I J T A
© Serials Publications
National Academy of Agricultural Science (NAAS) Rating : 3.03

Sanitary and Phytosanitary Agreement : Concern to India as wheat exporter

J. Kumar, K. K. Pramanick, D. Pal, A.K. Shukla and Madhu Patial

ABSTRACT: *With the establishment of WTO (World Trade Organization), the world market has provided unlimited opportunities for an international trade of agricultural products. The devastating effects of introduced diseases and pests, along with movement of agricultural produce and products are well known. Recently, biological and economical development in international trade activities and the thrust of the WTO agreement suggest that countries not only biological update their quarantine or plant health services to improve the health status of their export but to incorporate pest risk analysis (PRA) into making regulatory decisions concerning imports. To this end the Food and Agriculture organization (FAO) has been working in concert with various regional plant protection organizations such as the European and Mediterranean and the North American Plant Protection Organisations. FAO has published International standards for Phytosanitary Regulations (ISPM) (Part I) Imrot Regulations: Guidelines for Pest Risk, dated February, 1996. However the ISPM is still under discussion in various quarantine circles and therefore has not yet been finalized. All the members of WTO are required to develop their Phytosanitary measures based on international standards and transparent procedures. The measures should not arbitrarily or unjustifiably discriminate between countries where identical and similar conditions prevail. The standards, guidelines and recommendations developed under the auspices of the secretariate of International Plant Protection Convention (FAO) constitute Sanitary and Phytosanitary Measures (SPS measures) for plant health.*

India is the largest producer of wheat next only to China. Cultivation of high yielding varieties as well as adoption of improved production technologies by Indian farmers at large has made this country achieve a proud standing in the global agricultural scenario. Figure 1 portrays the quantum jump of wheat production ensued in this country after independence from the British rule.

Gone are the dark days of three and half decades back, when, India virtually begged wheat from other nations to meet basic obligation of supplying staple food to her population. Now situation has just reversed. Owing to lesser dependency on rainfed agriculture in the main wheat belt, the north west plain zone, there have been successful crop years in a row during the recent past. As a result, our buffer stocks went on swelling year by year. After having met the demand pertaining to internal food supply, there is a big question hovering around, that, what to do with this glut of unutilised wheat surplus? Obviously, export seems to be the best answer. We must harness this opportunity to earn foreign revenue and in bonus, get rid of unnecessary overheads related to storage of buffer stocks and protecting grains from storage pests.

The idea of exporting wheat from India is not a new one. Before independence, India exported wheat to U.K., Belgium, France and spain (Rao, 1994). Figure 2 shows amounts of wheat exported from India in the recent past. Countries which imported heat from India between 1994 – 1997 mainly included Turkey, Iran, Iraq, Jordan, Yemen, Kuwait in gulf, Poland, Russia, Netherlands and Switzerlands in Europe, Korea, Phillippines and Malaysia in east Asia, Morocco and south Africa in African continent and Newzealand (Singhal, 1999).

There had been several instances when Indian wheat consignments were refused by importing countries because of contamination with diseased and infested grains as well as impurities such as straw, dust etc. Majority of the times, pretext has been the presence of grains affected by a fungal disease, the Karnal bunt (causal organism *Tilletia indica* syn. *Neovossia indica*), which was feared to get introduced and spread in the territory of importing country. It is a hard fact that wheat produced especially in main

* ICAR – IARI Regional Station, Shimla – 171004 H.P., *E-mail-moola01@yahoo.com*

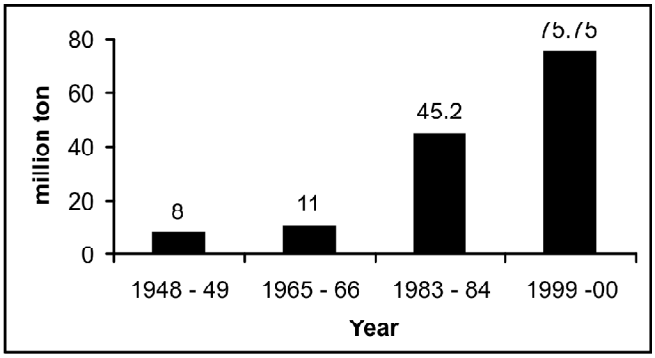

Figure 1: A spectacular stride of wheat production recorded in India over the years

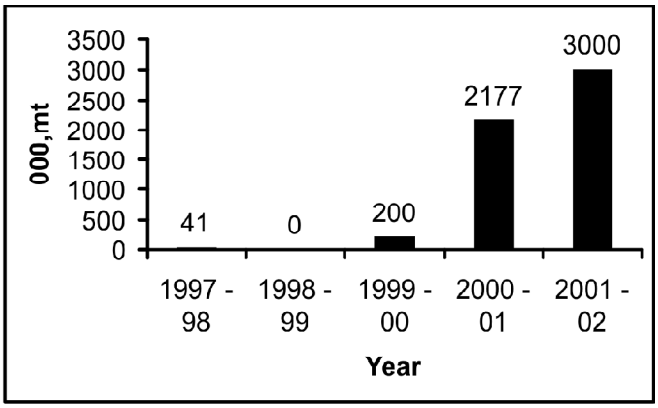

Figure 2: Amount of wheat exported from India in the near past (USDA, 2001)

wheat belt (Punjab, Haryana and west U.P.) gets infected with Karnal bunt and it is this area, which in real sense, contributes to the surplus production. Therefore, without putting blame on any party we must accept the concern of nations rejecting Indian wheat with supportive attitude. Karnal bunt does not occur in wheat growing areas of India other than north west plain zone. Wheat harvested from these areas meets the standards fixed for export under sanitary and phytosanitary agreement (SPS agreement). But, unfortunately, the Indian produce despite being free from Karnal bunt may also be discarded with the stereotypic apprehension for admixed diseased grains. At this juncture, if India feels dicriminately opposed or inadvertently restricted, she must seek opportunity to convince the importing countries that commodity under trade poses no risk on account of being produced in areas found to remain free of Karnal bunt during the survey/surveillance monitoring of past several years. Countries where Karnal bunt pathogen can not complete life cycle but still refuse to accept Indian wheat, can be satisfied by demonstrating with the help of scientifically developed pest risk assessment (PRA) models that biotic/abiotic conditions of their country would not favour disease establishment. In the modern day concept of WTO regime and liberalised international trade, we have golden opportunities on our side, if we bring to our rescue the new regulations of SPS agreement.

SANITARY AND PHYTOSANITARY AGREEMENT OF WTO – AN INTRODUCTION

WTO (World Trade Organisation) is a non – territorial/ non – national jurisdiction body empowered to draft rules of conduct pertaining to global trade, encourage their use and hand down penalities for imfringements. It was established on January, 1, 1995 with its secretariat in Geneva, Switzerland. It is a documentation of the Uruguay contemplations on General Agreement on Tariffs and Trade (GATT). In another words, WTO is a new version of GATT originally conceptualized in 1947. The GATT applies only to trade in goods whereas WTO covers trade in goods, services and "trade in ideas" or intellectual property. Its essential functions are:

- Administering and implementing the multilateral and pleurilateral trade agreements.
- Acting as a forum for multitrade negotiations.
- Seeking to resolve trade disputes.
- Overseeing national trade policies.
- Cooperating in global economic policies.

The WTO Agreement on agriculture is created and formulated to promote farm trade on international level. This agreement incorporates reforms in agricultural trade as well as safeguards the interests of both importing and exporting partners.The general scheme on structure and function of SPS agreement under WTO is illustrated in Figure 3. The very famous rule of this agreement known as Trade Related Intellectual Property Rights (TRIPS) envisages to improve conditions of competitions where ideas and inventions are involved. Similarly, the Sanitary and Phytosanitary Agreement (SPS) regulates the issues pertaining to trade of agricultural produce in context to the possible impacts on plant, animal and human health on arrival of commodity in the importing countries (Table 1). Plant pest quarantines which are supposed to function in accordance with International Plant Protection Convention (IPPC) of FAO (United Nations) are

imposed to prevent the artificial introduction or to limit the spread of plant pests. IPPC acts as an observer while SPS agreements are contemplated in WTO and it acts in confluence with several regional and national organizations depicted in Figure 4.

PHYTOSANITARY CERTIFICATION

SPS agreements give equal considerations for the opportunities and benefits of exporting nation. Quarantines are directed to act in a way not to become a barrier in grain trade. A commodity is not likely to be stopped by quarantine, if exporting country could demonstrate the non establishment of disease/pest in the importing country through a scientifically determined model of pest risk assessment (PRA). Phytosanitary regulations are established by the importing country. Exporters must determine if the importing country requires certification that the commodity meets that country's phytosanitary regulations; for example, freedom from a particular prohibited pest. The definition of phytosanitary certificate can be drafted as below:

- Written verification that plant and plant products meet the standards

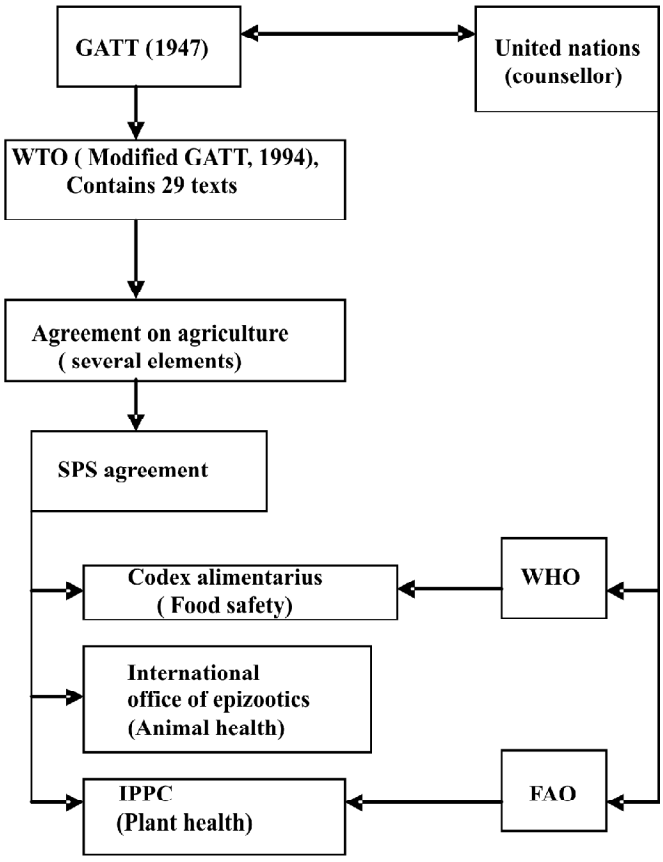

Figure 3: Hierarchial status of SPS agreement in WTO regime

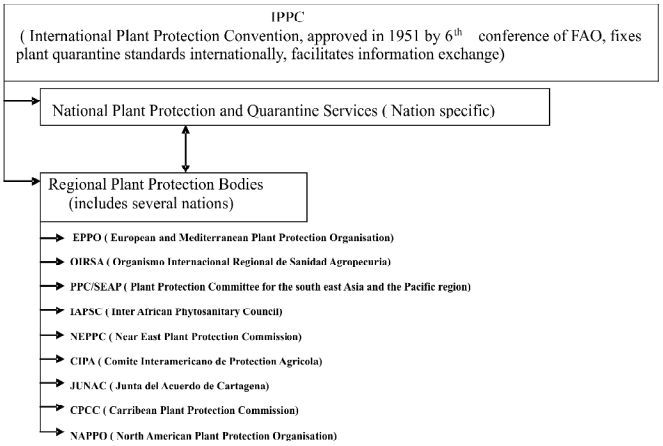

Figure 4: Tributaries of IPPC

- The goal is to protect the marketability of products of any country abroad

In the above context, concerning international trade of agricultural commodities, the following issues may become subject of SPS agreement while exporting wheat from India:

A. Biotic

- **A1. Disease Pests**
- A1a. Karnal bunt
- A1b. Black point
- A1c. Head scab
- A1d. Storage fungi
- **A2. Insect and Nematode Pests**
- A2a. Insect pests – Khapra beetle
- A2b. Nematode pests – Ear cockle or nematode gall disease
- **A3. Weed pest**
- A3a. *Phalaris minor*

B. Abiotic

- **B1. Wheat straw**
- **B2. Dust and dirt**

Karnal bunt : In 1931, Karnal bunt or the partial grain smut of wheat caused by a fungal pathogen *Tilletia indica* Mitra [also known as *Neovossia indica* Mitra (Mundkur)] was first recorded from a place Karnal in Haryana (then Punjab). Never any severe production limitation has been recorded in India arising due to epidemics of this disease. But, the infected grains get partially converted to black powder of fungal spores (teliospores). As a result, quality of floor is impaired as well as germination is reduced if such grains are used as seed. The disease perpetuates from season to season through seed and

exists endemically in Punjab, Haryana, western parts of U.P., northern Rajasthan, Jammu, tarai areas of Himachal Pradesh and Uttranchal. Due to unexplainable reasons, this cosmetic disease of wheat that had very limited world wide distribution became a quarantine concern globally interfering with free and fair grain trade (Nagarajan *et al*., 1997). In India, due to lack of domestic quarantine, the pathogen of Karnal bunt has already spread to its possible ecological limits. At the global level, it is yet to reach such limits, due to stringent phytosanitary and quarantine regulations adopted by several of the wheat growing nations. Nevertheless, disease has been recorded from northern gulf countries, Afghanistan, Mexico, USA and south Africa.

Owing to favourable crop weather which has been continuosly prevailing upon during wheat season of last few years led to bumper yields and India has stacked a wealth of surplus wheat now waiting disposal from warehouses. At this juncture, export is the best alternative and India needs customers. But unfortunately, several countries are afraid of Karnal bunt introduction into their territory if they import wheat from India. Moreover, there have been instances, that, even the countries reported to have Karnal bunt do not prefer to import from India on other pretexts of dust/dirt contaminations. These countries have every right to reflect their concern in this way according to the item 1 and 2 of SPS agreement of WTO (Table 2). But the SPS agreement is both – party – friendly (importer and exporter) in order to enhance the free, fair and liberalized global trade. Availing benefit of this liberal provision in SPS agreement, India has an advantage of seeking opportunity to prove that Indian produce being exported is either free of Karnal bunt or fear of Karnal bunt establishment in the territory of importing country is irrelevant since the ecological conditions prevailing upon there do not permit the survival of the pathogen as well as disease establishment. Under the provision of articles 3 and 4 of SPS agreement (Table 2), the wheat grains from India has to be accepted if this country fulfils the following requirements; (1) Provides an exemplary model of Pest Risk assessment (PRA) to importing country which fears introduction of Karnal bunt. The model of PRA must be prepared using scientifically documented facts about the disease and should be capable of demonstrating why Karnal bunt will not occur in free areas of the importing country. The importing country may then examine the possibility of Karnal bunt occurrence in its territory by applying the Indian model of PRA (article 5, Table 2).

(2) Through pest surveillance data, India has to declare areas where Karnal bunt does not prevail. Also, the inspectors of country interested to import wheat from India must be called to examine the status of disease at proper growth stage (harvesting time) (article 6 of SPS agreement, Table 2). The produce of this area will be fit for export and eligible to get phytosanitary certificate under SPS agreement.

OUR PREPAREDNESS : PEST RISK ANALYSIS (PRA) FOR KARNAL BUNT ACCOMPLISHED FOR INDIAN SITUATIONS

India being the home of Karnal bunt has generated over the last seventy years a considerable amount of scientific information. Also, from mid seventies onwards, western workers have generated much more precise knowledge. Using all these informations and the epidemiological knowledge on the pathogen and disease, a PRA model has been developed to calculate the risk of transporting wheat from Ludhiana, a Karnal bunt prone area in Punjab to different destinations within India where the disease does not occur. Factors of post harvest handling as well as climate during storage and transportation of grains which influence survival of pathogen and disease development were covered. The probability of risk was calculated using the computer softwares which were indigenously developed and named as GEOKB and KBRISK (Nagarajan, 2002). Based on geographical details and general agronomic practices of wheat cultivation followed in a given area, the GEOKB works out the probability of Karnal bunt establishment there. This probability value was based on the database of the Indian wheat disease survey information on the occurrence of KB in different parts of the country. The reliability of GEOKB was tested through some case studies (Table 3).

Table 1
Definitions of SPS measures

a. To protect animal or plant health within the territory of the member state from risks arising from the entry, establishment or diseases, disease carrying organisms or disease causing organisms

b. To protect human or animal life or health within the territory of the member state from risks arising from additives, contaminants, toxins or disease causing organisms in food, beverages or food stuffs

c. To protect human life and health within the territory of the member state from risks arising from diseases carried by animals, plants or products thereof, or from the entry, establishment or spread of pests

d. To prevent or limit other damages within the territory of the member state from the entry, establishment or spread of pests

Table 2
Articles of Sanitary and Phytosanitary measures - summarized statements (see Durand and Chiradia – Bousquet, 1999)

Number	*Name*	*Provision/s*
Article 1	General Provisions	Supplemented with Annex A11, deals with measures pertaining to protection of human, animal and plant life from foreign sources.
Article 2	Basic rights and obligations	Members have right to take SPS measures but with obligations stated in article XX(b) of GATT 1994.
Article 3	Harmonization	International standards are given due consideration.
Article 4	Equivalence	Equally applicable to all members (eg. exporter as well as importer).
Article 5	Pest risk assessment (PRA)	Risk associated with pests likely to get exported or imported must be analyzed scientifically.
Article 6	Consideration to regional conditions	Identification of pest free areas and areas of low pest prevalence for relaxation in quarantine regulations.
Article 7	Transparency	Supplemented with Annexure B11, All regulations must be in published form and available to member countries.
Article 8	Control, Inspection and approval Procedures	Supplemented in Annexure C11, All procedures must be undertaken completed without undue delay.
Article 9	Technical Assistance	Guidance to other members especially developing countries either bilaterally or appropriate internal organizations.
Article 10	Special and differential treatment	Applicable to the least developed countries.
Article 11	Consultations and dispute settlement	Constitution of a panel of experts to settle scientific and technical issues under provision of articles XXII and XXIII of GATT 1994
Article 12	Administration	Constitution of a committee for this purpose
Article 13	Implementation	Consistency with govt. bodies of member countries has to be maintained
Article 14	Final provisions	The least developed country may delay application of the provisions

Table 3
The probability values calculated using computer softwares GEOKB and KBRISK for outbreak of Karnal bunt (KB) in areas free of this disease by transporting wheat to those places from KB prone area, Ludhiana

Indian location	*Probability of KB establishment*			*Comparable to*
	GEOKB		*KBRISK**	
	1997	*1998*	*1999*	
Karnal	0.125	49.7 E -15	11.8E-14	38.45E	Pakistan's Punjab
Katrain	10^{16}E-20 or nil	Microconidia will not germinate[3]	Microconidia will not germinate[3]	Sporogenesis will not occur[4]	West and Central Europe
Mashobra	10^{15}E-20 or nil	Macroconidia will not germinate[2]	Microconidia will not germinate[3]	Sporogenesis will not occur[4]	East Europe, Turkey, Syria, Lebanon
Jodhpur	50^{15}E-017 or nil	Microconidia will not germinate[3]	Microconidia will not germinate[3]	16.088E-17 or 0	North Africa
Pune	25^{15}E-018 or nil	[1]Teliospores will not germinate[1]	Microconidia will not germinate[3]	Microconidia will not germinate[3]	Gulf countries
Dharwar	30^{15}E-017 or nil	Microconidia will not germinate[3]	Microconidia will not germinate[3]	Microconidia will not germinate[3]	Gulf countries
Indore	50^{15}E-0.8 or nil	Macroconidia will not germinate[2]	Microconidia will not germinate[3]	Microconidia will not germinate[3]	Central and south africa

* quantitative value indicates KB occurrence while text depicts reason for no occurrence of KB and the text statements are defined below:
[1]In grain affected by Karnal bunt, the floor contents are replaced by black powdery mass of fungal spores known as teliospores
[2]Teliospores germinate to give rise to a tubular structure promycelium bearing a bunch of thread like appendages known as macroconidia
[3]Macroconidia germinate to produce mycelium from the surface of whose hyphae, another spores known as microsporidia are budded off which act as infection agents. After infection of ovary by the germ tubes arising from microconidia, the fungal mycelium ramifies in the interior of grain replacing endospermic masss (floor)
[4]The mycelial hypahe inside the grain transform into tiny globose structures known as teliospores and the process termed as sporogenesis

Information available in the literature was used to construct statistical models for the different life stages of the pathogen and based on that the another model, KBRISK could be synthesized which calculates the probability of the pathogen completing various life cycle events finally leading to establishment of the disease. For this purpose, the weather data of the test site was subjected to analysis in the form of continuous series, each comprised of four day running means of traits namely temperature, relative humidity and rain. If the weather conditions at some stage is unfavourable for the further progress of the life cycle, then the programme terminates showing on the computer monitor the reason for the non establishment of the disease (see Table 3, explained as points 1, 2, 3, 4 as foot note) without exhibiting any value of probability. The survey/surveillance data for the eight test sites within India showed that there is a good match between the field data and the prediction of probability done by KBRISK . Both the software packages were developed at Directorate of Wheat Research – Karnal and form a copyright domain of this institute of Indian Council of Agricultural Research (ICAR), New Delhi. Both the softwares are available on demand.

The GEOKB and KBRISK can be applied to calculate the risk associated with transporting wheat from KB prone areas of India to KB free destinations anywhere in the world. Tentatively , some of the countries which are likely customers of Indian wheat can be compared to Indian locations remaining free of Karnal bunt (Table 3).

KARNAL BUNT SURVEILLANCE: WELL DOCUMENTED AND UP – TO - DATE

Under article 6 of SPS agreement (Table 2), exporting nation may be required to prove that the commodity being dispatched to importing destination was grown in a pest free location. Same clause may be equally applicable to the issue of Karnal bunt in the event of India exporting wheat to other countries. Karnal bunt is prevalent only in north west plain zone while other wheat growing areas of the country are free of this disease (Fig. 5). Since last 25 years, a regular annual monitoring have been accomplished by various agencies of ICAR and SAU's (State Agricultural Universities) in the areas of their jurisdiction.The results of these surveillance programmes are well documented and categorically maintained at ICAR's institute DWR (Directorate of Wheat Research) located at Karnal, Haryana. The wheat stocks harvested from Karnal bunt free areas of India can be pushed into export without any SPS issue becoming a trade hurdle.

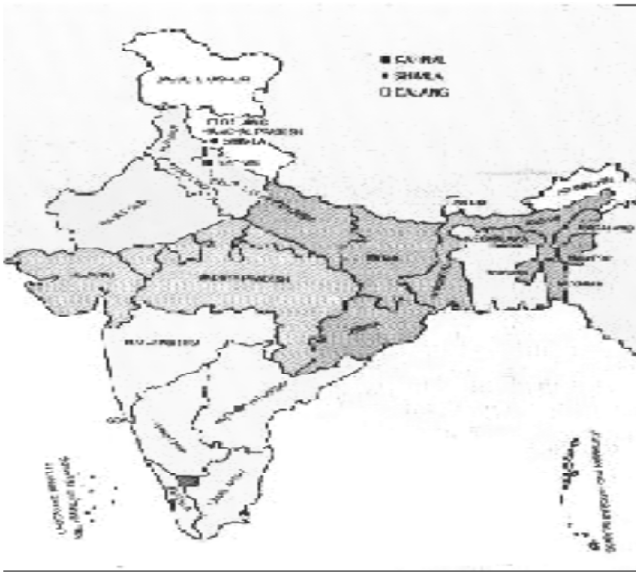

Figure 5: Prevalence of Karnal bunt in India

Other Wheat pests having potential to be identified as SPS issue: Black point, a disease confused with Karnal bunt

Unlike Karnal bunt which damages the interior of grain (Fig. 6B) by converting endosperm (the floor precursor) into black powder of fungal spore, the black point symptoms appear superficially as black patches on the seed coat mostly in the vicinity of embryonic end (Figure 6 C and D). The disease is principally caused by a fungal organism, *Bipolaris sorokiniana* and occasionally another fungus *Alternaria alternata* may also be associated. The very presence of this symptom reduces the market acceptance of grain. Black patches on grain contain fungal mycelium and produce asexual spores which cause another disease the root rot causing seedling necrosis if such grains are used as seed. The worst part associated with this disease is that the black point, if not examined carefully is confused with Karnal bunt. The black point affected lots may become subject of quarantine rejection in the pretext of detecting Karnal bunt. Therefore there is a need to create awareness among farmers, traders, dealers and sanitary authorities regarding this issue so that Indian consignments are not unnecessarily stopped from getting exported.

Head scab – needs a regular watch in context to global warming

The waste gases arising from overgrowing industries and automobiles has caused a green house effect

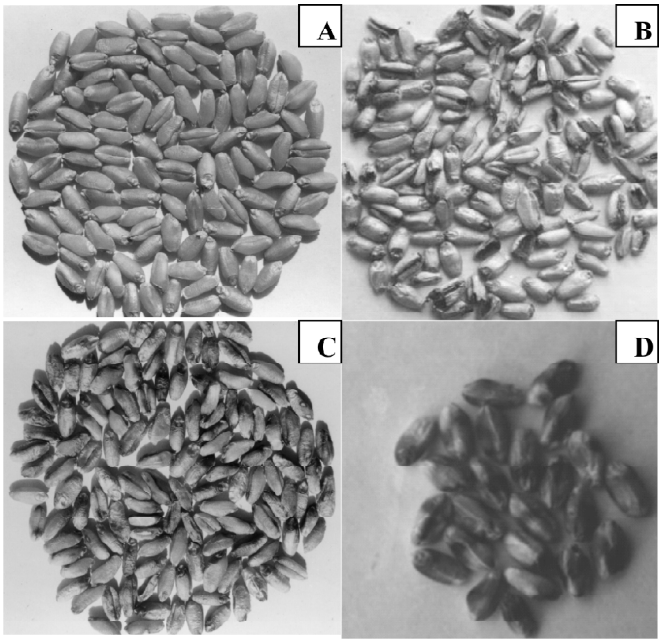

Figure 6: Healthy grains (A), Grains affected by Karnal bunt (B), Black point seen as black patches on embryonic end (C); in severe infections which are very rare, the whole grain may turn blackish and the disease can be termed as grain discoloration (D).

leading to overall rise in temperature not only in a specific zone or area but through out the globe. As a result of global warming, certain unanticipated ecological shifts are expected in India (Panayotou *et al*., 1999). The very presence of head scab symptoms particularly in durum wheats grown in Punjab after the year 1990 is envisaged to be a consequence of overall rise in temperature in this region recorded at grain formation stages of the crop growth. Head scab is a disease which prefers high humidity and high temperature. This disease is incited by several species of a fungus, the *Fusarium* and the *F. graminearum* has been recorded to be the most dominant in Punjab. Infection by *Fusarium* spp. also causes discoloration of ear head not allowing grain setting inside it (ear blight). However, in certain cases some seed setting takes place resulting in formation of shrivelled grains (Fig. 7). All grains in an infected earhead do not get shriveled as some may appear healthy. But, these grains may contain toxins which might cause serious ailments if consumed by humans and animals (Scott,1990) thus may become a serious SPS issue. The produce harvested from fields having incidence of head scab comprises a mixture of healthy and diseased grains and easily attracts eyes of traders and sanitary personnels. Now, it is a high time to get alarmed at political, beaurocratic and scientific fronts about this concealed hazard of Indian wheat export.

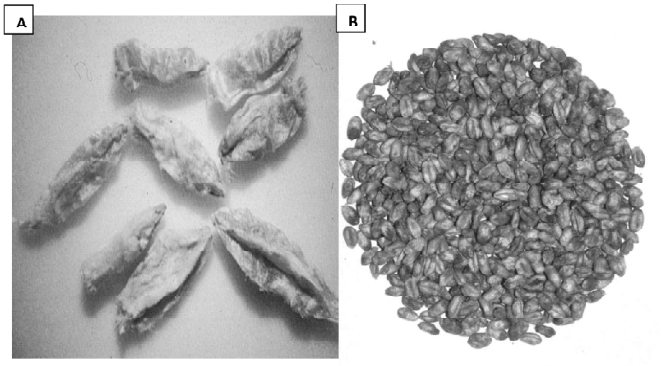

Figure 7: Shrivelled grains harvested from ear head infected by head scab pathogen *Fusarium graminearum* (A); all grains belonging to scabby ear head may not be shriveled as shown (B) and some appear healthy but may comouflague mycotoxins

Storage fungi: a neglected but potential danger for export

Unseasonal rains at the time of ripening and harvesting are not uncommon in India. Such rains may lead to an increase in moisture contents of the grain which is unsafe for the storage. High moisture content in wheat grains at the time of storage facilitates attack by several fungal saprophytes making the stocks under storage unhygenic for human consumption. A number of fungi have been reported to produce mycotoxins and these include the species of *Aspergillus, Penicillium, Alternaria, Curvularia, Fusarium, Mucor, Epicoccum, Trichoderma, Rhizopus* etc. The problem of mycotoxins in relation to fungi affecting grains in India has already been thoroughly reviewed (Bilgrami *et al*., 1983 and Majumdar *et al*., 1965). Amongst the various mycotoxins, aflatoxin produced by various species of *Aspergillus* particularly *A. flavus* can be of significant importance under the SPS agreement of WTO regime while exporting wheat from India. Species of *Aspergillus* producing aflatoxins have been encountered frequently in storage conditions in India. (Mehrotra, 1983).

We must conduct a thorough survey of our FCI (Food Corporation of India) godowns and other warehouses for occurrence of various stored fungi and have thorogh documentation on their status at least in the warehouses where stocks specifically meant for export purposes are stored. Such an exercise is essential to show our preparedness for obtaining phytosanitary clearance, in case any country desirous to import wheat from India demands so. Similarly we must strictly follow the preventive measures needed for keeping stored

grains free of disease/pest infestation. Our warehouses must be designed to meet the internationally accepted hygenic standards.

Nematode pests – an easy issue

The most important nematode which may be considered as a potential phytosanitary issue in India is the *Anguina tritici* associated with ear cockle and tundu disease. Grains affected by this disease are transformed into irregularly shaped bodies termed as galls (Fig. 8) enclosing larvae of nematode which infect the next crop while sown with seed. The disease incidence depends upon the degree of admixture at the time of sowing. This disease generally prevail in Delhi, Rajasthan, Punjab, Haryana and recently reported from Darbhanga in Bihar. The annual loss caused by this nematode are not very threatening. But indirectly, country may be deprived of earning foreign exchecquer since the presence of galls can become a reason for rejection of Indian wheat by importing countries. Wheat stocks to be exported must be raised using the clean seed free from nematode galls which is the surest way of controlling ear cockle and tundu diseases.

Figure 8: Wheat grains converted into nematode galls

Insect pests – to be dealt more intensively

In India, the insect pests in wheat are more serious at the post harvest stages as they directly eat away the contents of stored grains. Variety of them cause considerable loss every year. In the north, the grain is infested by Khapra beetle, *Trogoderma granarium* Everts (Fig. 9). Rice weevil, *Sitophilus oryzae* is very destructive in the humid central and eastern regions. The other storage pests which are of importance are

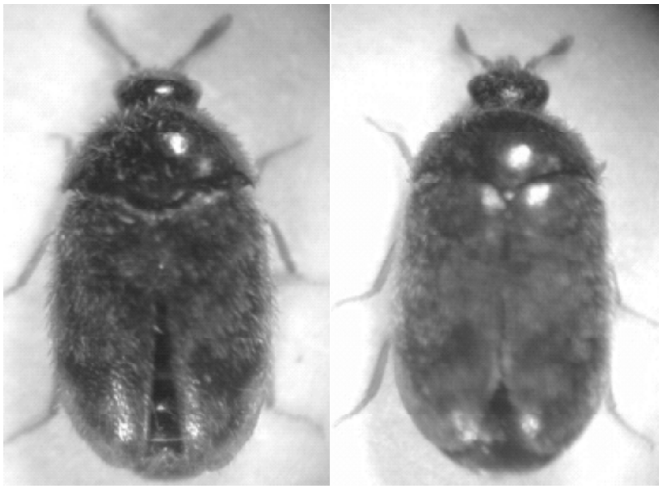

Figure 9: Khapra beetle ; male (left), female (right)

Rhyzopertha dominica Fab., *Cadra cautella* walk., *Sitotroga cereallela* Oliv. and *Tribolium castaneum* Herbst.

Khapra beetle has already been noticed abroad in Indian wheats (unconfirmed reports) and hence might emerge as a serious SPS concern in future. We must plan our activities in advance to convince rest of the world about the necessary precautionary measures undertaken to protect our storage wheat from this abnoxious pest. In fact we must keep ourselves ready to deal with all kinds of insect pests monitored in Indian warehouses since any one of them may emerge as a concern to our potential customers.

Weed pest – needs PRA (Pest Risk Analysis)

Little seed canary grass (*Phalaris minor*) is the most dominant grass weed of wheat in the rice – wheat zone of North west India contributing a major share to our surplus stocks. Seeds of this weed (Fig. 10, ear head shown left) needs high soil moisture for germination and is not a menace in areas where soil conditions does not match with those typical of rice – wheat belt of north India. Therefore, this weed does not pose any risk in most of the other wheat growing zones in India as well as several wheat growing countries abroad. But to convince this fact we have to develop a very sound and convincing PRA model based on biology and habitat of weed.

Abiotic Issues: Unrealised

Just in the recent past, there was a news about one of the Indian wheat consignments being refused by a country owing to presence of dust, dirt and straw contaminants. According to SPS agreement, the importing country can exercise this prerogative to

reject an agricultural commodity traded from other country if found to contain unwanted contaminants. Dust, dirt and straw debris may be carrying propagules of harmful pests and diseases and our export consignments may fall prey to the article 1 of SPS agreement stating that importing country can stop any material entering their territory carrying harmful microorganisms. We must ensure that wheat consignments are thoroughly cleaned and subjected to required specifications for export at the level of farmer, trader or agencies involved with grain storage and trade.

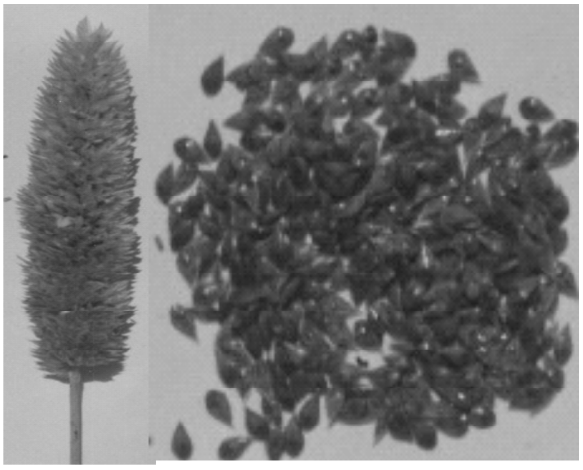

Figure 10: Phalaris minor weed ; earhead (left), seeds (right)

CONCLUSIONS

The disease/pests and other contaminants of wheat grains described above are, or may become, the potent constraints of wheat export from our country. A lot of hue and cry surfaced in the recent past while Indian wheat consignments were rejected by importing countries primarily due to the fear that these carried along a fungal disease Karnal bunt which might get introduced there. Fortunately, an attempt has been made to develop models of pest risk analysis which can be applied to reveal that ecological situations in several countries envisaged to be potential customers of Indian wheat do not permit development of Karnal bunt. Hence, such countries should not refuse Indian wheat at least in the pretext of Karnal bunt. Moreover, there are certain wheat growing zones in India identified as free of Karnal bunt on the basis of survey/surveillance data of several years. Wheat produce of these areas, if meets the required price and quality standards can not be denied by any of the country as per norms of SPS agreement defined in the WTO regime. There is need to create awareness among traders and quarantinists regarding another grain disease of Indian wheat named black point which is confounded as Karnal bunt. This disease if identified as Karnal bunt, may create unnecessary hurdles in the venture of Indian wheat export. We need to be alarmed on head scab disease of wheat which induces production of toxins in grains and poses serious health risks if consumed as food or feed. This disease is being anticipated to flare up in north west plain zone of India as a consequence of global warming. To gain reputation in the international market, India must strengthen or upgrade post harvest storage facilities. Warehouses must be protected from certain fungi responsible for contaminating wheat stocks with dreadly poisonous aflatoxin as well as grain feeding insects. Contamination of wheat stocks with nematode galls can be easily avoided by using clean seed especially while raising export stocks. By developing a suitable model of pest risk analysis, we can convince our importers that the abnoxious weed *Phalaris minor*, whose seeds can be found contaminating produce of north west plain zone, will not establish in areas lacking high levels of soil moisture at the time of sowing.

As a policy matter of world trade, export of wheat from India is liable to the regulations of SPS (sanitary and phytosanitary) agreement under WTO (World Trade Organisation) regime. Articles of SPS agreement stipulate right for importing country to stop entry of any biotic or abiotic entity being traded to its territory and found harmful to the human, animal or plant health.On the other hand, to facilitate free and fair trade, exporting nation if feel discriminately opposed or inadvertently restricted, can seek a chance to convince the importing countries that commodity under trade poses no risk. The claims of exporting country should be based on scientifically designed risk analysis models and survey/ surveillance data pertaining to the pest/disease of concern.The fungal disease of wheat grains known as Karnal bunt has burgeoned as the most important SPS concern and due to fear of introduction of this disease, several countries refuse buying Indian wheat. But, indigenously developed models of pest risk analysis (PRA) namely GEOKB and KBRISK reveal that Karnal bunt shall never establish in several of those countries and their fear of Karnal bunt introduction is unfounded and stereotypic. Survey / surveillance data of several years show that this disease is restricted only to north west plains of the country. The grain stocks belonging to other parts of

the country are free of Karnal bunt and can be safely exported.The other important SPS issues which may be of concern during export of wheat from India include black point, a fungal disease confused with Karnal bunt, another fungal disease the head scab; the insect namely Khapra beetle, the nematode causing gall disease, the aflatoxin producer fungi in storage and straw contaminants.

REFERENCES

Rao, M. V. (1994), The Indian Wheat Scenario – past, present and future. Birth Centanary lecture (Ch. RamDhan Singh). Lecture / Notes series no. 2. DWR, Karnal, India, 12pp.

Singhal, V. (1999), Indian agriculture 1999. Indian Economic Data Research Center, B – 713, Panchvati, Vikaspuri, New Delhi, 110018, 78 pp.

Nagarajan, S.,Aujla, S.S., Nanda, G. S., Sharma, I., Goel, L. B., Kumar, J. and Singh, D.V. (1997), Karnal bunt (*Tilletia indica*) of wheat – a review. Review of Plant Pathology **76,** 1207 – 14.

Nagarajan, S. (2002), Pest risk analysis for shipping wheat from Karnal bunt (*Tilletia indica*) infected areas to disease free destinations. Consultancy report of an USDA aided project extended to Dr. S. Nagarajan, Project Director – Wheat of ICAR, New Delhi, 114 pp.

Panayotou, T., Jeffrey, S., and Alix, P. (1999), Developing Countries and the Control of Climate Change: Empirical Evidence, Centre for International Development, Harvard University, Cambridge, MA, USA.

Scott, P. M. (1990), Trichothecenes in grains. Cereal Food World **35**, 661 – 666.

Bilgrami, K. S. and Sinha, K. K. (1983), Aflatoxin contamination in agricultural commodities with special reference to maize and groundnut. In Recent Advances in Plant Pathology. (Eds.) A. Hussain, Kishan singh, B. P. Singh, V.P. Agnihotri. Lucknow Print House (India), pp. 253 – 63.

Majumdar, S. K., Narsimhan, K. S. and Parpia, H. A. B. (1965), Microecological factors of microbial spoilage and occurrence of mycotoxins in stored grains. In " Mycotoxins in foodstuffs". (Eds.) G. N. Wogan. Cambridge, M.I.T. press, pp. 27 – 47.

Mehrotra, B.S. (1983), The impact of fungal infestation of cereal grains in field and storage. In Recent Advances in Plant Pathology. (Eds.) A. Hussain, Kishan singh, B.P. Singh, V.P. Agnihotri. Lucknow Print House (India), pp. 185 – 200.

USDA. (2001), Grain: world markets and trade. October, 2001, pp. 9. Foreign Agriculture Service, Washington, D.C.

Durand, S. and Chiradia – Bousquet, J. (1999), New principles of Phytosanitary legislation. FAO, Rome – Italy, 90 pp.