Annals of the Sri Lanka Department of Agriculture 2012. 14: 265-271.

A STUDY TO INVESTIGATE QUARANTINE NON-COMPLIANCE ON A CONSIGNMENT OF WHEAT-BRAN PELLETS

W.M.D.H. KULATUNGA[1], S.G.R. SILVA[1], I.K. WARSHAMANA[2] and R.W.P.M. RAJAPAKSHA[3]

[1]*Seed Certification and Plant Protection Center, Gannoruwa, Peradeniya, Sri Lanka*

[2]*National Plant Quarantine Service, Katunayake, Sri Lanka*

[3]*Department of Biotechnology, Faculty of Agriculture and Plantation Management, Wayamba University of Sri Lanka*

INTRODUCTION

Wheat (*Triticum aestivum* L.) is not produced in Sri Lanka and the grain is imported from Canada. Whole wheat is not permitted to be imported to Sri Lanka under the prevailing quarantine regulations. However, permission has been granted for the importation of wheat subject to special conditions into the isolated flour milling complex of Prima Ceylon Limited, which is self-contained and located near the port of Trincomalee, away from agricultural areas of the country. The Prima Ceylon Limited is one of the biggest flour milling complexes of the world under one roof, having a milling capacity of 3600 mt of wheat per day, which will be further expanded in the future. The factory provides modern facilities for loading and unloading of wheat grain, flour and by-products directly on to and from the ship dockings.

An investigation was conducted recently in Sri Lanka to verify the complaint made by the Vietnam National Plant Protection Organization on the presence of the Khapra beetle (*Trogoderma granarium* Everts) in a wheat-bran pellet (WBP) consignment exported to Vietnam by Prima Ceylon Limited. The Khapra beetle (Figures 1, 2, 3) is one of the most destructive pests of grain products and seeds, and has been originated in Asia. The pest has been reported in Sri Lanka, too. The pest is quarantined in many countries including Vietnam and restrictions are imposed on the importation of commodities with known infestation of the beetle. Concerns have been expressed that stored grain pests, especially the Khapra beetle, has posed a serious threat to global food security and safety (Ahmedani, 2007). The pest has been categorized as an A_2 quarantine organism by the European Plant Protection Organization (OEPP/EPPO, 1981) and has been nominated as one of the 100 worst invasive species worldwide due to being a serious pest of stored grain products in Africa, the Middle East, Near East, pockets of Europe and eastern Asia (French *et al.*, 2005). The Crop Protection Compendium (CPC, 2007) has indicated the presence of the beetle in Sri Lanka. The beetle spreads mainly through international trade.

Figure 1. Adult Khapra beetle (*Trogoderma granarium*)

Figure 2. *Trogoderma granarium* (Everts). Lateral view (right) - Female

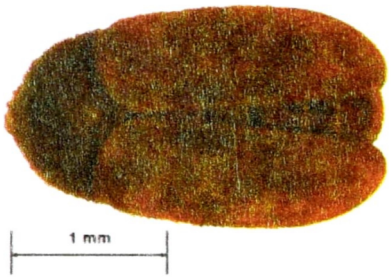

Figure 3. *Trogoderma granarium* (Everts). Dorsal view - Female

While the investigation was on-going, a ship arrived from Canada carrying wheat grain and at the same time another ship was berthed at the harbor to take WBP to Vietnam. Thus, all factors required were in place to carry out a comprehensive investigation starting from the unloading of bulk grain to the silos from the ship up to loading of WBP at the dispatch point to the ship destined to Vietnam after completing the full production cycle.

MATERIALS AND METHODS

As a result of non-compliance being informed by the National Plant Protection Organization of Vietnam, an initial factory inspection was conducted by the Quarantine Officer of Sri Lanka as a part of the verification process. As an initial step, all the quality standards and other relevant certificates at Prima Ceylon Limited were inspected, prior to the comprehensive study was undertaken as it was considered as one element of the conformity assessment. The objective was to verify the Quality maintenance of Prima Ceylon Limited regarding the presence of any insect pests including Khapra beetle. This inspection was further intended to

cover any declared additional certification-related requirements of the National Plant Quarantine Service (NPQS) of Sri Lanka.

The comprehensive study was undertaken by random sampling of the wheat grain during each production step and visual observation of factory conditions facilitating the growth of pests. Samples were initially obtained from the bulk carries of the ship where there were seven hatches of wheat, comprising of five varieties. Observations were also made at each stage of the production process where flour is the main product and WBP is the by-product. Samples of wheat grain and WBP were sent to the laboratories of the Entomology and Nematology Division, Weed Science Division and the Pathology Division at the NPQS, where they were visually observed under illuminated magnifiers and optical microscopes for the presence of any insect pests and weed seeds, and were cultured to test for the presence of pathogens.

RESULTS AND DISCUSSION

The flour mill of the Prima Ceylon Limited is situated in the coastal area of the north-east in Trincomalee, Sri Lanka, surrounded by sea. There is no paddy cultivation within 15 km radius. All raw materials, *i.e.* various types of wheat, are imported from Canada, Australia and the U.S.A. and wheat flour is exported to Thailand, Indonesia, Hong Kong, Malaysia, Cambodia, Korea, Taiwan, Singapore and The Maldives.

The quality standard certificates and records namely, the ISO 22000:2005 certificate, ISO 9001:2008 certificate, certificate of Good Manufacturing Practices and Free Sale issued by the Ministry of Health, Nutrition and Welfare, and the Fumigation Certificates issued by SGS Lanka (Pvt.) Ltd. were made available by the factory management to the inspection team. The records were found to be authentic as they were issued after auditing the internationally accepted quality requirements.

The fumigation certificates issued by the factory, where indicated that cargo of the WBP in bulk-loads have been fumigated on stream continuously during loading using Phostoxin round tablets. The fumigation has been done with automatic dispensers at the rate of 5.4 round tablets per metric ton (10.03 m^{-3}). The temperature of the product was at the maximum of 29 °C. The factory produced Wheat Flour (as the main product) and WBP (as the by-product). The processing steps of imported wheat are illustrated in Figure 4.

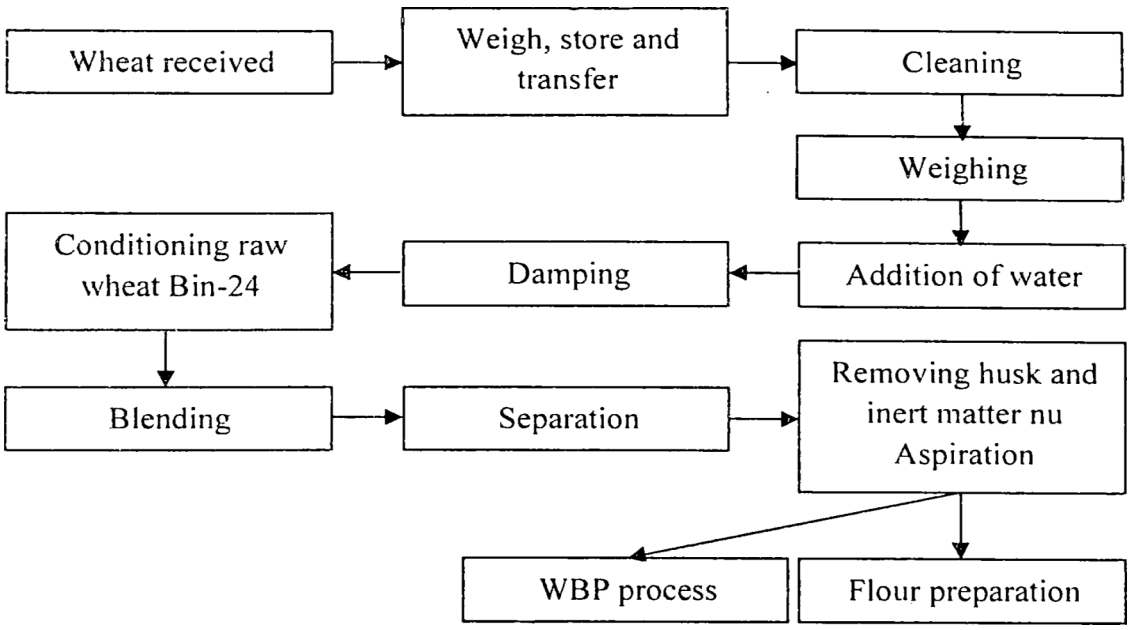

Figure 4. Steps involved in processing of imported wheat

The wheat is discharged through a closed conveyor system with the speed of 500 mt hr^{-1} and stored in concrete silos. While discharging, wheat was to found to be fumigated on stream continuously using Phostoxin round tablets in a rate of 2 tablets per mt (approximately 2 tablets per $2m^3$ volume). The wheat is processed into high quality wheat flour for human consumption in the most modern plant with the latest technology in the world, at te Prima Ceylon Limited. The by-products, wheat bran and pollard, were further processed by pelletizing into WBP. During pelletizing, the wheat bran and pollard were mixed with dry steam at above 135 °C and 2.5 bar pressure (Figure 5). The mixture was squeezed through a die into the form of pellets. The temperature and pressure indicators and the heated WBP mixtures were visually observed at the place of production, which indicated that any viable organism cannot be remained within the mixture after completing the above production step. Therefore, the attention was mainly focused on to find out possible contaminations of Khapra beetle that could occurred mainly during storage.

After production, the WBP was cooled and stored in closed concrete silos. The cooling system incorporated inside the silos maintained the temperature of WBP at 24 to 25 °C until loading into the vessel on board. The Khapra beetle (*T. granarium*) occurs in hot dry conditions predictably in areas, which for at least four months of the year have a mean temperature greater than 20 °C and relative humidity below 50 % (CPC, 2007). The pest has the ability to cause heavy losses in stored grains through voracious feeding and heating of grains, and the ability of its larvae to withstand starvation up to three years, and ability to live on food with very low moisture content (Ahmedani, 2007).

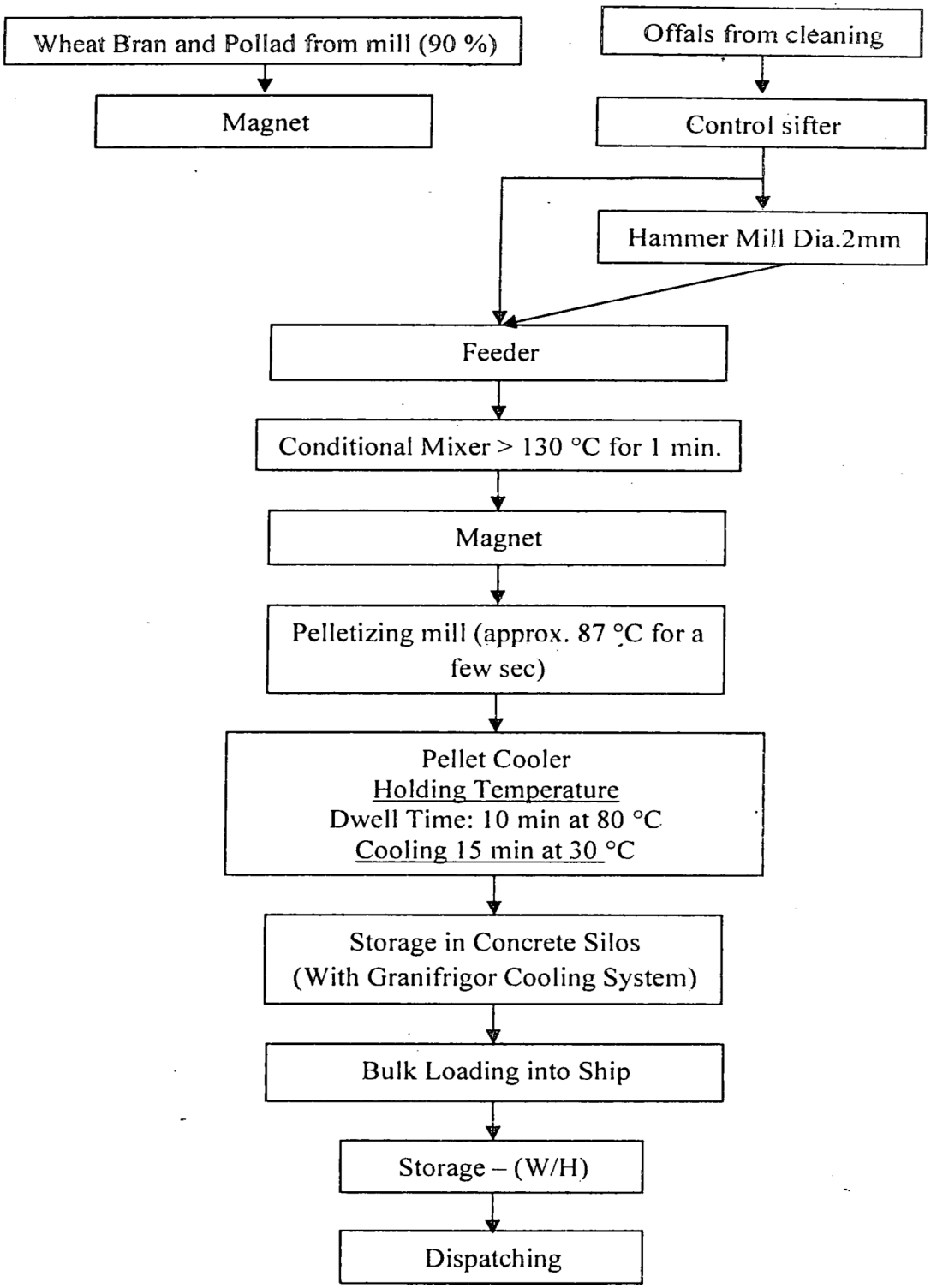

Figure 7. Pelletizing Process

The conditions inside the factory were detected as not supportive either for adult or larval stages of Khapra beetle. With the food safety management system and pelletizing process, there is no any possibility to detect the survival of any stage

of the life cycle of the pest. The fully automated milling process, which was operated by the latest milling technology, was not conductive for the multiplication of Khapra beetle. This situation was proven by the test reports of the representative samples gathered from Prima Ceylon Limited.

The laboratory investigation carried out at the NPQs at Katuayaka, Sri Lanka revealed that there was no pest contamination, including that of Khapra beetle, in the WBP and wheat samples. Though *Rhizopus sp.* and *Aspergillus sp.* were reported from the wheat (Table 1), they were not considered as microorganisms of quarantine importance. However, some weed species including *Polygonum sp.* (family: Polygonaceae), *Brassica sp.* (family: Brassicasiae) and unidentified weed species belonging to family Poaceae were detected in the WBP samples.

Table 1. Pests reported in the wheat and WBP samples of Prima Ceylon Limited

Organism	*Wheat*	*Wheat Bran Pellets (WBP)*
Insects	Nil	Nil
Pathogens	*Rhizopus sp.* *Aspergillus sp*	Nil
Weeds	*Polygonum sp.*(Polygonaceae), *Brassica sp.*(Brassicasiae) Unidentified weed speices of Poaceae	Nil

The test report issued by the Weed Science Division stated that some species of the families Brassicasiae and Poaceae are important as quarantine weeds and *Polygonum sp.* have the risk of being a noxious weed to Sri Lanka. However, according to the milling process where wheat is directly injected into the factory without exposing to the open environment, and it is subjected to high temperatures of about 135 °C, the possibility of biological invasions can be eliminated. The several safety measures implemented in the production process makes it highly unlikely to be contaminated with Khapra beetle. Credible evidence for the presence of Khapra beetle was not found during the investigation.

CONCLUSIONS

The wheat and WBP samples collected from the Prima Ceylon Limited were devoid of any pest and diseases of quarantine significance. The fully-automated milling process, which is operated by the latest milling technology, was not conducive for the multiplication of Khapra beetle. The possibility of pest contamination at the factory premises and up to the dispatch point of WBP for

shipment to Vietnam is ruled out. However, further investigations are suggested to find out whether there is a possibility of contamination taking place from the time of dispatch up to the entry point and beyond at the destination in Vietnam.

ACKNOWLEDGEMENTS

The authors thank Mr. S.C. Wanigasuriya, the Deputy Director of the National Plant Quarantine Service (NPQS) at Katunayake, Sri Lanka for the assistance provided to carry out the investigation. Gratitude is also due to Ms. W.J. Nimanthika, Research Officer at the NPQS, and Mr. Osmand de Piyadasa, Officer in Charge of the Seed Certification Regional Office for their assistance during the study. The support extended by Mr. Ma Bo Qi, the Assistant General Manager, and Mr. Asoka Gunawardana, Assistant Shipping Manager of the Prima Ceylon Limited, Colombo by providing all logistical support to carry out this study is highly appreciated. Acknowledgements are also due to Mr. Kithsiri Maniyangamuwa, the Assistant District Manager and Mr. Premalal Munagamage, the Assistant Factory Manager, of the Prima Ceylon Limited, and their staff at Trincomalee for extending assistance at the factory premises.

REFERENCE

Ahmedani, M.S., Khaliq, A., Tariq, M., Anwar, M. and Naz, S. 2007. Khapra beetle (*Trogoderma granarium* Everts): A serious threat to food security and safety. *Pakistan Journal of Agricultural Sciences*. 44(3): 481-493

CPC 2007. Crop Protection Compendium. Wallingford. UK: CAB International.

French, S. and Venette, R.C. 2005. Mini risk assessment - Khapra beetle (*Trogoderma granarium*) (Everts) (Coleoptera: Dermestidae). Purdue University, USA. pp 22

OEPP/EPPO 1981. Data sheet on quarantine organism No. 121, *Trogoderma granarium*. *Bulletin OEPP/EPPO Bulletin* 11(1)