dinh Province; Kalleshwaraswamy[4] reported attacks on rice *Oryza sativa* in southern India, Karnataka State, between May and June 2019; and in China, the Jiangsu[5] Province reported attacks in July 2019; Xuwen[6] County reported in March 2020 and attacks on rice crops were reported in local Mandarin news articles.

[9] It is necessary to keep in mind that reports through FAO projects so far, as well as in the majority of peer-reviewed publications, have suggested that maize is the preferred host for the FAW populations in the affected countries in Asia. Detections of FAW in rice are therefore potentially incidental.

Q5: How the eggs masses or FAW moth is stuck or entered in the aircraft's? Was it natural mating of unintentional introduction?

[10] **A:** This information is reported as an hypothesis of introduction of FAW in Africa in the article "Cock MJW, Beseh PK, Buddie AG, Cafá G & Crozier J. 2017. Molecular methods to detect Spodoptera frugiperda in Ghana, and implications for monitoring the spread of invasive species in developing countries. Scientific Reports 7, 4103" and is based on a 1950 paper of Porter " Porter, J. E. & Hughes, J. H. Insect eggs transported on the outer surface of airplanes. J. Econ. Ent. 43(4), 555–557 (1950)" in which it is written: *"Egg masses can be laid in, or on, parts of aircraft, including wheel bays. In one 1950 study, more than 9,000 aircraft coming from South America and the Caribbean were examined at Miami airport; Lepidoptera eggs were found on 98 of these (0.86%), and the predominant species was S.* frugiperda*".*

Q6: Any impact observed on the climate parameters like temperature, humidity etc. on establishment and multiplication of FAW?

[11] **A:** These are analyzed in the European Food Safety Authority (EFSA) Pest Risk Assessment[7], Jeger M, Bragard C, et al. (2017) Pest categorization of *Spodoptera frugiperda*. EFSA Journal 15(7), e04927., Weiss, J. 2020. Review of ecological modelling of fall armyworm, Spodoptera frugiperda with respect to Australia

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3 USDA GAIN. 2019. *Fall Armyworm damages corn and threatens other crops in Vietnam. Report Number VM2019-0017* [Online]. October 11, 2019. 7pp. https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Fall%20Armyworm%20Damages%20Corn%20and%20Threatens%20Other%20Crops%20in%20Vietnam_Hanoi_Vietnam_10-02-2019

4 **Kalleshwaraswamy CM, Asokan R, Mahadevaswamy HM, Sharanabasappa**. 2019. First record of invasive fall armyworm, Spodoptera frugiperda (J.E. Smith) (Lepidoptera: Noctuidae) on rice (Oryza sativa) from India. *Journal of Entomology and Zoology Studies* 7(3), 332-337pp.

5 Jiangsu Province: https://finance.sina.com.cn/money/future/agri/2019-07-02/doc-ihytcerm0752366.shtml

6 Xuwen Province: https://www.sohu.com/a/383786254_208565

7 EFSA (European Food Safety Authority). 2018. *Pest Risk Assessment of Spodoptera frugiperda for the European Union* [online]. 31 March 2018. https://efsa.onlinelibrary.wiley.com/doi/10.2903/j.efsa.2018.5351

(Agriculture Victoria Research, Department of Jobs, Precincts and Regions). Technical report, May 2020. According to the European Food Safety Authority (EFSA) Pest Risk Assessment (Jeger et al. 2018).

Q7: Concerning FAW morphological identification, what characters are used to differentiate species of the genus Spodoptera?

[12] **A:** Please see EPPO Diagnostic protocol PM 7/124.

[13] Molecular identification would be more rewarding in working out if existing populations are supplemented by new arrivals from their native ranges of North, Central and South Americas, with new economically important traits being introduced.

[14]

Q8: What is the best lure to be used for FAW trapping? There are many companies providing lures with 2, 3 or 4 pheromonal compounds.

[15] **A:** There are many FAW surveillance protocols available[8] (e.g., Kearns et al. 2020), the FAO & Centre for Agriculture and Bioscience International CABI (2019) instructions[9], and the EFSA FAW surveillance guidelines[10] (Kinkar et al. 2020) that detail specific objective-oriented considerations. The Fall Armyworm Trapping and Surveillance Manual[11] of the Australian Government provides very operational instructions to select a site, place a trap, maintain a trap, submit samples and manage data (Britton &Greenwood 2020). Field scouting protocols can also be found in FAO Farmer Field School FFS guide for FAW management[12] and International Maize and Wheat Improvement Center, CIMMYT Fall Armyworm in Africa: A Guide for Integrated Pest Management[13].

[16] The "best" lure may depend on various factors such as the trap type and location, FAW population characteristics, as well as what other noctuid are present. Other species can be attracted and caught, so a lure that minimises these catches might be preferable. Pheromone lures should be sourced from reputable suppliers who are willing to tell you what pheromone components are in the lure and in what proportions.

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8 **Kearns S, Bett B, Carnovale D, Maino J, Lye J, Overton K, Wong C, Day R, Miles M, Thia JA, McDonald G and Reynolds O**. 2020. Fall armyworm Continuity Plan: Australian Grains Industry. A Grains Research and Development Corporation Investment Initiative. 79pp.

9 FAO & CABI. 2019. *Fall Armyworm Field Handbook: Identification and Management. [online]*. First Edition. 38 p. https://www.cabi.org/isc/FullTextPDF/2019/20197200644.pdf

10 **Kinkar M, Delbianco A. Vos S**. 2020. Pest Survey Card on Spodoptera frugiperda. EFSA supporting publication. 2020:EN-1895. 29pp. doi:10.2903/sp.efsa.2020.EN-1895

11 **Britton D & Greenwood T.** 2020. Fall Armyworm Trapping and Surveillance Manual. Australian Government. Department of Agriculture, Water and the Environment. 21 p.

12 FAO. 2019. *Farmer Field School FFS guide for FAW management* [online]. http://www.fao.org/3/i8665en/I8665EN.PDF

13 CIMMYT. 2018. *Fall Armyworm in Africa: A Guide for Integrated Pest Management* [online] https://repository.cimmyt.org/handle/10883/19204

Q9: Can community surveys be a convenient tool for conducting accurate, quick and cost-efficient survey for estimation of yield loss caused by FAW?

[17] **A:** Yes, community and village level surveillance is important to compliment more detailed and extensive surveillance by plant health specialists and entomologists and is often very cost effective. However, it should be noted that farmers may overestimate their losses due to FAW, particularly when the pest is unfamiliar to them. For instance, community and village level survey and awareness activities have been supported in Papua New Guinea over the past six months and if FAW larvae is found, it is sent to Australian laboratories for identification. The FAO FAMEWS[14] app can be used for data collection and reporting for both delimiting and yield loss.

[18] Please consult the dedicated webpages at https://www.ippc.int/en/the-global-action-for-fall-armyworm-control/.

Q10: What are the 21 target countries for the prevention?

[19] **A:** The 21 target countries of the FAO/IPPC FAW Technical Working Group are those countries where FAW is still absent or of limited distribution. This comprises as of now the following countries:

- Europe: France, Greece, Italy, Spain, Portugal.
- Near East and North Africa: Algeria, Iraq, Jordan, Lebanon, Libya, Morocco, Oman, Saudi Arabia, Syria.
- South West Pacific: Australia, Federate States of Micronesia, Fiji Islands, Guam, New Zealand, Papua New Guinea, Vanuatu.

Q11: Considering that FAW is a strong flier (wind-assisted) known to fly up to 500 km before oviposition (Prasanna et al., 2018) and spread through natural pathways, I am curious to know the FAW prevention activities for some of these 21 target countries.

[20] **A:** FAO and the IPPC Secretariat will implement the following activities to facilitate prevention in the 21 target countries:

- Prevention and preparedness guidelines for FAW will be open for consultation to the 21 target countries on the IPPC Online Commenting System (please see FAW website[15])
- Establish a FAW platform on the IPP whereby the 21 target countries can provide information on their achievements on FAW (Pest Risk Analysis available for this pest, pest regulated in the country, contingency plan available, crisis unit set, etc.) in order to understand the needs of the countries.
- Organization of global, regional and national webinars to develop the capacities of the 21 target countries in implementing the Prevention and preparedness guidelines for FAW. These webinars are planned to be organized in the first semester of 2021 with the support of the related Regional Plant

14 http://www.fao.org/fall-armyworm/monitoring-tools/famews-mobile-app/en/

15 https://www.ippc.int/en/the-global-action-for-fall-armyworm-control/?__cf_chl_jschl_tk__=5b7b1c306a8c07070712658c3ac8e995c0749d17-1608547020-0-Ac7nm3IDQD__CQebXvkLCdsG7taW4y7yCqZXWj67A01B5vl0428wbYcJIk9vC4JB-LetGQZtT8GPNq87_NQPv9st1mWJh71cCL1m4Uj_x5DgKfaEwuUUMNhLGUjkn0CxJoJvFuH8UVAcLo8OCUPLUX40k2xwv-OiMsb98HSkP6POnnhU61h1K1d_LMX1IUa-6VdIqTVbVNeYc2VHhM-mSfd1e-hXK32zDLxMtcSvvyJD-W6FtDpxE3cTwNHkimKD_p9VDNkqGY2Nctkq6Kle9-qIcQmV_OD2babEZcKmk5L_bEB-Mk_nCf4Unm_ynilnsMKD1qfCMbQ137EynTq6desRAMT01_RSd8O6end07UJUM9RjnN9rtncNSkp-kOjpew

Protection Organizations, namely the European and Mediterranean Plant Protection Organization (EPPO), the Near East Plant Protection Organization (NEPPO) and the Pacific Plant Protection Organization (PPPO).

Q12: Do you try to preventive control by natural enemies, means Trichogramma sp. (parasite), Podisus sp. (predator) or entomopathogens fungus?

[21] **A:** Pest control through the introduction of natural enemies cannot be carried out without the presence of the pest. However, it is important for pest-free countries to check the natural occurrence of any natural enemies in their regions that may help regulate the pest, possibility of acquiring the natural enemies from others countries and mass rearing them if none is found within the country per se, to acquire any authorizations for their use in good time. It is likely that there will be endemic as well as previously introduced parasitoids, for controlling other insect pests that are capable of attacking FAW in the new invasive countries. Studies into understanding diversity and presence of parasitoids in Africa and Asia that are capable of attacking FAW have uncovered many genera of hymenopteran (e.g., *Telenomus*, *Cossygidium*, *Chelonus*, *Cotesia*) and dipteran (mainly Tachinidae) parasitoids attacking FAW.

Q13: What steps taken by FAO IPPC to deal with FAW amidst Covid_19 induced pandemics for last one year. Lockdowns and travel restriction have limited access to technical knowledge, demonstration and field program?

[22] **A:** For what concerns our prevention programmes, all activities are now virtual. Webinars are planned to be organized the first semester of 2021. Furthermore, new e-learning courses are being developed on Pest Risk Analysis and Expert Certification Systems with the support of the *Comité de Liaison Europe-Afrique-Caraïbe-Pacifique*[16] (COLEACP) in the framework of a FAO Project financed by the Common Market for Eastern and Southern Africa[17] (COMESA). These new e-learning courses will allow to develop the capacities of all countries. They should be ready in May 2021 in both English and French.

Q14: What efforts are made to assess the impact of FAW on the quality of corn production, issues of mycotoxins and effect of international trade from developing countries or vice versa, if any?

[23] **A:** Rwomushana et al (2018) discussed the possible impacts of FAW on trade[18]. Please see the evidence note CABI[19] on March 2019 for Tomato leafminer (*Tuta absoluta*): impacts and coping strategies for Africa

16 https://www.coleacp.org/

17https://www.ippc.int/en/core-activities/capacity-development/projects-on-implementation-and-capacity-development/comesa-trade-facilitation-programme/

18 **Rwomushana I, Bateman M, Beale T, Beseh P, Cameron K, Chiluba M, Clottey V, Davis T, Day R, Early R, Godwin J, Gonzalez-Moreno P, Kansiime M, Kenis M, Makale F, Mugambi I, Murphy S, Nunda W, Phiri N, Pratt C, Tambo J.** 2018. Fall armyworm: impacts and implications for Africa [online]. 53 p. https://www.invasive-species.org/wp-content/uploads/sites/2/2019/02/FAW-Evidence-Note-October-2018.pdf (accessed 17-Dec, 2020).

Rwomushana, I., Bateman, M., Beale, T., Beseh, P.,

19 CABI. 2019. *Tomato leafminer (Tuta absoluta): impacts and coping strategies for Africa* [online]. https://www.invasive-species.org/wp-content/uploads/sites/2/2019/04/Tuta-Evidence-Note_FINAL.pdf

Q14: Is FAO collaborating with World Trade Organization (WTO) on emerging phytosanitary issues and what is it doing to build, capacities of developing countries?

[24] **A:** The IPPC Secretariat attends the Sanitary and Phytosanitary (SPS) Committee of the WTO and collaborates with the Standards and Trade Development Facility (STDF). The STDF financed a few phytosanitary capacity development projects managed by the IPPC Secretariat, hence building capacities.

[25] The WTO SPS Committee held a thematic session on FAW. See https://www.wto.org/english/tratop_e/sps_e/workshop19032019_e.htm

Q15: This week FAW has been registered in Syria in Daraa city which is not far from Jordan. Technical support should be ASAP provided.

[26] **A:** While the IPPC Secretariat does not provide specific funds to deal with such emergency, Syria could apply for an emergency technical cooperation project to FAO.

[27] Countries have also received specific assistance from other countries. This is the case for Fiji. The regional cooperation in the South Pacific region via the RPPO - Pacific Plant Protection Organisation (PPPO) and the developed countries (like Australia, New Zealand) assisting Fiji with resources, advice, training and communications on FAW via various platforms like eForums, monthly casual discussions (known as Talanoa sessions of PPPO members) providing physical resources (traps and accessories), advisories and horizon scanning for the movements of FAW in the region and necessary precautions to take.

Q16: Right now, how many people are involved in the Pacific islands to follow any kind of pest or disease?

[28] **A:** In the Pacific there can be more than 300 Biosecurity Officers in bigger countries like Australia, New Zealand, Fiji and PNG. For the smaller countries there can be 1 to 20 Biosecurity Officers. This is a real challenge, given the huge threat FAW represents for the PPPO region. Thus the PPPO secretariat works collaboratively with NPPO's and stakeholders to strengthen Pre-Border assessments and Border inspections as well as ongoing Post Border survey for the FAW threat. Work is also ongoing with Academia and Ministries of Agriculture in the various countries to address this threat.

[29] There are many biosecurity projects and initiatives in the pacific region to support and strengthen quarantine and biosecurity systems at the national and regional levels. There are also formal capacity development projects in the region to strengthen biosecurity preparedness and response of countries and to strengthen the surveillance and diagnostic skills for early identification and response and the PPPO is doing a great job in coordinating these activities.

Integrated Pest Management

Q17: There are great achievement in rearing biological enemies and formulations of biorational insecticides in China. Is it envisaged to transfer these technologies to the NENA region?

[30] **A:** There are ongoing South-South Cooperation projects facilitating lesson sharing in fall armyworm management across regions, including those from China and elsewhere. Lessons learned in one region will also be shared across regions through the use of webinars, newsletters and other channels.

Q18: Mauritania is the first country in North Africa infested by FAW since February 2020. To prevent FAW spread in other countries, we need to support this country on rearing enemies natural and build capacities on FAW management. What concrete actions can be done through this global actions programme on that?

[31] **A:** Mauritania can apply for emergency technical cooperation project to FAO. In the framework of the Global Action, Integrated Pest Management (IPM) strategies successfully validated in the demonstration country (i.e. Egypt for NENA) will be shared with other countries in the region through regional extension conferences, webinars and virtual training, as well as development of knowledge products.

Q19: From those countries who suffers from FAW infestation, is there any available data of which FAW do more damage and do great yield loss on merely on what specific crop? Corn or rice or on vegetables?

[32] **A:** Based on the data submitted through FAMEWS app so far, the highest infestation rate has been observed on maize compared to other crops.

Q20: Could you share any study that shows that the FAW is not active and damages winter maize crops? The experience in Nepal shows that there is very few or no damage and/or very few number of FAW in maize in the winter season, but in the summer season, the FAW damaged significant percentage (very high) in Maize.

[33] **A:** FAW development is dependent on climatic variables, so how rapidly it develops, how well it survives and how much damage it causes will depend on those variables. There are many studies in USA that show FAW cannot survive winter temperatures except in Florida and Texas, but each year it migrates north and causes damage in many areas in which it cannot survive the winter (it does not diapause).

Q21: Could you please provide information about mass rearing of biocontrol agent of FAW which was held on 23-24 Nov, 2020?

[34] **A:** The training was planned to be face to face in March 2020. Because of COVID 19, a virtual training workshop was organized on 23-24 November 2020 for North Africa and Near East countries by the Near East Regional Office with NEPPO and the animation of International Centre of Insect Physiology and Ecology (ICIPE). Three experts facilitated the training Dr Samira Abuelgasim Mohamed; Dr Francis Obala and Dr Subramanian Sevgan. The training course started with a general review on how to rear an insect, conditions impacting the process, followed by rearing parasitoid *Telenomus remus*; *Cotesia icipe* by Dr Samira Abuelgasim Mohamed; Dr Francis Obala. Dr Subramian presented the basis of entomopathogenic fungi with highlight on some of them such as *Beauveria bassiana*; *Isaria fumosorosea*; *Metharizium* spp and *Pandora neophidis*. The discussion was relevant and very useful. The attendance of experts from Syria and Egypt for instance enhanced the debate with their experience on mass rearing of biocontrol agents.

Q22: With regard to integrated pest management the traditional push and pull system. Could you give analysis of alternative crops that a local small scale farmer could use to help alter the cycle of the

pest and allow for the maize main crop to grow sacrificial crops that can be grown on farm boundary to cover the main maize crop on the field?

[35] **A:** Push-pull for FAW is described in Midega[20] et al (2018) and in Prasanna[21] et al. (2018; Chapter 2). https://www.sciencedirect.com/science/article/pii/S0261219417303216

[36] See also Hailu[22] et al (2018) who describe intercropping and push pull for FAW management.

Q23: what biological control agents are successful against FAW so far? Can we use parasitoid cards in field for FAW control ?any research?

[37] **A:** There are different types of biological control:

- Classical/introduction. This has not been implemented yet in Africa or Asia, but parasitoids have been collected in Latin America and their host specificity is being tested.
- Augmentation. *Trichogramma* and *Telenomus remus* are used in Latin America, and trials are in progress in Africa and Asia. With large enough releases, it is quite likely that FAW can be controlled, but whether it can be done cost effectively remains to be seen. Note that *T. remus* has been reported as a candidate for FAW control[23] and this parasitoid originated from S.E. Asia (Malaysia) and it is likely that FAW in SE Asia are being attacked by this parasitoid, although research on parasitism efficacies remained to be carried out.
- Encouragement/conservation. Many natural enemies have been found attacking FAW in its invasive range[24]. These may not be adequate to provide full control, but methods to encourage them are being researched. Other management methods should be selected that do not damage natural enemy populations.

[38] A review on natural enemies found in the different countries are given below:

- Ghana and Benin: Agboyi et al. 2020 https://doi.org/10.3390/insects11020068
- Ghana: Koffi et al. 2020 https://doi.org/10.1653/024.103.0414
- Mozambique: Caniço et al. 2020. https://doi.org/10.3390/insects11090615
- Africa: Kenis M, et al. 2019. Insects 10(4), 92. https://doi.org/10.3390/insects10040092

20 **Midega CAO, Pittchar JO, Girma JAP, Zeyair WH, Khan R**. 2018. A climate-adapted push-pull system effectively controls fall armyworm, Spodoptera frugiperda (J E Smith), in maize in East Africa. Crop Protection. Volume 105, March 2018, Pages 10-15. https://www.sciencedirect.com/science/article/pii/S0261219417303216

21 **Prasanna BM, Huesing JE, Eddy R, Peschke VM (eds**). 2018. Fall Armyworm in Africa: A Guide for Integrated Pest Management, First Edition. Mexico, CDMX: CIMMYT. https://www.usaid.gov/sites/default/files/documents/1867/Fall-Armyworm-IPM-Guide-for-Africa-Jan_30-2018.pdf

22 **Hailu G, Niassy S, Zeyaur KR, Ochatum N, Subramanian**. 2018. S Maize–Legume Intercropping and Push–Pull for Management of Fall Armyworm, Stemborers, and Striga in Uganda. Pest Interactions in Agronomic System. Volume110, Issue6. Pages 2513-2522. https://acsess.onlinelibrary.wiley.com/doi/full/10.2134/agronj2018.02.0110

23 **Hay-Roe et al**. 2015. Annals of the Entomological Society of America [online] 108(5), 729–735.[September 2015], https://doi.org/10.1093/aesa/sav074

24 See: https://faw.researchcollaborationportal.org/natural-enemies/

- Varshney et al. 2020. https://doi.org/10.1007/s41348-020-00357-3. Reported that the use of trichocards as a part of a broader IPM package resulted in reduction of egg mass and larval populations as well as higher yield compared to farmers' practice in India.
- India: Firake DM, Behere GT. 2020. Crop Protection 137, 105233. https://doi.org/10.1016/j.cropro.2020.105233
- India: Firake DM, Gehere GT. 2020. Biologiccal Control 148, 104303. https://doi.org/10.1016/j.biocontrol.2020.104303
- China: Liao Y-L, et al. 2019. *Jourrnal of Hymenoptera Research* 73, 95-102pp.
- Indonesia: Sari A, et al. 2020. Planta Tropika: Journal of Agro Science 8(2). Doi: 10.18196/pt.2020.116.-69-74 (download from: https://www.researchgate.net/publication/346474931_The_potential_of_Telenomus_remus_Nixon_Hymenoptera_Scelinoidae_as_biocontrol_agent_for_the_New_Fall_Armyworm_S_frugiperda_Lepidoptera_Noctuidae_in_Indonesia)
- Australia (indirectly; Ichneumon promissorius parasitoid of Helicoverpa armigera and H. punctigera introduced to US and found to also attack FAW): Molina-Ochoa et al. 2003. Florida Entomologist, 86(3):254-289. https://doi.org/10.1653/0015-4040(2003)086[0254:PAPOSF]2.0.CO;2

Q24: Is there any efforts to generate a new resistant maize line?

[39] **A**: Yes by multiple actors. For example, African Centre for Crop Improvement is actively screening maize germplasm for sources of resistance against FAW[25]. CIMMYT is also actively integrating FAW resistance traits into its breeding lines[26].

[40]

For further information on the prevention of FAW, please consult: https://www.ippc.int/en/the-global-action-for-fall-armyworm-control/

For further information on the Global Action for FAW control, please consult: http://www.fao.org/fall-armyworm/en/

25 KAsoma et al. 2020. Revealing the genetic diversity of maize (Zea mays L.) populations by phenotypic traits and DArTseq markers for variable resistance to fall armyworm. [online] [31 July 2020] https://doi.org/10.1007/s10722-020-00982-9

26 https://www.cimmyt.org/projects/fall-armyworm-r4d-and-management/