

## ADDRESSING THE THREAT OF *CACTOBLASTIS CACTORUM* (LEPIDOPTERA: PYRALIDAE), TO *OPUNTIA* IN MEXICO

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### ABSTRACT

The South American cactus-feeding moth, *Cactoblastis cactorum* (Berg) (Lepidoptera: Pyralidae), is a serious threat to the high diversity of native *Opuntia* species in Mexico, both wild growing and cultivated. An action plan has been compiled and submitted to the FAO for funding. The objectives are to collate all available information on the insect, to evaluate the risks to Mexico, to verify the presence of the insect and the most likely route of entry; also to mobilize the cactus pear industry, cactus and related societies, and government officials into the action plan, to embark on an extensive publicity campaign, and to consult international experts, including those in neighboring countries. The final goal is to generate a strategy that will be followed by the Mexican government with a medium- to long-term plan to ensure the protection of the cactus pear industry and the native cactus flora.

Key Words: Mexico, cactus pear, FAO, threatened floras, invasive species

### RESUMEN

La polilla sudamericana que se alimenta del cactus, *Cactoblastis cactorum* (Berg), es una serie amenaza a la gran diversidad de especies nativas en México de *Opuntia*, tanto las silvestres como las cultivadas. Un plan de acción fue elaborado el cual se entregó a la FAO para su financiamiento. Los objetivos son conjuntar toda la información existente acerca del insecto, evaluar los riesgos para México, verificar la presencia del insecto y su probable ruta de entrada, movilizar a la industria del nopal, así como las asociaciones relacionadas con las cactáceas y a los representantes del gobierno para que formen parte del plan de acción. Promover una gran campaña publicitaria y consultar asesores internacionales incluyendo aquellos de países vecinos. El objetivo final es proveer al gobierno mexicano de una estrategia a mediano y largo plazo para asegurar la protección de la industria del nopal y de la biodiversidad de las cactáceas nativas.

The cactus-feeding moth, *Cactoblastis cactorum* (Berg) (Lepidoptera: Pyralidae), is native to Argentina, from where it was introduced to many countries, including a few small islands in the Caribbean, for the biological control of various cactus invaders in the genus *Opuntia* (Julien & Griffiths 1998). It was also introduced, either deliberately or accidentally, to the Dominican Republic, Hispaniola, Cuba and Puerto Rico (Habeck & Bennett 1990; Pemberton 1995; Johnson & Stiling 1996). The insect was first recorded in south Florida in 1989, from where it has spread along the north and northwestern coasts (Johnson & Stiling 1998). Although it could be possible that it spread from Cuba to Florida naturally, there is strong evidence that it arrived there with infested cactus plants through the nursery trade (Zimmermann et al. 2000). It attacks all six native *Opuntia* species in Florida and one of the rare species, *Opuntia spinosissima* P. Miller, is now threatened with extinction (Johnson & Stiling 1998). Its rate of spread along the coast of Florida was estimated by Johnson & Stiling (1998) as being 256 km per year, although this figure is challenged by Zimmermann et al. (2000). Unconfirmed records of *C. cactorum* in Mexico (Yucatan State) and its in-

terception at the Mexican-U.S. border at Laredo, Texas (Pemberton 1995) have raised the suspicion that the insect may already be in Mexico, although recent surveys have all been negative (Zimmermann et al. 2000). There is, however, general consensus that the moth will arrive in Mexico. Should this happen, various important local industries that are based on the extensive cultivation of *O. ficus-indica* (L.) Miller, and related species (Pimienta 1994), will be threatened. The most serious threat is to the 79 native species in the genus *Opuntia*, which are all more or less vulnerable to attack, and which will be impossible to protect once the moth has naturalized. This paper proposes a program to address this serious threat to Mexico. The proposal has been submitted to the FAO as a TCP project.

### RESULTS

#### The Threat to Mexico

When evaluating the potential threat of *C. cactorum* to Mexican *Opuntia* populations it is important to study the impact the insect has had on *Opuntia* populations in other countries outside its

natural distribution in South America. In all cases the effect was dramatic, more so where small species were targeted (Julien & Griffiths 1998).

The area with free living and cultivated cactus pear in Mexico has been estimated at 3 million ha (Flores & Osorio 1997) of which about 217,000 ha are under cultivation (Vigueras & Portillo 2001). Of the approximately 79 species of *Opuntia* native to Mexico (Zimmermann et al. 2000) there are about six species under intensive cultivation. At least 18 wild growing species are also actively used, mainly for fruit, fodder and, to a lesser extent, the rearing of the cochineal insect, *Dactylopius coccus* Costa (Rodriguez & Portillo 1988; Fuentes 1997; Vigueras & Portillo 2001). The cultivation of cactus pear involves some 20,300 fruit producers and 8,095 nopalitos growers; to this can be added many more who are involved with byproducts derived from the plant, including cosmetics, medicines, confectioneries and juices (Flores 1997). *Opuntia* has been of special importance to Mexico since ancient times and it features strongly in its history, economy and cultural life (Hoffmann 1983). Besides being of aesthetic value, *Opuntia* also comprises some rare species that are central to the unique floral diversity of the northwestern deserts of Mexico and the United States (Bravo-Hollis 1978). There is no evidence that these species will be immune to attack by *C. cactorum*.

The platyopuntias (including the 10 species previously known as *Nopalea*) are most threatened and these comprise most of the species in the genus. The few cylindropuntias (chollas) are not suitable hosts for *C. cactorum* (Zimmermann et al. 2000). In Florida the insect is spreading at an alarming rate and all six native species are attacked, including the endangered semaphore cactus, *O. spinosissima* (Johnson & Stiling 1996, 1998). In South Africa *C. cactorum* attacks all 11 naturalized *Opuntia* (platyopuntia) species, including 9 species of Mexican origin (Zimmermann & Perez-Sandi 1999). It is unlikely that many native *Opuntia* species in Mexico will be immune to the insects. As in Florida and other countries, the smaller species are most vulnerable to attack and are easily killed. The larger shrub and tree-like *Opuntias* are seldom killed but are severely damaged and defoliated (Zimmermann et al. 2000). Secondary fungal and bacterial infections often complete the destruction. This may be particularly applicable to Mexico where a large diversity of pathogens is associated with Cactaceae (Zimmermann & Granata 2001). Although the large cultivations of *O. ficus-indica*, *O. streptacantha* Lemaire, *O. tomentosa* Salm-Dyck, *O. robusta* Wendland, *O. amyclea* Tenore and *O. megacantha* Salm-Dyck are unlikely to be destroyed, the damage could be severe and the additional control costs will be a heavy burden to growers, which they can ill afford. The most serious threat will be the invasion and damage to native species grow-

ing in natural areas where control will be impossible. Some rare and low-growing species could face extinction.

#### Preventive Measures for Mexico

A proposed TCP-FAO project, recently submitted to the FAO for approval, is aimed at obtaining basic information on *C. cactorum*, evaluating the risks, providing the government of Mexico with a long-term strategy for preserving the country's cactus pear resources, publicizing the threat, encouraging international cooperation and verifying the presence or absence of the insect from mainland Mexico. Mexico will be expected to provide the necessary financial support for the continuation of the project after two years. The project involves mobilizing several leading organizations, stakeholders and experts at national and international levels, with management by a national steering committee. The main aims of the project are the following:

#### Information

All published and unpublished information on *C. cactorum* will be collected. Contacts with experts in countries, who have researched the insect, including South Africa, Australia, Argentina and Florida, will also be established. This will be one of the main tasks of the international consultant to be appointed to the project.

#### Risk Analysis

The risks of *C. cactorum* to existing agricultural resources and cactus biodiversity, and implications for social and economic security will be determined. Models to predict its potential impact, rate of spread, and climatic tolerances within Mexico will be designed. Extrapolations based on information received from other countries will be made, keeping in mind some important counterbalancing factors that are already present in Mexico, including parasitoids, predators, diseases and host-plant characteristics. Neighboring countries will be consulted and asked to provide information that will ensure the consultants make reliable assumptions. These countries will include Cuba, Haiti, Dominican Republic, Puerto Rico and the United States (Florida), in addition to South Africa, Australia and Argentina.

#### General Awareness

The presence of *C. cactorum* on mainland Mexico has not yet been confirmed, although there are some indications that the insect may already be established there (Pemberton 1995). Confirming the presence of *C. cactorum* in Mexico is thus crucial to the project in order to determine the type of

control measure to be implemented. This will be done through a publicity campaign that will use pamphlets, posters, television and radio programs, as well as the press to disseminate information on the insect and its damage.

All stakeholders in Mexico (cactus grower associations, cactus societies, cactus researchers, extension officers, phytosanitary personnel, farmers, nature conservation and horticulturist societies and enthusiasts) will be identified and alerted. The rationale is not only to detect the insect's presence wherever it may occur, but also to determine its location as soon as possible no matter when or where it arrives. A quick identification service will be provided at a central locality to confirm the identity of any collected material. Training programs for extension officers and phytosanitary personnel at border posts will be put in place with emphasis on the states of Yucatan and all the states bordering Texas.

#### Dissemination of Information

The national coordinator together with the steering committee will organize at least two workshops involving scientists and other stakeholders. These workshops will also coincide, if possible, with national and international cactus pear congresses, which are held every 18 to 24 months in Mexico. The objectives are to inform and mobilize all academic and industry leaders involved with cacti and cactus pears, to transfer the latest information about the threat and actions to be taken, and to identify research needs.

#### International Liaison

The consultants and the steering committee will liaise closely with neighboring countries that already have *C. cactorum* control programs in place. This will apply in particular to the United States and Cuba, which are likely origins for possible invasions. The national coordinator and the consultants will actively participate in follow-up workshops on *C. cactorum*.

#### Establishment of a National Plan

The final goal will be to inform the Mexican government of the risks and consequences of invasions by *C. cactorum*, and to provide it with a national medium- and long-term strategy to prevent invasions and/or to provide it with an effective control plan. The national plan will also identify certain research needs that will be essential to ensure its success. The Mexican government will be expected to provide the necessary resources to execute the plans.

#### Project Team

The project will be run by a national coordinator who will be appointed by the responsible gov-

ernment departments, namely SEMARNAT (Secretaría del Medio Ambiente y Recursos Naturales) and SAGARPA (Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación). CONABIO (Comisión Nacional para el Conocimiento y Uso de la Biodiversidad) will analyze risk to native cactus diversity and implement all geographical information systems that may be needed. The project will have the support of a national steering committee that will be appointed by SEMARNAT, SAGARPA and CONABIO. The national steering committee, together with the national coordinator, will appoint the national and international expert consultants as well as the publicity officer. Other institutions may also be invited to participate by the national steering committee. The FAO will be represented at the deliberations of the national steering committee.

#### CONCLUSIONS

Mexico has the capacity and the infrastructure to prevent the arrival and invasion of *C. cactorum* in the country. Its most valuable asset is the dedicated team of cactus pear researchers whose influence filters through to every individual grower in the country. The regularly held cactus pear and cochineal congresses, normally attended by about 100 delegates with various ties to and interests in cactus, must be one of the main focal areas from where a publicity campaign is launched. The paper presented by Zimmermann & Perez-Sandi (1999) at the VIII National and VI International Congress on Cactus Pear in San Luis Potosi, on the threat of *C. cactorum* to Mexico, received widespread publicity and has put important actions in motion among leading researchers, officials and politicians within a very short time. Most researchers, agricultural leaders and conservation bodies are now aware of the threat and are supporting drastic control measures. If this project can succeed in preventing the arrival of *C. cactorum* and in ensuring its eradication, it will not only have averted a possible disaster, but will also have gone a long way in preventing further negative sentiments toward the science of biological weed control: *C. cactorum* is still regarded as the textbook example, epitomizing the successes that can be achieved with natural enemies as biological control agents, but also the dangers in introductions of nonnative species (Dodd 1940; Pettey 1948; Moran & Zimmermann 1984; Julien & Griffiths 1998).

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