EUROPEAN AND MEDITERRANEAN PLANT PROTECTION ORGANIZATION
ЕВРОПЕЙСКАЯ И СРЕДИЗЕМНОМОРСКАЯ ОРГАНИЗАЦИЯ ПО КАРАНТИНУ И ЗАЩИТЕ РАСТЕНИЙ
ORGANIZATION EUROPEENNE ET MEDITERRANEENNE POUR LA PROTECTION DES PLANTES

05-11646
PPM point 8.2~~02/9267~~

PEST RISK ASSESSMENT SCHEME

Organism:	***Claviceps africana***
Assessor(s):	**Riccardo Bugiani Plant Protection Service – Regione Emilia-Romagna (Italy)**
Date:	**February 2005**
Approximate time spent on the assessment	

PEST RISK ASSESSMENT

STAGE 1: INITIATION

Reasons for PRA

During the second part of nineties, *Claviceps africana*, responsible for sorghum ergot, spread from the original area and new outbreaks in America and Australia were found. This fact caused a general concern and warning at the global level. The disease was added to EPPO Alert List. Considering that sorghum is an important crop in Emilia-Romagna region (Italy) a PRA has been conducted in order to evaluate the phytosanitary risk posed in the pathogen.

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Identify pest

This section examines the identity of the pest to ensure that the assessment is being performed on a real identifiable organism and that the biological and other information used in the assessment is relevant to the organism in question.

1. Is the organism clearly a single taxonomic entity and can it be adequately distinguished from other entities of the same rank? *if yes go to 3* *if no go to 2*	**YES**	Taxonomy is based on data of Ainsworth and Bisbi's (http://www.indexfungorum.org/Names/fundic.asp) Phylum: *Ascomyceta* Class: *Ascomycetes* Subclass: *Sordiaromycetidae* Order: *Hypocreales* Family: *Clavicipitaceae* Genus: *Claviceps* Species*: africana* *Claviceps africana* was recognised as a distinct species in 1991 after the first description of its teleomorph by Frederickson, Mante & and de Milliano. Before 1991, *C. Africana* was considered synonymous with *C. sorghi*. However there has been much speculation that the strains of *C. africana* spreading across the world at present may be different from some of those existing in Africa. Scientists at various U.S. and international locations are using both traditional and biotechnological approaches to determine the genetic relatedness between strains from different geographical regions. The three species of *Claviceps* pathogens affecting sorghum crops are in fact distinguished mainly by morphological differences of ascostromata and sclerotia, and alkaloid production. Identification of genetic differences would necessitate a re-evaluation of *C. africana* and the major differences between strains, especially as they may relate to epidemiology, survival, toxicity, and virulence

2. Attempt to redefine the taxonomic entity so that the criteria under 1 are satisfied. Is this possible? *if yes go to 3* *if no go to 22*	**Not applica-ble**	
The PRA area *The PRA area can be a complete country, several countries or part(s) of one or several countries*		
3. Clearly define the PRA area. *go to 4*		EPPO area. In Europe sorghum growing area was about 155.000 ha in 2004 (FAO-Stat,web site). France, Italy, Russia and Ukraine are the most important producers in Europe..
Earlier analysis *The pest, or a very similar pest, may have been subjected to the PRA process before, nationally or internationally. This may partly or entirely replace the need for a new PRA.*		
4. Does a relevant earlier PRA exist? *if yes go to 5* *if no go to 7*	**Yes**	A first version of the PRA was prepared in 2002 (EPPO document 02/9267).
5. Is the earlier PRA still entirely valid, or only partly valid (out of date, applied in different circumstances, for a similar but distinct pest)? if entirely valid End if partly valid go to 6 if not valid go to 7	**Still valid**	The previous PRA has been ~~simply~~ completed with further information regarding ergot toxicity damages and some ~~explenations~~explanations missing in the first version..
6. Proceed with the assessment, but compare as much as possible with the earlier assessment. *go to 7*		

STAGE 2: PEST RISK ASSESSMENT **Section A: Pest categorization (qualitative criteria of a quarantine pest)**		
Geographical criteria *This section considers the geographic distribution of the pest in the PRA area.*		
7. Does the pest occur in the PRA area? *if yes go to 8* *if no go to 9*	**No**	*Claviceps Africana* is currently distributed in Africa, Asia, Argentina, Bolivia, Brazil, Colombia, Paraguay, Venezuela~~Brazil~~, Caribbean (including Puerto Rico), Mexico, USA (Texas, Kansas, Nebraska, Georgia, Florida, Mississippi, New Mexico), Australia (Queensland)..
8. Is the pest of limited distribution in the PRA area?	**~~Not~~**	

Note: "of limited distribution" means that the pest has not reached the limits of its potential range either in the field or in protected conditions; it is not limited to its present distribution by climatic conditions or host-plant distribution. There should be evidence that, without phytosanitary measures, the pest would be capable of additional spread. *if yes go to 18* *if no go to 22*	~~applica-ble~~	
Potential for establishment *For the pest to establish, it must find a widely distributed host plant in the PRA area (do not consider plants which are accidental/very occasional hosts or recorded only under experimental conditions). If it requires a vector, a suitable species must be present or its native vector must be introduced. The pest must also find environmental conditions suitable for survival, multiplication and spread, either in the field or in protected conditions.*		
9. Does at least one host plant grow to a substantial extent in the PRA area, in the open, in protected conditions or both? *if yes go to 10* *if no go to 22*	**YES**	Sorghum (*Sorghum bicolor*) crop is ~~extensively~~ grown in the ~~region particularly in the central and eastern provinces in the open~~PRA area in open field on a surface of about 155.000 ha . *Sorghum halepense* grows abundantly in the PRA area and it is considered an important weed for ~~other~~ many ~~most~~ important crops ~~grown in the region~~. In Australia and America, the continual flowering of *Sorghum halepense* is likely sufficient to perpetuate *C. africana* in the absence of *S. bicolor* crops or any other collateral host. However caution is needed because numerous *Claviceps* species naturally parasitize grasses. *Sorghum* crop is mainly grown in the PRA area generally from April-M~~m~~ay, when it is sown, to A~~a~~ugust-September, when it is harvested. *Sorghum halepense* grows abundantly in the same period ~~and it is considered an important weed for other most important crops grown in the region.~~
10. Does the pest have to pass part of its life cycle on a host plant other than its major host (i.e. obligate alternate host plant)? *if yes go to 11* *if no go to 12*	**NO**	
11. Does the alternate host plant also occur in the same part of the PRA area as the major host plant ? *if yes go to 12* *if no go to 22*	Not applicable	

12. Does the pest require a vector (i.e. is vector transmission the only means of dispersal)? *if yes go to 13* *if no go to 14*	**NO**	
13. Is the vector (or a similar species which is known or suspected to be a vector) present in the PRA area or likely to be introduced. If in doubt, a separate assessment of the probability of introduction of the vector (in section B1) may be needed? *if yes go to 14* *if no go to 22*	Not applicable	
14. Does the known geographical distribution of the pest include ecoclimatic zones comparable with those of the PRA area? *if yes go to 18* *if no go to 15*	**NO**	At present the disease seem to be confined to tropical ad sub tropical regions. ~~Only~~ C~~c~~limatic zones within South Africa may be comparable with climatic zones within PRA area characterised by a temperate climate as well as in some US states.
15. Is it probable, nevertheless, that the pest could survive and thrive in a wider ecoclimatic zone that could include the PRA area? *if yes go to 18* *if no go to 16*	**YES**	At present the disease seems to be confined to tropical ad sub tropical regions. Climate changing on earth however may have an important impact on diseases and pest spread in new eco-climatic zones. *C. africana* was present primarily in Africa. In mid-1995 an important epidemic was reported in Brazil on forage fields and F1 hybrid production fields. Afterwards, pathogen spread rapidly in South America and parts of Australia in 1996. In 1997, it reached Mexico and the Caribbean including Puerto Rico and after that it was reported in Texas, Kansas, Nebraska, Georgia and Mississippi wherever sorghum crops grows. Moreover, ~~Ergot~~ the pathogen is favoured by mean temperature of 19-21°C and by high relative humidity (100% optimal). The range of environments over which the pathogen can cause infection are temperature from 14-28°C and relative humidity down to 67%.
16. Could the ecoclimatic requirements of the pest be found in protected conditions in the PRA area? *if yes go to 17* *if no go to 22*	**NO**	
17. Is a host plant grown in protected conditions in the PRA area? *if yes go to 18* *if no go to 22*	Not applicable	

Potential economic importance		
Economic impact principally concerns direct damage to plants but may be considered very broadly, to include also social and environmental aspects. The effect of the presence of the pest on exports from the PRA area should also be allowed for. *In deciding whether economically important damage or loss to plants may occur, it is necessary to consider whether climatic and cultural conditions in the PRA area are conducive to damage expression, which is not always the case even if both host and pest survive under these conditions.* *Note: when performing a PRA on a pest that is transmitted by a vector, consider also any possible damage that the vector may cause.*		
18. With specific reference to the host plant(s) which occur(s) in the PRA area, and the parts of those plants which are damaged, does the pest in its present range cause significant damage or loss? *if yes go to 21* *if no go to 19*	**YES**	In some countries are reported very severe losses. In India, for instance, losses of 10-80% in hybrid seed cops are reported as well as of up to 70% in grains. In Zimbabwe, annual losses of 12 to 25% regularly result and, on occasion, total losses are realised. Ergot is a serious disease that affects the production of F1 hybrid seed. Disease is particularly severe in male-sterile lines (A-lines) when either non synchronous flowering of A-lines and the restorer lines (R-lines) or adverse environmental conditions result in a lack of viable pollen and delayed seed set. Under normal conditions, the disease is of little consequence in well-adapted male-fertile cultivars. However widespread damage to male-fertile cultivars subjected to unfavourable weather conditions in farmer's fields was documented. Honeydew produced on infected sorghum panicle is a sugar-rich substrate which encourages mould growth. Honey-dew also contains substances which are directly toxic. Seeds that become coated with honeydew have a reduced germination and seedlings show reduced growth and a predisposition to post-emergence damping-off. Male-sterile sorghum lines are highly susceptible to ergot because they are dependent upon an outside source of pollen for fertilisation. Most inbred lines and hybrids of grain sorghum are highly self-fertile and therefore unsusceptible to the disease. However they may become susceptible if exposed to pre-bloom temperature below 12°C. Yield is directly reduced by the disease because infected florets in the sorghum head produce no grain. Sugary exudates from infected florets lower seed quality by inducing secondary

		mould growth. As non-fertilised florets of male-sterile sorghums are highly susceptible, the disease has tremendous impact on hybrid seed production in which cytoplasmic male-sterile lines are used as female parents. Sclerotia of *C. africana* produce the alkaloid dihydroergosine, which demonstrated to be toxic on poultry and swine.
19. Could the pest, nevertheless, cause significant damage or loss in the PRA area, considering ecoclimatic and other factors for damage expression? *if yes go to 21* *if no go to 20*	**YES**	On the bases of preliminary climatic assessment with forecasting model elaborated by McLaren in South Africa, in the PRA area the disease could cause low to medium economic damages regarding yield loss, harvest problems and increase costs~~, as well as toxic problems in animal feeding~~.
20. Would the presence of the pest cause other negative economic impacts (social, environmental, loss of export markets)? *if yes go to 21* *if no go to 22*	**No**	On the bases of the present knowledge, there area neither social nor environmental effects. ~~The spread of the disease could affect the export markets.~~[1]
21. This pest could present a risk to the PRA area **Go To Section B**		
22. This pest does not qualify as a quarantine pest for the PRA area and the assessment can stop *However, if this is the first time that the decision-making scheme has directed you to this point, it may be worth returning to the question that led you here and continuing through the scheme in case the remaining questions strongly indicate categorization as a possible quarantine pest. In this latter case, seek a second opinion to decide whether the answers which led you to this point could be given a different reply.*		

[1] E' in contrasto con quanto detto al punto 2.11

Section B: Quantitative evaluation

The second part of the risk assessment process firstly estimates the probability of the pest being introduced into the PRA area (its entry and establishment) and secondly makes an assessment of the likely economic impact if that should happen. From these two aspects, it should be possible to consider the level of "pest risk" presented by the pest; this can then be used in the pest risk management phase to decide whether it is necessary to take phytosanitary measures to prevent the introduction of the pest, or if the measures chosen are appropriate for the level of risk. The questions in this section require an evaluation from minimum probability or impact (1) to maximum probability or impact (9). This must be done by an expert who can make an estimate according to the information provided (following the format of the check-list of EPPO (OEPP/EPPO, 1993a) and also according to comparison with other pests.
Answer as many of the following questions as possible, insofar as they are relevant to the pest concerned. If you cannot answer a particular question, do not give any score. Note whether this is because of lack of information or because the question is irrelevant to the pest concerned.

Questions marked with an asterisk (*) are to be considered as more important than the others in the same section.

1. Probability of introduction
Introduction, as defined by the FAO Glossary of Phytosanitary Terms, is the entry of a pest resulting in its establishment.

Entry

List the pathways that the pest could be carried on. *Note: a pathway can be any form of human activity that could transport the pest from a particular origin: e.g. plants and plant products moving in trade, any other traded commodity, containers and packing, ships, planes, trains, road transport, passengers, mail, etc. Note that similar means of pest transport from different origins can present greatly different probabilities of introduction, depending on the concentration of the pest in the area of origin. The pathways given should be only those already in operation, or proposed.*		
1.1 How many pathways could the pest be carried on? *few = 1* *many = 9*	**1**	The organism could be carried on through seeds and grains. There is the hypothesis that the fungus can long-distance spread by means of air-borne spores, but the ~~likehood~~likelihood is very low[2].
1.2 For each pathway, starting with the most important pathway identified above (i.e. that which carries the greatest trade or which is most likely to act as a means of introduction) and then in descending order of importance, answer questions 1.3 – 1.13. If one of the questions 1.3a, 1.5a, 1.7a or 1.12a is answered by 'no', the pathway could not act as a means of entry for the pest, and the scheme will return directly to this point, omitting later questions. Use expert		

[2] Riferimento bibliografico?

judgement to decide how many pathways to consider. ***Go to 1.3***		
1.3a Could the pest be associated with the pathway at origin? *Note: does the pest occur in the area of origin? Is the pest in a life stage which would be associated with commodities, containers, or conveyances?* *if yes go to 1.3b* *if no go to 1.2*		
1.3b How likely is the pest to be associated with the pathway at origin? [i.e. are all areas infested or highly infested; will every consignment or part of it be infested?] *not likely = 1* *very likely = 9*	**5**	Sorghum seeds are imported in the PRA area, mainly from US, but in this country the disease is a regulated pest. There is also import of grains from countries where the disease occurs, but this commodity is not regulated. Italy, for instance, imports seeds from France, where the pest does not occur, and USA where the pest occurs, and grains from different countries.
1.4 Is the concentration of the pest on the pathway at origin likely to be high? [i.e. will there be many individuals associated with the consignment?] *not likely = 1* *very likely = 9*	**6**	For seeds, the risk should be low as in US the pest is regulated. On the contrary the import of grains represents a higher risk as the commodity is not regulated and grains sometimes are used by farmers for sowing.
1.5a Could the pest survive existing cultivation or commercial practices? *Note: these are practices mainly in the country of origin, such as pesticide application, removal of substandard produce, kiln-drying of wood.* *if yes go to 1.5b* *if no go to 1.2*		
1.5b How likely is the pest to survive existing cultivation or commercial practices? *not likely = 1* *very likely = 9*	**4**	The current cultivation practices and pesticides application contain the pest in the field, even though are not able to eradicate it.~~.~~
1.6 How likely is the pest to survive or remain undetected during existing phytosanitary procedures? *Note: existing phytosanitary measures (e.g. inspection, testing or treatments) are most probably being applied as a protection against other (quarantine) pests; the assessor should bear in mind that such measures could be removed in the future if the other pests were to be re-evaluated.* *The likelihood of detecting the pest during inspection or testing will depend on a number of factors including:* • *ease of detection of the life stages which are likely to be present. Some stages are more readily detected than others, for example insect adults may be more obvious than eggs;* • *location of the pest on the commodity. Surface feeders are more*	**6**	In the seeds, the phytosanitary procedures should avoid the ~~t~~presence of the disease, while for grains is li~~k~~kely ~~yhay~~ that the disease can remain undetect~~r~~ed. During import inspections is very difficult to detect the pest if a sampling method is not defined.

readily detected than internal feeders; • *symptom expression - many diseases may be latent for long periods, at certain times of the year, or may be without symptoms in some hosts or cultivars and virulent in others;* • *distinctiveness of symptoms - the symptoms might resemble those of other pests or sources of damage such as mechanical or cold injury;* • *the intensity of the sampling and inspection regimes;* • *distinguishing the pest from similar organisms.* *not likely = 1* *very likely = 9*		
1.7a Could the pest survive in transit? *Note: consideration should be given to:* • *speed and conditions of transport;* • *vulnerability of the life-stages likely to be transported;* • *whether the life cycle is of sufficient duration to extend beyond time in transit;* • *the number of individuals likely to be associated with a consignment.* *Interception data can be used to estimate the ability of a pest to survive in transit.* *if yes go to 1.7b* *if no go to 1.2*	**Yes**	
1.7b How likely is the pest to survive in transit? *not likely = 1* *very likely = 9*	**9**	~~If present on seeds or grains, t~~The disease can survive in transit in the form of slerotia mixed in the seeds or grain bulk.
1.8 Is the pest likely to multiply during transit? *not likely = 1* *very likely = 9*	**1**	No, because the sclerotia are durable form of the fungus
1.9 How large is movement along the pathway? [i.e. how much trade?] *not large = 1* *very large = 9*	**6**	Seeds from US are imported normally in many countries. Grains area traded throughout the world, including the countries were the disease occurs..
1.10 How widely is the commodity to be distributed throughout the PRA area? *Note: the more scattered the destinations, the more likely it is that the pest might find suitable habitats.* *not widely = 1* *very widely = 9*	**3**	Sorghum is grown in some European countries, but the growing surface is not so large. The total surface reaches 155.000 ha and the most important producers are France, Italy, Russia and Ukraine (see the attached table).

1.11 How widely spread in time is the arrival of different consignments? *Note: introduction at many different times of the year will increase the probability that entry of the pest will occur at a life stage of the pest or the host suitable for establishment.* *not widely = 1* *very widely = 9*	**3**	Seeds are imported usually at the end of the winter~~, -~~beginning of spring, while grains are imported around the year, depending on the country of origin and the market request.
1.12a Could the pest transfer from the pathway to a suitable host? *Note: consider innate dispersal mechanisms or the need for vectors, and how close the pathway on arrival is to suitable hosts.* *if yes go to 1.12b* *if no go to 1.2*	**Yes**	
1.12b How likely is the pest to be able to transfer from the pathway to a suitable host? *not likely = 1* *very likely = 9*	**9**	~~Everywhere seeds are grown.~~Seeds are intended to be sown and so the pathogen easily originates new infections.
1.13 Is the intended use of the commodity (e.g. processing, consumption, planting, disposal of waste) likely to aid introduction? *Note: consider whether the intended use of the commodity would destroy the pest or whether the processing, planting or disposal might be done in the vicinity of suitable hosts.* *not likely = 1* *very likely = 9*	**8**	Seeds are used for sowing and so it is likely that help the ergot introduction; the grains sometimes are used as seeds by the farmers to save money and so can show the same risk. The previous intended uses are currently the most common ones, In the last years, researches are addressed to a no-food uses such as bio-alcohol, fibre and bio-mass (producing of energy). Sorghum is largely grown for producing bio-alcohol or fibre.
Establishment		
1.14 How many host-plant species are present in the PRA area? *one or very few = 1* *many = 9*	**2**	Sorghum is the main crop interested by the disease. Some weeds as *S. halepense* are host of the disease.
1.15 How extensive are the host plants in the PRA area? *rare = 1* *widespread = 9*	**3**	Sorghum is grown on a surface of 155.000 in Europe (see the attached table)
1.16 If an alternate host is needed to complete the life cycle, how extensive are such host plants in the PRA area? *rare = 1* *widespread = 9*	**Not applica-ble**	

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	Not applica-ble	
1.18 Has the pest been recorded on crops in protected conditions elsewhere? (Answer this question only if protected cultivation is important in the PRA area.) *no = 1* *often = 9*	**Not applica-ble**	
1.19 How likely are wild plants (i.e. plants not under cultivation, including weeds, volunteer plants, feral plants) to be significant in dispersal or maintenance of populations? *not likely = 1* *very likely = 9*	**8**	*Sorghum halepense* is a common weed in many countries.
1.20 *How similar are the climatic conditions that would affect pest establishment in the endangered area and in the area of origin? *Note: the climatic conditions in the PRA area to be considered may include those in protected cultivation.* *not similar = 1* *very similar = 9*	**3**	At the moment the disease is mainly present in tropical and sub-tropical countries, but in US has been found in some states of the corn belt (Central US).
1.21 How similar are other abiotic factors in the PRA area and in the area of origin? *Note: the major abiotic factor to be considered is soil type; others are, for example, environmental pollution, topography/orography.* *not similar = 1* *very similar = 9*	**3**	It is likely that soil type of some areas of US and Europe is similar.
1.22 How likely is the pest to have competition from existing species in the PRA area for its ecological niche? *very likely = 1* *not likely = 9*	**Not applicable**	
1.23 How likely is establishment to be prevented by natural enemies already present in the PRA area? *very likely = 1* *not likely = 9*	**Not applicable**	

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1.24 *If there are differences in the crop environment in the PRA area to that in the area of origin, are they likely to aid establishment? *Note: factors that should be considered include time of year that the crop is grown, soil preparation, method of planting, irrigation, whether grown under protected conditions, surrounding crops, management during the growing season, time of harvest, method of harvest, etc.* *not likely = 1* *very likely = 9*	**1**	Sorghum is more susceptible to ergot if grown in cool climate especially during the flowering.
1.25 Are the control measures which are already used against other pests during the growing of the crop likely to prevent establishment of the pest? *very likely = 1* *not likely = 9*	**1**	In Italy sorghum is very poorly chemical treated during the growing period (one fungicide spray a year on average).
1.26 *Is the reproductive strategy of the pest and duration of life cycle likely to aid establishment? *Note: consider characteristics which would enable the pest to reproduce effectively in a new environment, such as parthenogenesis/self-crossing, duration of the life cycle, number of generations per year, resting stage, etc.* *not likely = 1* *very likely = 9*	**9**	Considering that it may overwinter as a sclerotia and reproduce and spread by means of air-borne spores and ooze, its reproductive power is very high.
1.27 How likely are relatively low populations of the pest to become established? *not likely = 1* *very likely = 9*	**6**	Due to its many means of spreading (conidia, sclerotia, ooze, macroconidia, microconidia) and the history of the disease, the establishment capacity is high.
1.28 How probable is it that the pest could be eradicated from the PRA area ? *very likely = 1* *not likely = 9*	**9**	For the above mentioned reasons, it would be difficult to eradicate once established
1.29 How genetically adaptable is the pest? *Note: is the species polymorphic, with, for example, subspecies, pathotypes? Is it known to have a high mutation rate? This genotypic (and phenotypic) variability facilitates the pest's ability to withstand environmental fluctuations, to adapt to a wider range of habitats, to develop pesticide resistance and to overcome host resistance.* *not adaptable = 1* *very adaptable = 9*	**4**	The ergot is a tropical and sub-tropical disease, but it has been enable to adapt also a wider range of climatic conditions (~~Brasil and~~ US for instance)

1.30 *How often has the pest been introduced into new areas outside its original range? *Note: if this has happened even once before, it is important proof that the pest has the ability to pass through most of the steps in this section (i.e. association with the pathway at origin, survival in transit, transfer to the host at arrival and successful establishment). If it has occurred often, it suggests an aptitude for transfer and establishment.* *never = 1* *often = 9*	**8**	From Africa and Asia it rapidly spread to other continents (Australia, South and North America). In America in few years the pathogen spread from Brazil to US.

2. Economic Impact Assessment *Identify the potential hosts in the PRA area, noting whether wild or cultivated, field or glasshouse. Consider these in answering the following questions. When performing a PRA on a pest that is transmitted by a vector, consider also any possible damage that the vector may cause.* *According to the pest and host(s) concerned, it may be appropriate to consider all hosts together in answering the questions once, or else to answer the questions separately for specific hosts.* *Note that, for most pest/crop/area combinations, precise economic evaluations are lacking. In this section, therefore, expert judgement is asked to provide an evaluation of the likely scale of impact. Both long-term and short-term effects should be considered for all aspects of economic impact.*		
2.1 *How important is economic loss caused by the pest within its existing geographic range? *little importance = 1* *very important = 9*	**7**	In suitable climatic conditions it might cause important losses. In India, damages in hybrid seed crops range from 10 to 80%. In Zimbabwe, annual losses of 12 to 25% regularly result and, on occasion, total losses are realised.
2.2 How important is environmental damage caused by the pest within its existing geographic range? *Note: environmental damage may be impact on ecosystem health, such as effects on endangered/threatened species, keystone species or biodiversity.* *little importance = 1* *very important = 9*	**1**	No specific data has been found on environmental impact in the checked literature.
2.3 How important is social damage caused by the pest within its existing geographic range? *Note: social effects could be, for example, damaging the livelihood of a proportion of the human population, or changing the habits of a proportion of the population (e.g. limiting the supply of a socially important food).*	**3**	Sorghum is used as fodder. In US no damages due to ~~mycotoxins~~ an alkaloid on livestock have been reported. On the contrary (Odvody, personal communication), in Australia there are reports of livestock being affected by ~~micotoxins~~ alkaloid produced by ergot.

little importance = 1 *very important = 9*		
2.4 *How extensive is the part of the PRA area likely to suffer damage from the pest? *Note: the part of the PRA area likely to suffer damage is the endangered area, which can be defined ecoclimatically, geographically, by crop or by production system (e.g. protected cultivation).* *very limited = 1* *whole PRA area = 9*	**2**	In Europe few countries have an extensive cultivation of *Sorghum* (France, Italy, Russia and Ukraine). Probably the most significant damages could interest the seed production, while it is difficult to estimate important losses for the crops due to the lack of climatic conditions favourable to the disease.
Spread potential is an important element in determining how fast economic impact is expressed and how readily a pest can be contained.		
2.5 *How rapidly is the pest liable to spread in the PRA area by natural means? *very slowly = 1* *very rapidly = 9*	**9**	If introduced, ~~D~~due to its many means of spreading (conidia, sclerotia, ooze, macroconidia, microconidia) the potential spreading capacity is high.
2.6 How rapidly is the pest liable to spread in the PRA area by human assistance? *very slowly = 1* *very rapidly = 9*	**3**	If appropriate phytosanitary procedures are taken, the human assistance is not very important.
2.7 How likely is it that the spread of the pest could be contained within the PRA area? *Note: consider the biological characteristics of the pest that might allow it to be contained in part of the PRA area; consider the practicality and costs of possible containment measures.* *very likely = 1* *not likely = 9*	**7**	Considering the ergot's aerial spread it is difficult to contain the disease and the history of its spread into new continents is another example of such a spread capacity.
2.8 *Considering the ecological conditions in the PRA area, how serious is the direct effect of the pest on crop yield and/or quality likely to be? *Note: the ecological conditions in the PRA area may be adequate for pest survival but may not be suitable for significant damage on the host plant(s). Consider also effects on non-commercial crops, e.g. private gardens, amenity plantings.* *not serious = 1* *very serious = 9*	**3**	Direct effects might be important ~~only~~ probably for hybri~~ee~~d seed production. For grain production there might be important damages only when cool temperatures (> 12°C) occur during 2-3 weeks before flowering~~.~~
2.9 How likely is the pest to have a significant effect on producer profits due to changes in production costs, yields, etc., in the PRA area? *not likely = 1* *very likely = 9*	**3**	It is likely that the effects on the producers are low. Seed production has already high standards, while for grain production in some countries there might be a shift of the growing season towards warmer months.

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2.10 How likely is the pest to have a significant effect on consumer demand in the PRA area? *Note: consumer demand could be affected by loss in quality and/or increased prices.* *not likely = 1* *very likely = 9*	**1**	Probably not an important effect, in fact the imports of sorghum grains coming from countries where the ergot occurs keep going on.
2.11 How likely is the presence of the pest in the PRA area to affect export markets? *Note: consider the extent of any phytosanitary measures likely to be imposed by trading partners.* *not likely = 1* *very likely = 9*	**1**	See the above mentioned reasons.
2.12 How important would other costs resulting from introduction be? *Note: costs to the government, such as research, advice, publicity, certification schemes; costs (or benefits) to the crop protection industry.* *little importance = 1* *very important = 9*	**2**	Fungicides effective against the ergot are known from US experience. New costs would regard only the authorisation files.
2.13 How important is the environmental damage likely to be in the PRA area? *little importance = 1* *very important = 9*	**2**	At the moment sorghum is the only important plant. Other hosts are weeds. The only possible impact could come from the increase of pesticide use.
2.14 How important is the social damage likely to be in the PRA area? *little importance = 1* *very important = 9*	**1**	There are different data about the fungus toxicity for livestock, In US no damages on livestock have been reported, while in Australia some claims about livestock feeding with contaminated grains.
2.15 How probable is it that natural enemies, already present in the PRA area, will affect populations of the pest if introduced? *very likely = 1* *not likely = 9*	**Not applica-ble**	
2.16 How easily can the pest be controlled? *Note: difficulty of control can result from such factors as lack of effective plant protection products against this pest, occurrence of the pest in natural habitats or amenity land, simultaneous presence of more than one stage in the life cycle, absence of resistant cultivars).* *easily = 1* *with difficulty = 9*	**3**	Both the seed coating and the field fungicide sprays are effective to contain the pathogen. In PRA area the climatic conditions responsible for an epidemics are not common.

2.17 How likely are control measures to disrupt existing biological or integrated systems for control of other pests? *not likely = 1* *very likely = 9*	**7**	Sorghum is normally poorly chemical treated, so new chemical treatments would cause a change of cultivation practices
2.18 How likely are control measures to have other undesirable side-effects (for example on human health or the environment)? *not likely = 1* *very likely = 9*	**4**	Even if fungicides effective against sorghum ergot do not have a deep environmental impact, they would increase the chemical pollution.
2.19 Is the pest likely to develop resistance to plant protection products? *not likely = 1* *very likely = 9*	**2**	Considering the active ingredient that might be applied and a few numbers of sprays to control the pathogen during the season, the ~~likehood~~likelihood of the occurrence of fungicides-resistant strains is rare.
After completing this section, the assessor should comment on whether sufficient information exists to trust the answers given; or if he/she knows of other relevant factors that have not been considered in this evaluation		

3. Final Evaluation

At the end of the procedure, the assessor will have at his disposal:
(1) one or several sets of replies (1-to-9 scores) to questions 1.1-1.13, for one or several pathways (if no pathways have been retained, the probability of introduction will be zero);
(2) one set of replies (1-to-9 scores) to questions 1.14-1.30;
(3) one or several sets of replies (1-to-9 scores) to questions 2.1-2.19, for single, grouped or separate hosts (according to the manner of answering which has been chosen).

The assessor should first consider the quality and quantity of the information used to answer the questions, and give an overall judgement of how reliable the pest risk assessment can be considered. If other relevant information is available that has not been considered, this should be noted.

By the means of his choice, the assessor should attempt to make a separate estimate of the probability of introduction of the pest and its probable level of economic impact. As explained in the introduction, these estimates cannot, on the basis of the procedure used in the scheme, be expressed in absolute units. The numerical scores may be combined, weighted and averaged in appropriate ways that may enable the assessor who uses them consistently to make useful comparisons between pests, pathways and hosts. No particular mode of calculation is specifically recommended by EPPO. Certain questions have been identified as more important than others, and the assessor should take due account of this.

The assessor may then combine his estimates of probability of introduction and probable economic impact to formulate a single estimate of pest risk. This may usefully be compared with one or several reference levels of risk to decide whether the pest should be considered to be a quarantine pest, so that phytosanitary measures should be taken against it.

Finally, the scores given in answer to the different sections (particularly that on pathways) may be used again in pest risk management.

Conclusions

~~*Appendix I*~~

The results of the risk of introduction is medium (5,166). In fact a certain amount of sorghum seeds and grains is imported in some PRA countries like Italy. The risk of economic impact is low (3.38) due to the fact that ~~fe~~male-steryl hy~~i~~bri~~ee~~ds are rarely grown and the climatic risk of pathogen's infection seems to be low~~to -~~-medium throughout the sorghum growing season. This is mainly due to the high temperature (rarely below the critical minimum temperature of 13°C for ~~E~~ergot infection) occurring at the end of May-middle of June (sorghum susceptibility is maximum at 23-27 days pre blossom).

There are still uncertainties regarding the risk of toxicity for livestock, as it is not clear why there are problems for Australia and not for US (different alkaloid ~~toxine~~toxin-producing strain?). Anyway, if we compare *C. africana* to a similar species, *C. purpurea*, an indigenous pathogen producing toxins too and which caused problems for men in the past centuries, we can see that the disease management and the cleaning procedures in the last 50 years have reduced the toxicity danger to an absolutely rare event.

Considering its medium- ~~to -~ -~~ low risks of introduction and economical impact the pathogen may not be considered a quarantine pest at the moment. ~~Also in~~The US experience has shown that while the early reports indicated ergot sorghum as a high risk pathogen, now significant damages are not reported.

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GROWING SURFACE IN THE PRA AREA

Sorghum *Area Harv (Ha)*	Year 2004
Albania	0
Bulgaria	3,100
Croatia	130
France	48,000
Greece	1,000
Hungary	3,000
Italy	31,000
Macedonia	50
Moldova, Republic of	2,500
Romania	5,000
Russian Federation	25,000
Serbia and Montenegro	2,200
Slovakia	300
Spain	7,500
Ukraine	25,000
Algeria	200
Egypt*	160.000
Morocco	19.600
Tunisia	3.000
Israel	1.200
Syria	4.000

FAOStat, statistical database

*** Not an EPPO member state.**