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Research Article

Insect Quarantine Status in Association with Imported Commodities from Timor Leste Passed through Agricultural Quarantine Ware of Mota'ain-District of Belu

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ABSTRACT

Timor Leste is one of the exporting countries of agricultural products to Indonesia via the Mota'ain-Belu Regency cross-border. Imported commodities from the country may constitute those which are possible as Pest Quarantine (PQ) carrier media into Indonesia. The status of insect quarantine associated with imported commodities has been studied. Sampling of imported commodities both as open trucks shipments and toted passenger bags are done based on the Agricultural Quarantine Product Sampling Guidelines using the Non-Statistic method (convenience). Samples of commodities in the form seeds or grains were taken as much as 250 grams, while other forms were taken as much as 500 grams. For this study, 40 sample units were taken from seven commodities. The commodity samples were stored for 30 days at the laboratory of Agricultural Quarantine office in Kupang, as most life cycle of postharvest insects ranges from 3 to5 weeks. Specimens of the infecting insects were identified and their quarantine status were determined. The results showed that there were eight different insects species found in association with six kinds of commodities, while in one sample of rice no insect was found. In robusta coffee the insects found were *Necrobia rufipes*, *Hypothenemus hampei*, *Cryptolestes ferrugineus*, and *Pyralis manihotalis*. In arabica coffee we found *H. hampei*, and *C. ferrugineus*. In copra, there were *N. rufipes*, and *Carpophilus dimidiatus*. In red beans, there were *Callosobruchus chinensis*. In mixed red beans, peanuts, and soybeans *C. chinensis*, *C. dimidiatus*, and *Sitophilus oryzae* were found, and in the candlenut there were *Oryzaephylus surrinamensis*, and *C. dimidiatus*. All of the insects found in the examined commodities had plant pests status. The highest number of insects associated with the examined commodities from 40 sample units were *H. hampei* insects found in arabica coffee, which were 62.3 individuals. *N. rufipes* insects in copra commodity samples appeared on the 25th day after sampling, which meant they were the fastest among other insects.

Keywords: import of East Timor commodities, pest on quarantine storage, status of insect quarantine

INTRODUCTION

Indonesia imported several agricultural commodities from several countries, including from Timor Leste. In 2016 the Ministry of Industry recorded the value of imports of agricultural products in 2015 amounting to US $ 7,685,056,757 or 5.15% of the total imports of Indonesia. In addition to the officially registered import of agricultural products, in places of entry, especially border areas such as the Mota'ain Boundary Post (BP) located on Timor Island, Belu Regency of East Nusa Tenggara Province, there is also a traffic of agricultural products carried by passengers in bags with the purpose of consumption.

The country of Timor Leste in 2014 is exporting agricultural commodities to Indonesia through post border crossing of Mota'ain such as coffee 771,170 kg, copra 492,850 kg, candlenut 573,950 kg, tamarind 17,500 kg, yam 42.490 kg and vanilla 735 kg (Balai Karantina Pertanian Kelas I Kupang, 2015). Imported products of agriculture and by passengers were suspected to be the carriers or media for Pest Quarantine (PQ) into Indonesia.

Besides exporting agricultural commodities to Indonesia Timor Leste also imports agricultural commodities from other countries to supply the necessary of its people. Some countries that export their agricultural commodities to Timor Leste are the countries that spread PQ A1 areas for Indonesia such as Thailand, Malaysia, USA and Australia. These countries are the spread areas for *Sitophilus granarius* L. *S. granarius* is one of the most important pests in seed commodities in storage areas. *S. granarius* comes from areas in the Eastern Mediterranean

region. In the area of origin, the presence of *S. granarius* in grains such as wheat can caused total damage (Ebeling, 2002).

The Decree of the Minister of Agriculture No. 51/Permentan/KR.010/9/2015, dated September 23, 2015, describes types of Pest Quarantine (PQ) category A1 class I and II and category A2 class I and II at Host, Carrier Media, and distribution area of the PQ. Where Category A1 is PQ species which has not yet found in Indonesia. Category A2 is PQ species already exist in Indonesia but its distribution is still limited to certain area. Group I is PQ type which can not be eliminated by treatment, and Group II is PQ type which can be eliminated by treatment, while the pest is a plant pest organism that already exists in Indonesia. The purpose of this study is to determine the status of insect quarantine associated with commodities from the State of Timor Leste entering to the territory of the Republic of Indonesia through BP Mota'ain.

MATERIALS AND METHODS

The study took place from November 2016 to January 2017 at the Boundary Post (BP) Mota'ain-Belu District. All types of agricultural commodities from the State of Timor Leste entering Indonesia were intercepted through the BP quarantine inspection during November 2016. The insects associated with the commodity are observed directly *in situ* and at the Pest Laboratory of the Agricultural Quarantine Office at Kupang. Found insects were identified and their quarantine status were determined.

Sampling

The sampling technique uses the Plant Product Sampling Guidelines for Medical Examination of PEST/PQ Carrier-The Agricultural Quarantine Agency of the Non-Statistic Method (convenience) as follows. Samples were selected from the most possible lot of insect infestation. Transportation tools such as pickup trucks carrying agricultural commodities while passing BP are dismissed for inspection. Commodity samples are taken from five easily accessible points. The sample of agricultural commodities brought about by the passengers is taken in sufficient number by considering the quantity of the commodities brought. Seed or grain samples such as coffee, candlenut, rice, beans are taken as much as 250 grams, while the copra commodity is 500 grams. Each sample is packed in a plastic bag and labeled with information about: vehicle identity, location, date of sampling, and commodity name.

Sample Storage at Laboratory

All commodity samples are then stored for 30 days at the laboratory Agricultural Quarantine Office at Kupang, to await any insects which may emerge from the samples. This is because the life cycle of postharvest insects ranges from 3−5 weeks (Wagiman, 2014). The samples of commodity in the plastic bag packaging are moved in a jar and covered with gauze and labeled, then placed in a room 25-27°C. The emerging insects are identified.

Identification

Collected insects are identified by their characters or morphological traits, where insects in postharvest commodities are generally come from the Coleoptera and Lepidoptera order. Identification of adult insects of the Coleoptera order was done by observing the head, elytra, antennae, thoracic (pronotum), and limbs, whereas in the order of Lepidoptera was by seeing wing venation, antennae, mouth parts (palpus and probosis), the presence of a single eye, and limbs. Identification of adult insects was referred to Haines (1991), Schnitzeler *et al.* (2014) for the order of Coleoptera, and Leschen & Marris (2005). Identification of insects was conducted at the laboratory of Agricultural Quarantine Office at Kupang.

Determining Status of Quarantine Type of Insect Identification Result

The identified insects are then grouped according to their status referring to the PQ list in the Decree of the Minister of Agriculture No. 51/Permentan/KR.010/9/2015, dated September 23, 2015. The insects obtained into PQ Category A1 Group I is not present in Indonesia and cannot be eliminated from carrier media by treatment; PQ Category A1 Class II is not available in Indonesia and can be eliminated from carrier media by treatment; PQ Category A2 class I that already exist in the territory of Indonesia but its distribution is still limited and cannot be decimated from the carrier media with treatment; PQ Category A2 Class II is already present in the territory of Indonesia but its distribution is still limited and can be decimated from the carrier media by treatment.

RESULTS AND DISCUSSION

Commodities encountered during the month of November 2016 were seven types consisting of four imported commodities namely Robusta coffee, arabica coffee, copra, candlenuts, and three commodities of passenger bags, mixed red beans; peanuts; red beans; soybeans, and rice. The commodities are mostly production from within the country of the Democratic Republic of Timor Leste (RDTL) and some are imported from Thailand, namely rice. Insects found very limited type. The results of identification of specimens and the insect quarantine status found are presented in Table 1.

Necrobia rufipes

Necrobia rufipes Degeer or known as copra beet from Coleoptera family order Cleridae is the main pest of copra. This insect is found in the adult stadium, with a metallic blue elytra, 5 mm long body, has a seta, the antenna is red and the color is light brown (Figure 1). This is in accordance with Haines (1991) that this insect is metallic blue and the legs are reddish brown. These insects are found in copra and robusta coffee after being kept in the laboratory. In copra these insects are found to be between copra pieces, while in coffee this insect is found hanging on the gauze jar cover.

In Indonesia beside in stored copra *N. rufipes* was also found in imported cheese and meat products (Kalshoven, 1981). These insects are cosmopolitan and can live in tropical and subtropical regions. In Indonesia this insect is not included in the list of names of PQ in the Decree of the Minister of Agriculture No. 51/Permentan/KR.010/9/2015, dated September 23, 2015 which means in the quarantine this insect status is pest.

Oryzaephylus surrinamensis

Oryzaephylus surrinamensis Linneaus or known as the sawtoothed grain beetle comes from the order of the Coleoptera family Silvanidae. The insects that were found in this imago stadium were dark brown, the body was slender and flat with a body length of 3.5 mm. In pronotum there were six pairs of serrations such as tooth saw and there were three elongated grooves, while in the elytra there were longitudinal lines (Figure 2). It is as proposed by Haines (1991) that in the pronotum part of *O. surrinamensis* there are six pairs of teeth that resemble tooth saws and in the elytra there were clear longitudinal lines. *O. surrinamensis* adult stadium was found to be actively eating on the rejuvenated candlenut.

These insects are poliphagous on commodities such as rice, nutmeg and copra, therefore it is possible that the candlenut commodity is also one of its host. *O. surrinamenensis* has a wide adaptability (cosmopolitan) especially on stored products. In Kalshoven (1981), *O. surrinamenensis* was first discovered in Indonesia in the nutmeg seeds product. *O. surrinamenensis* is not included in the list of PQ names attached in the Decree of the Minister of Agriculture No. 51/Permentan/KR.010/9/2015, dated September 23, 2015 which

Table 1. Results of identification of insects associated with agricultural commodities entered Indonesia from Timor Leste through BP Mota'ain

Number	Commodity	The insects were found	Quarantine status
1.	Coffee Robusta	*Necrobia rufipes*	PEST
		Hypothenemus hampei	PEST
		Cryptolestes ferrugineus	PEST
		Pyralis manihotalis	PEST
2.	Coffee Arabika	*Hypothenemus hampei*	PEST
		Cryptolestes ferrugineus	PEST
3.	Copra	*Necrobia rufipes*	PEST
		Carpophilus dimidiatus	PEST
4.	Kidney bean	*Callosobruchus chinensis*	PEST
5.	Kidney bean, soybean	*Callosobruchus chinensis*	PEST
		Carpophilus dimidiatus	PEST
		Sitopilus sp.	PEST
6.	Candlenut	*Oryzaephylus surrinamensis*	PEST
		Carpophilus dimidiatus	PEST
7.	Rice	-	-

Astuti (2017) (magnification 16×)

Astuti (2017)

Figure 1. *Necrobia rufipes* Degeer (Coleoptera; Cleridae)

Astuti (2017) (magnification 16×)

http://keys.lucidcentral.org

Figure 2. *Oryzaephylus surrinamensis* Linneaus (Coleoptera; Silvanidae)

means that the insect has a pest status in quarantine especially when considering that its existence has been long enough in Indonesia.

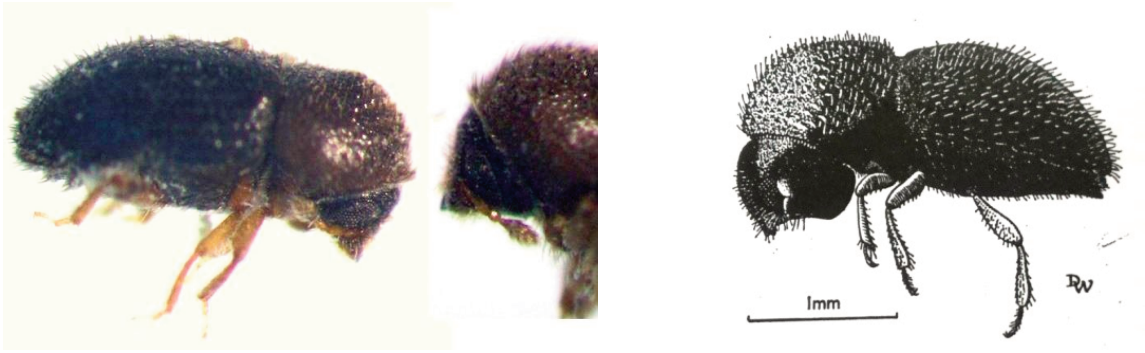
Hypothenemus hampei

Hypothenemus hampei Ferrari or known as coffee berry borer and it is an insect of Coleoptera family order Scolytidae. This insect was found in coffee beans in adult stadia with a short body measuring 1.3 mm, black, antennashape capitates, elytra and pronotum large and spiked but short (Figure 3). This is as proposed by Haines (1991) that the body is black with elytra and pronotum large and spiked but short. This insect attacks the coffee beans since the plants are still in the field. These insects originated from Africa and spread to other countries including Indonesia through the delivery of coffee beans. *H. hampei* entered the island of Java in 1909 carried by coffee beans (Kalshoven, 1981). International spreads of *H. hampei* include Brazil, Guatemala, Asia including India, Indonesia and several islands in the Pacific islands including Puerto Rico (Vega, 2002).

This insect is found in both robusta and arabica coffee beans. Both of these commodities are the host of these insects. *H. hampei* insects attacked the beans and they can be found by splitting the seeds that have attack's symptoms in the laboratory. *H. hampei* is not included in the list of PQ names attached in the Decree of the Minister of Agriculture No. 51/Permentan/KR.010 9/2015, dated September 23, 2015 which means the quarantine status of these insects are pests.

Callosobruchus chinensis

Callosobruchus chinensis (Linneaeus) or southern cowpea weevil is an insect of the family Bruchidae order Coleoptera. *C. chinensis* which in adult phase is blackish brown with a body length of 3.5 mm, has elytra stripped and shorter than the abdomen so the tip of the abdomen is visible. At the back of the limb, the femur enlarged, and on their inside and



Astuti (2017) (magnification 50×) Kalshoven (1981)

Figure 3. *Hypothenemus hampei* Ferrari (Coleoptera; Scolytidae)

Astuti (2017) (magnification 25×) Haines, 1991

Figure 4. *Callosobruchus chinensis* Linneaeus (Coleoptera; Bruchidae)

outside there are a pair of thorns. The pectoral section is ivory white, and the antenna is serrate (Figure 4). These characteristics are similar to those proposed by Haines (1991) that this insect has a pair of teeth in the rear femur, the inner teeth longer than the outside, elytra pale brown, the outline of the abdominal side has a clear white set and pectinate male antenna while the female serrate. This insect is found on red bean commodity samples and in mixture of commodities of pea beans/red beans/soybeans after being stored. These insects are oligophagic, mostly fed on beans. However, it is possible that the commodities where this insect is found are its host.

C. chinensis comes from the tropical Asia region and spreads to the subtropical region. This insect is not included in the list of PQ names in the Decree of the Minister of Agriculture No. 51/Permentan/KR.010/9/2015, dated September 23, 2015 which means the insect has a pest status.

Carpophilus dimidiatus

Carpophilus dimidiatus Linneaeus known as corn beetle (corn sap beetle) is an insect of the family Nitidulidae order Coleoptera. These insects are obtained from samples of copra, nuts, and candlenuts stored. Insects were found in the adult phase. The body is dark brown, the head and pronotum are darker than elytra, the elytra has brown spots, 2.5 mm in length, the last 3 segments of the antenna is enlarged, the emblem is unlined and does not cover the entire abdomen (the last two abdominal segments) (Figure 5), in addition to having reddish-brown limbs. This is as proposed by Leschen & J.W.M. Marris (2005) and Jihan, *et al* (2014) that the main feature of this insect is that its elytra does not cover the last two segments of the abdomen, these insects are brown to light brown, the head and the pronotum are darker compared with its elytra, reddish-brown limbs, and there is a

Astuti (2017) (magnification 32×)

USDA (2015)

Figure 5. *Carpophilus dimidiatus* Linneaeus (Coleoptera;Nitidulidae)

Astuti (2017) (magnification 25×)

USDA (2015)

Figure 6. *Cryptolestes ferrugineus* Stephens (Coleopteran; Cucujidae)

reddish brown spot on its elytra. These insects are often found in stored peanut commodities, rice, nutmeg, broken corncobs, copra and sapodilla fruit (Kalshoven, 1981).

According to Kalsoven (1981) this insect already exists in Indonesia precisely the island of Java. *C. dimidiatus* insects are not included in the list of PQ names attached in the Decree of the Minister of Agriculture No. 51/Permentan/KR.010/9/2015, dated 23 September 2015 which means they have pest status in Indonesian agricultural quarantine.

Cryptolestes ferrugineus

Cryptolestes ferrugineus Stephens which is also known as rusty grain beetle, is an insect of the Coleopteran order Cucujidae family. These stadia imago insects are found in coffee commodities that are kept within the coffee beans as well as between the coffee beans. This insect is reddish brown, measuring 1.3 mm, with a filiform antenna shape that reaches 0.9 mm long, almost as long as its body, elytra covering the whole part of the abdomen and at the edges rounded. The head and prothorax length are almost the same as the length of the body, and have a flat body (Figure 6). This is the same as Haines (1991) suggests that *C. ferrugineus* has a flat, light brown body, and a filiform shaped antenna. *C. ferrugineus* is a secondary pest that damages, rice, corn and grains (Prabawadi, *et al*., 2015). These insects also attack wheat in Canada (Karunakaran, *et al.*, 2004) and are often found under the bark of dead trees. In Indonesia, the pest led to problems with the export of mace to U.S.A., so that in Makasar commodity mace to be exported must first fumigation (Kalshoven, 1981).

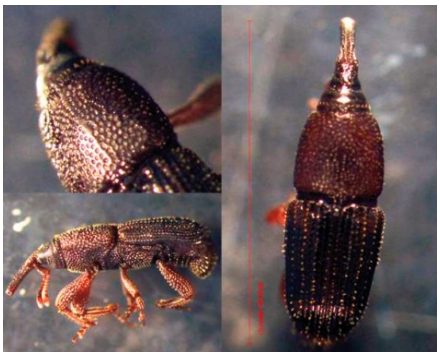
C. ferrugineus spreads in tropical regions with high humidity, and in subtropical regions. In Indonesia the insect has pest status because it is not included in the list of PQ names in the Decree of the Minister of Agriculture No. 51/Permentan/KR.010/ 9/2015, dated 23 September 2015.

Sitophilus oryzae

Sitophilus oryzae or weevils originated from the order of the Coleoptera family of Dryophthoridae. These insects are found in adult stadium in the stored bean/bean/soybean commodity. The insect, which is found to be blackish brown, has an elongated muzzle, the antenna is swollen; antenna inserted close to the base of rostrum and funicle with 6 or fewer segments; distal segment of funicle enlarged; added to club and constituent the basal segment of club (Morimoto & Kojima, 2004), has a hole in the rounded pronotum, and a body length of 4.5 mm (Figure 7). Such characteristics are as proposed by Haines (1991) that belong to *Sitophilus oryzae*. The antenna consists of 8 segments, has rostrum or an elongated muzzle, and the body length ranging from 2.4−4.5 mm. In addition, according to Rahman *et al*. (2012) *Sitophilus oryzae* has reddish-brown spots that form a complexion on the elytra and lamellate-shaped antennae or swabs. According to Roesli *et al.* (2003), *S. oryzae* is an important pest of postharvest grain material. These insects are found in tropical climates and sometimes also found in cold climates. In Indonesia the insect has a pest status because it is not included in the list of PQ names in the Decree of the Minister of Agriculture No. 51/Permentan/KR.010/9/2015, dated September 23, 2015.

Pyralis manihotalis

Pyralis manihotalis Guenee is a gray pyralid or meal moth of the order Lepidoptera family Pyralidae. This insect is found in adult stadium in a jar used to store coffee commodities which is one of its host. The found insects are gray-brown, and have a wingspan of 12 mm (Figure 8). Kalshoven (1981) reports that these insects already exist in Indonesia and attack coffee beans, green beans, coriander, cumin, dried acids, cocoa, and animal products such as meat and leather.

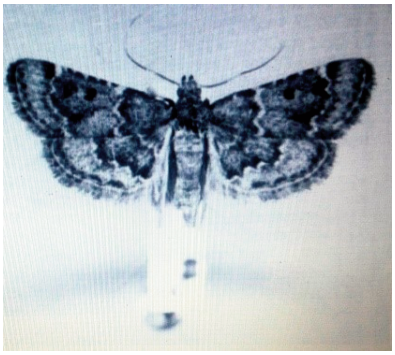


Astuti (2017) (magnification 20×)

https://en.wikipedia.org/wiki/Maize_weevil

Figure 7. *Sitopilus oryzae* (Coleoptera; Dryophthoridae)

Astuti (2017) (magnification 10×)



ANIC,CRISO (1978)

Figure 8. *Pyralis manihotalis* Guenee (Lepidoptera; Pyralidae)

These insects are from Central and South America and spread to various countries including Africa, India, Ceylon, China, Formosa, Malaysia, Philippines, Australia, Samoa, South America and West Indies (Zimmerman, 1958), besides Sri Lanka, Taiwan, Thailand, Singapore, Hawaii, and Indonesia (Kalshoven, 1981). In Indonesia this insect is not included in the PQ list of names in the Decree of the Minister of Agriculture No. 51/Permentan/KR.010/9/2015, dated September 23, 2015 so that the insect status is pest.

On the seven samples of agricultural commodity observed, there is one commodity where no insect was found, that is rice commodity. The rice was under the trademark Globus 'AAA' Tein Sae and For Jasmin. Based on the information obtained that the rice commodities circulating in the State of Timor Leste under the trademark Globus 'AAA' Tein Sae are imported from Vietnam and the rice under the trademark For Jasmin is imported from Thailand (Quintao, 2017, personal communication).

Number of insects that arise from the maintenance of samples Timor Leste imported commodities transported by means of conveyance through BP Mota'ain can be seen in Table 2.

Table 2 shows that the highest number of insects found in the association of imported commodity samples was *Hypothenemus hampei* on arabica coffee, i.e. as many as 62.3 individuals while the lowest were *Necrobia rufipes* and *Pyralis manihotalis* on robusta coffee commodity and *Cryptolestes ferrugineus* in arabica coffee commodity, resepectively, with an average number of 0.2 individuals. Differences in the number of insect populations that appear can be caused by several factors such as storage duration. The longer the agricultural commodity is stored, the number of insects that appear will also be more diverse both in types and population. This research is consistent with Rimbing research (2015), which concluded that the length of corn storage for animal feed is closely related to species and population. The longer the storage of animal feed in a certain time, the higher the number of species and population will be. With the increase in population and the number of types of insects that appear then the damage will occur higher. This is consistent with Wagiman's (1999) research on the combination of *Sitophilus oryzae* and *Tribolium castaneum* attacks significantly increase the percentage of rice groats and rice so it smells very stale, the percentage of rice groats is expected to increase because the number of both populations is so much that the damage potential becomes higher. For commodities passenger bags number of population is not displayed because the purpose of these passers by were to consume them directly.

Table 2 shows that *N. rufipes* insects associated with copra commodities came out faster than other insects. *N. rufipes* appeared on 25th day calculated from the time of sampling. While *N. rufipes* found in coffee commodities appeared on the 30th day after sampling. Shorter storage times result in less number of insects appearing. This was because the length of the life cycle of the postharvest on *N. rufipes* takes 25 days to develop from egg to adult at a temperature of 30^{o}C (Edde *et al*., 2012).

Table 2. The number of insects that have emerged since commodity sample maintenance began Origin Timor Leste carried by means of conveyance

Number	Commodity	The insects were found	Number of Insects	Days since maintenance
1.	Coffee Robusta	*N. rufipes*	0.2	30
		H. hampei	21	
		C. ferrugineus	1	29
		P. manihotalis	0.2	30
2.	Coffee Arabika	*H. hampei*	62.3	
		C. ferrugineus	0.2	29
3.	Copra	*N. rufipes*	2.95	25
		C. dimidiatus	0.7	30
4.	Candlenut	*O. surrinamensis*	8.8	26
		C. dimidiatus	4.2	28

This study demonstrates the presence of insect associations with commodities exported to Indonesia from Timor Leste with their insect status as pests, mostly from the Coleoptera and the Lepidoptera orders. The Coleoptera order were the most found in the sample compared with the Lepidopetra order. This is in accordance with what was proposed by Haines (1991) that the Coleopteran order is a type of post-harvest pests that is much more damaging to postharvest materials such as savings grains. According to Supeno (2005) the infestation of *C. chinensis* on green bean seeds resulted in very harmful damage, from several varieties tested only three resistant varieties while the remaining 86.0% to 99.0% damage and the number of imago greatly affected the percentage of seed damage, the more the number of imago that attack, the greater the percentage of seed damage.

The agricultural commodities being exported are not free from pests, therefore the supervision and inspection conducted by Agricultural Quarantine for commodities imported into Indonesia through BP Mota'ain should be further tightened. This is because in the future the traffic of agricultural commodities will increase and the commodities are not entirely products originating from the State of Timor Leste, but the from other countries that become PQ origin for Indonesia. The existence of pests on agricultural commodities can be a source of investment for agricultural commodities stored in storage and might generate significant losses later. In addition, vigilance must be improved in the face of free market because agricultural commodities can be a carrier of PQ into Indonesia that might threaten agriculture in the Republic of Indonesia.

CONCLUSION

Commodities entering Indonesia from Timor Leste are imported commodities namely arabica coffee, robusta coffee, copra, pecan transported with vehicular means and commodities namely red beans, peanuts/soybeans and rice intercepted from passengger bags. Specimens of insects are found in six commodities and are not found in rice. The insects found are *Necrobia rufipes* Degeer (Coleoptera; Cleridae), *Oryzaephylus surrinamensis* Linneaus (Coleoptera; Silvanidae), *Hypothenemus hampei* Ferrari (Coleoptera; Scolytidae), *Callosobruchus chinensis* Linneaeus (Coleoptera; Bruchidae), *Carpophilus dimidiatus* Linneaeus (Coleoptera; Nitidulidae), *Cryptolestes ferrugineus* Stephens (Coleopteran; Cucujidae), *Sitophilus oryzae* (Coleoptera; Dryophthoridae), and *Pyralis manihotalis* Guenee (Lepidoptera; Pyralidae). All types of insects are not PQ because it is already in Indonesia, or having the status of pests. The highest number of insect populations, *H. hampei*, was found in arabica samples with populations of 62.3 individuals and *N. rufipes* associated with copra commodities appeared more rapidly at day 25 after sampling.

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