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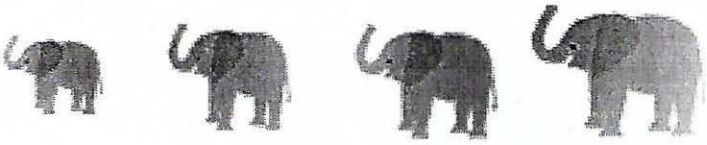
The Eighth Conference of the Pacific Rim Termite Research Group

28 February -1 March 2011,
Tawana Hotel, Bangkok, Thailand



Thailand
2011

List of TRG 8 participants

	Name	Affiliation	Member (S or O)
1	Kunio TSUNODA	Research Institute for Sustainable Humanosphere, Kyoto University	O
2	Naotaka MARU	Research Institute for Sustainable Humanosphere, Kyoto University	O
3	Thuy Hien NGUYEN	Institute for Termite Control and Works Protection, Vietnam	O
4	Quoc Huy NGUYEN		O
5	Thu Huyen TRAN		O
6	Tan Vuong NGUYEN		O
7	Indah SULISTIJOWATI	Faculty of Civil Engineering and Planning, Trisakti University	O
8	Chow-Yang LEE	Universiti Sains Malaysia	O
9	Foong Kuan FOO		O
10	Jian HU		O
11	Ching Chen LEE		O
12	Ikhsan GUSWENRIVO		O
13	G Veera SINGHAM		O
14	Kook Boon NEOH		O
15	Brian FORSCHLER	University of Georgia	O
16	Yusuf Sudo HADI	Bogor Agricultural University	O
17	Arinana		O
18	Dede HERMAWAN		O
19	Shuichi DOI	Tsukuba University	O
20	Niken SUBEKTI	Semarang State University	O
21	Gina BACHTIAR	State University of Jakarta	O
22	Nurwati HADJIB	Forest Products Research and Development Center	O
23	Maya ISMAYATI	Research & Development Unit for Biomaterial, Indonesian Institute of Sciences (LIPI)	O
24	Farah DIBA	Tanjungpura University	O
25	Ignasia Maria SULASTINGSIH	Forest Products Research and Development Center	O

55	Lusita WANDANI	Lambung Mangkurat University	O
56	Elis Nina HERLIYANA	Bogor Agricultural University	O
57	Ilyas ZULYUSRI	Faculty of Mathematics and Science of State of Padang University	O
58	Istie Sekartining RAHAYU	Bogor Agricultural University	O
59	Charunee VONGKALUANG	Royal Forest Department	O
60	Khwanchai CHAREONKRUNG		O
61	Krisna CHAIKUAD		O
62	Sujit CHUTIBHAPAKORN		O
63	Sukun TANTICHAROENKIAT	Sherwood Chemicals PCL	S
64	Fa SAEBE		S
65	Vorasith KAHASATHIEN		S
66	Jason NASH	Bayer Thai Company Ltd	S
67	Piya PISAINORADEJ		S
68	Yoshio KATSUDA (Bayer?)		S
69	Ken STERN	Ensystex (Thailand)	S
70	Sulaeman YUSUF	Research & Development Unit for Biomaterial, Indonesian Institute of Sciences (LIPI)	O
71	Van Hanh TRINH	Institute for Termite Control and Works Protection	O
72	Peerasak CHANTARAPRATEEP	Chulalongkorn University	O
73	Numchai LERTWUTTIKRAI	Chieng Thai Trading LTD., Partnership	S
74	Saowaluck PORNKULWAT	FMC Chemical (Thailand) LTD.	S
75	Somsak SAMANWONG	Dow Agroscience (Thailand) LTD.	S
76	Chayapol PRATHOOMRAT		S
77	Theodore EVANS	CSIRO	O
78	Beak Yong CHOI	BASF	N-S
79	Weerawan AMORNSAK	Kasetsart University	O
80	Isareerat SRIVORARAT	Bistec (Thailand) Limited	S
81	Nancy LEE	Chung Hsi Chemical Plant Ltd.	S
82	Trithot KHUEKAEW NA LUMPOON	TPMA	S
83	Airy Bin ABDULLAH		S

113	Sinthawee KLINPONKULKIT	Chemfleet CO.,LTD.	S
114	Norachote PUAGPIPAT	Pae Tradig CO.,LTD.	S
115	Andre KELLER	Advance Service (Thailand) CO.,LTD.	S
116	Nattaphong NATTAPHORNPHOT		S
118	Somchai PRECHATHAVEEKID	Food and Drug Administration	Guest
119	Sunantha PANTUWAN		Guest
120	Steve BROADBENT	Ensystex Thailand	S
121	Siri PONG	Sumitomo Thai	S
122	Suriyan VANITKITKOURPOL	Kincho Thai	S
123	Hirokazu KATO	Kincho Thai	S
124	Tharakorn SUTTHISIN	Kincho Thai	S
125	Sakorn TANGSUWAN	Intergrade Trading Thai	S
Accompanying persons			
126	Akiyo TSUNODA		A
127	Lisa KALA		A
128	Epifania F. GARCIA		A
129	Marsiah YUSRAM		A

Note: O = ordinary member, Non-O = non-ordinary member, S = sponsor member, N-S = non-sponsor member (local company), A = accompany person

28 Feb 2011 (First Day)

1.1 Registration began at 08.20 am.

1.2 The opening session (the first plenary session) started at 09.05 am with opening remarks from Dr. Kunio Tsunoda (KT), the President of the Pacific-Rim Termite Research Group (PRTRG). KT started by welcoming everyone to Bangkok, Thailand, and proceeded with the approval of agenda. Mr Jim Creffield was honored with an honorary life-long membership of the PRTRG for his dedication and services to the group. This year, there were a total of 3 recipients for the TRG Travel Fund, namely:

Ms Foong-Kuan FOO (Universiti Sains Malaysia, Penang, Malaysia).
Ms Maya Ismayati (Indonesian Institute of Science, Indonesia).
Mr Ronniel Manalo (University of the Philippines, Los Banos, Philippines).

1.3 Number of participants per country (129 participants [including 4 accompanying persons] from 12 countries)

Australia (3)
China [including Hongkong] (2)
Indonesia (20)
Japan (6)
Malaysia (27)

Pakistan (2)
Philippines (4)
Singapore (12)
Taiwan (1)
Thailand (42)
USA (4)
Vietnam (6)

1.4 A total of 38 papers (including 1 keynote paper) were presented at the conference. Dr Jeff Lloyd presented the keynote paper.

The Eighth Conference of the Pacific Rim Termite Research Group
Conference Program

1st day Monday 28 February 2011
08:30 – 09:00 Registration
09:00 – 09:20 Opening session Opening remarks
Plenary session (1)
(1) Approval of the agenda
(2) Reports from EC
(3) Other relevant issues
09:20 – 10:26 **Session (1)**-Oral presentations Chairperson: Kunio Tsunoda

- Jeff Lloyd and Kristen van den Meiracker (keynote): Termite Control - with Experience from the U.S.A. (30 min)
- Kunio Tsunoda: Methods to Determine the Minimum Number of Termites Required to Cause Visible Damage to Susceptible Plastic Films (12 min)
- Vernard Lewis, Shawn Leighton, Robin Tabuchi and Michael Haverty: Diurnal and Seasonal Patterns in Feeding Activity for the Western Drywood Termite, *Incisitermes minor*, for Naturally Infested Logs (12 min)
- Robert Hickman and Brian Forschler: Efficacy of Detection and Spot Treatment for the Drywood Termite *Incisitermes snyderi* (Kalotermitidae) in Naturally Infested Lumber Using Three RTU Products (12 min)

10:26– 10:45 Tea/Coffee break

10:45 – 12:11 **Session (2)**-Oral presentations Chairperson: Vernard Lewis

- Yoshio Katsuda and Yoshihiro Minamite: Development of Silafluofen and Its Practical Uses in Japan (10 min)
- Charunee Vongkaluang and Yoshio Katsuda: Development of Silafluofen-Based Termiticides in Thailand (10 min)
- Istie Sekartining Rahayu, Arinana and Imam Wahyudi: The Effect of Ammonia Fumigation on Subterranean Termites Mortality Percentage (12 min)
- Maya Ismayati, Khoirul Himmi Setiawan, Didi Tarmadi, Deni Zulfiana, Sulaeman Yusuf and Budi Santoso The Efficacy of Organo-Complex Based Wood Preservatives Formula against Drywood Termite *Cryptotermes cynocephalus* Light (12 min)
- Farkhanda Manzoor, Saadiya A. Malik, Narjis Naz and Ayisha Liaquat: Laboratory Evaluation of Insecticide Treated Soil against *Coptotermes heimi* (Wasmann) (Isoptera: Rhinotermitidae) (12 min)
- Trinh Van Hanh, Tran Thu Huyen, Nguyen Quoc Huy and Nguyen Thi My: Research on Utilization Metavina 80LS to Treat *Odontotermes hainanensis* (Isoptera: Macrotermitinae) Damaging Dikes (12 min)
- Desyanti, Yumarni and Zulmardi: Pathogenicity of the Entomopathogenic Fungus *Myrothecium roridum* Tode Ex Steudel, *Beauveria bassiana* (Bals.) Vuill. and *Metarhizium* sp. from Natural in West Sumatera Indonesia against *Coptotermes gestroi* Wasmann (Blattodea: Rhinotermitidae) (10 min)
- Desyanti, Zulyusri and Melvi Zuhra: Pathogenicity of Entomopathogenic Fungi *Metarhizium anisopliae* (METSCH) SOROKIN and *Metarhizium brunneum* (PETCH) against Drywood Termites (*Cryptotermes* sp.) (Isoptera: Kalotermitidae) (8 min)

[illegible] Lunch

[illegible] Excursion: Visit to the Ancient City in Samut Prakhan and dinner

[illegible] Tuesday 1 March 2011

[illegible] Session (3)-Oral presentations

Chairpersons: Abu Hassan Ahmad (4) & Chow-Yang Lee (4)

- Partho Dhang: Elimination of Colonies of the Mound Building Termite *Macrotermes gilvus* ((Hagen)) Using Chlorfluazuron Based Termite Bait in Philippines (12 min)
- Kok-Boon Neoh, Atiqah Jalaludin and Chow-Yang Lee: Evidence of Colony Elimination of a Higher Termite, *Globitermes sulphureus* (Blattodea: Termitidae) by Bistrifluron Bait (12 min)
- Naotaka Maru, Kunio Tsunoda and Tsuyoshi Yoshimura: Laboratory Evaluation of Five Commercial Sports Drinks as Attractants and Arrestants for Subterranean Termites (12 min)
- Ching-Chen Lee and Chow-Yang Lee: Population Size and Caste Composition of a Fungus-Growing Termite, *Macrotermes gilvus* (Blattodea: Termitidae) (12 min)
- Ikhsan Guswenrivo, Hideyuki Nagao and Chow-Yang Lee: Analysis of Cellulose and Nitrogen Content of Nest Materials of a Higher Termite *Globitermes sulphureus* (Haviland) (12 min)
- Indah Sulistyawati, Surjono Surjokusumo, Yusuf Sudo Hadi and Niken Subekti: Similarity of Building Ventilation and Termite Mounds Architecture (12 min)
- Niken Subekti and Dodi Nandika: Soil Physical Properties of Subterranean Termite Mounds of *Macrotermes gilvus* Hagen (Blattodea: Termitidae) in Natural Forest, West Java, Indonesia (12 min)
- Trinh Van Hanh, Nguyen Tan Vuong, Ngo Truong Son and Nguyen Thuy Hien: Structure of *Odontotermes hainanensis* Light 1924 (Isoptera, Macrotermitinae) Nests in the Red River Dyke Systerm in Vietnam (12 min)

10:36– 11:00 Tea/Coffee break

11:00 – 12:20 **Session (4)**-Oral presentations Chairperson: Jim Creffield

- Aiman Hanis J. and Abu Hassan A: An Evaluation of Termite Attack Incidence on Araucaria Plantation Forest in Teluk Bahang, Penang (12 min)
- Gina Bachtiar and James Rilatupa: Termite as Silent Pest of Buildings and Things Inside (12 min)
- Kwan-Cheung Cho and Shing-Kwong Cheng: The Preservation of Heritage Buildings through the Weakening of Termite Attack (10 min)
- Nurwati Hadjib and Mohammad Muslich: The Resistance of Some Indonesian Lesser Used Species against Termites (12 min)
- L. Wardani and Y.S.Hadi: Durability of Natural and Cultured Ironwood (*Eusideroxylon zwageri* T Et B) on SubterraneanTermite (*Coptotermes curvignathus* Holmgren) (12 min)
- Arinana, Kunio Tsunoda, Elis Nina Herliyana and Yusuf Sudo Hadi: Resistance of Woods against Subterannean Termites by Laboratory Tests Using Indonesian and Japanese Standards (12 min)
- Arinana, Yudi Rismayadi and Elis Nina Herliyanai: Inventory of Low Grade Wood in East Java, Indonesia (10min)

12:20 – 13:40 Lunch

13:40 – 14:52 **Session (5)**-Oral presentations Chairperson: Sulaeman Yusuf

- I.M. Sulastiningsih and Jasnil: The Resistance of Laminated Bamboo Boards to the Subterranean Termite (*Coptotermes curvignathus* Holmgreen) (12 min)
- Y.S. Hadi, E. Fajriani, D. Hermawan, M.Y. Massijaya and N. Hadjib: Resistance of Particleboard Made from Fast Growing Species to Subterranean Termite Attack (12 min)

- D. Hermawan, Y.S. Hadi, A. Erizal, M.Y. Massijaya and N. Hadjib: Resistance of Mangium Medium Density Fiberboard to Subterranean Termite (12 min)
- Firda Aulya Syamani, Muh. Yusram Massijaya, Bambang Subiyanto: Termite Resistant Properties of Sisal Board (12 min)
- Garcia, C.M., M.Y. Giron, M.R. San Pablo, D.A. Eusebio and E.D. Villena: Resistance of Wood Wool Cement Board to the Attack of Philippine Termites (12 min)
- Ronniel D. Manalo and Carlos M. Garcia: Termite Resistance of Thermally-Modified *Dendrocalamus asper* (Schultes f.) Backer ex Heyne (12 min)

14:52-15:20 Tea/Coffee break

15:20 – 16:20 **Session (6)**-Oral presentations Chairperson: Brian Forschler

- G. Veera Singham, Ahmad Sofiman Othman and Chow Yang-Lee: Preliminary Detection of SSR Markers in Mound Building Termite, *Macrotermes gilvus* (Hagen) (Termitidae: Macrotermitinae) (12 min)
- Jian Hu, Kok-Boon Neoh and Chow-Yang Lee: Cuticular Permeability of Two Sympatric Species of *Macrotermes* (Blattodea: Termitidae) (12 min)
- Wen-Hui Zeng, Rui-Xian Liu, Zhi-Qiang Li, Bing-Rong Liu, Qiu-Jian Li, Weiliang Xiao, Lai-Quan Chen, Jun-Hong Zhong: Comparison of Termite Lignocellulases Activity and Enzyme Distribution Patterns across Different Termite Genus (12 min)
- Foong Kuan-Foo, G Veera Singham, Ahmad Sofiman Othman and Chow Yang-Lee: Survey of Natural Parasitism of *Macrotermes gilvus* (Termitidae: Macrotermitinae) by *Misotermes mindeni* (Diptera: Phoridae) in Malaysia (12 min)
- Farah Diba: Antitermite and Antifungal Properties of the Soldier Defense Secretions of *Coptotermes curvignathus* Holmgren (Blattodea: Rhinotermitidae) (12 min)
- Theo Evans

16:30 – 16:40 **Plenary session (2)**

(1) Future venues

(2) Proposals and requests from participants and EC, any other business matters

Closing remarks

18:00– 20:30 Banquet

1.4 Chairpersons of oral presentation sessions

Session (1): Kunio Tsunoda (KT)
Session (2): Vernard Lewis (VL)
Session (3): Abu Hassan Ahmad (AHA) and Chow-Yang Lee (CYL)
Session (4): Jim Creffield (JC).
Session (5): Sulaeman Yusuf (SY).
Session (6): Brian Forschler (BF)

1.5 Session (1) started at 09.20 am and was followed by session (2) after tea/coffee break.

1.6 The excursion started at 01.30 pm after lunch to visit the Ancient City in Samut Prakhan province.

2 1 March 2011 (Second Day)

2.1 Sessions (3) and (4) were held in the morning.

2.2 Sessions (5) and (6) and were held in the afternoon.

2.3 After oral sessions were over, the second plenary session was held. Steph Chua (ST) announced the 8th TRG sponsors and each of them were presented with a momento of appreciation by the local organizing chairperson Dr Charunee Vongkaluang. They were:

Bayer Thai Company Ltd.
Chieng Thai Trading Company Ltd
Dainihon Jochugiku Company Ltd
Dow AgroSciences
Ensystex Company Ltd
FMC Thailand Company Ltd
Sherwood Thailand.

In addition, a momento was also presented to Dr Jeff Lloyd, the vice-president of the International Research Group on Wood Protection for delivering his keynote address at the conference. SC subsequently announced that the next conference venue (TRG 9 in 2012) would be in Hanoi, Vietnam, and 2013 in Malaysia, and 2014 in China.

2.4 Banquet was held at the conference venue, Tawana Hotel.

...rmination of Resistance of Woods against Subterranean Termites by Laboratory Tests Using Indonesian and Japanese Standards

by

Arinana[1)], Kunio Tsunoda[2)], Elis Nina Herliyana[1)] and Yusuf Sudo Hadi[1)]

[1)] Bogor Agricultural University, Kampus IPB Darmaga, Bogor 16680 Indonesia

[2)] Kyoto University, Uji, Kyoto 611-0011, Japan

Abstract

...ndard testing of wood wood-based products against subterranean termite ... ...ndonesia SNI ...-2006 has no requirements of control (reference) wood species. The present research is ...d to the selection of a control (reference) wood species from the Indonesian community woods, ...gh Indonesian community woods is known to be perishable to subterranean termites. ...rative laboratory evaluation was conducted by two methods, SNI 01.7207-2006 and JIS K ...-2004 using *Coptotermes formosanus*. Species of community woods were *Acacia mangium*, ... *brasiliensis*, *Paraserianthes falcataia* and *Pinus merkusii*. *Cryptomeria japonica* which is a ...nce wood species in JIS standard, was included in the test for comparison. Percentage mass ... termite mortality, and wood feeding rates were measured to discuss relative termite-resistance ... wood species. The highest mean percentage mass losses were recorded with *P. merkusii* at ... and 16.8%, respectively in SNI and JIS tests, whereas those of *C. japonica* were 42.1% and ... The lowest mortalities were also recorded with *P. merkusii* ie, 9% and 7%. Feeding rates ...ined with *P. merkusii* were 79 and 95 µg/termite/day, respectively in SNI and JIS tests. These ... strongly suggested that *P. merkusii* was most suitable for a control (reference) wood species ...nesian standard SNI 01.7207-2006.

Key words: percent mass loss, termite mortality, wood feeding rate, *Coptotermes formosanus*, SNI 01.7207-2006, JIS K 1571-2004

Introduction

Indonesia has huge community forests which produce a variety of wood species. Following ...es are abundant in quantity with potential constant supply: *Acacia mangium*, *Paraserianthes ...aria*, *Hevea brasiliensis*, and *Pinus merkusii*. However, most of wood species from community ... are highly vulnerable to wood-attacking organisms. Although there are over 4,000 wood ...es in Indonesia, most of them (80-85%) are regarded as low-quality woods due to low-...bility, lack of knowledge on their characteristic and uses (Mandang & Pandit 1997)

The success in determining the termite-resistance of wood materials is largely dependent on ...te activities in laboratory conditions. This means that control (reference) wood specimens ...n a certain level of attack which supports the reliability of relative comparison of results. Test ...lts are always influenced by environmental conditions such as temperature, humidity and ...ulation of airborne spores during the test. Some failures might be caused by high termite ...lity. percentage. Therefore, it seems important to choose an appropriate wood species as

control (reference) for comparison of the termite-resistance of untreated and chemically-treated woods.

Unfortunately, the Indonesia standard SNI 01.7207-2006 does not designate a selected control wood species so that we need to carefully compare the results obtained by different researchers. Since the 4 wood species used in this research are graded as durability class III-IV, they are thought to be a candidate of a control in SNI 01.7207-2006.

Materials and methods

Wood species

Wood species that we were used in this research were *Acacia mangium, Paraserianthes falcataria, Hevea brasiliensis,* and *Pinus merkusii*. We used *Cryptomeria japonica* (wood control in JIS) for reference material.

Testing method according to SNI 01. 7202-2006

The standard refers to a forced-feeding test using 200 g sand media, 50 ml aquadestilata, and 200 worker termites of *Coptotermes formosanus* for four weeks in the dark. The wood samples were placed inside the jar with standing position and was leaned on so that one of the widest side was leaned on to the jar wall. Details should be referred to the previous article (Hadi and Tsunoda 2010). Figure 1 shows an assembled test jar.

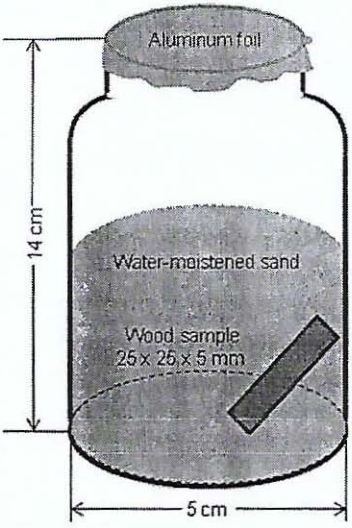


Figure 1 Termite test assembly used in the Indonesian standard SNI 01.7202-2006

Testing method according to JIS K1571-2004* (*recently revised as JIS K1571-2010)

The principle of the test method is the same as the above-mentioned Indonesian standard (forced-feeding test). Sugi (*Cryptomeria japonica*) sapwood samples are used as reference untreated materials. As shown in Figure 2, a wood sample is a sole food source for termites. An individual wood sample is placed on a plastic net to avoid direct contact of wood sample with moist plaster bottom in an acrylic cylindrical yest container with 150 worker termites and 15 soldiers. The assembled test container is maintained at 28 ± 2°C and ca. 80% R H for three weeks in the dark.

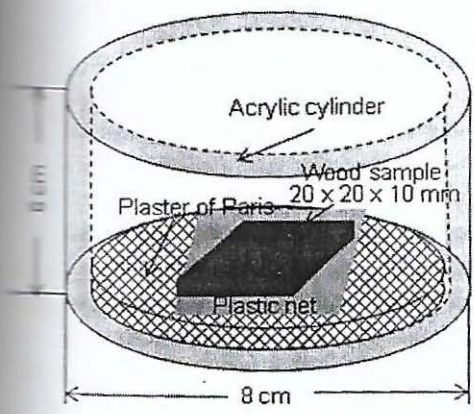


Figure 2 Termite test assembly used in the Japanese standard JIS K 1571-2004

...uation of results

Percent mass loss of the individual wood sample is calculated by the difference in weights ...re and after test according to the following equation:

Percent mass loss = $(W_1 - W_2)/W_1 \times 100$, where

W_1 = weight of oven-dried wood before test (g),

W_2 = weight of oven-dried wood after test (g).

When mean percent mass loss of 5 untreated wood samples is < 15%, the test should be ...ne.

In addition to the percent mass loss, termite mortality is calculated according to the following ...ion:

Termite mortality (%) for SNI = (number of dead workers)/200 x 100

Termite mortality (%) for JIS = (number of dead workers)/150 x 100

The feeding (wood consumption) rates are thought to be helpful for comparing test results ...ained with wood species of different densities. In order to calculate the feeding rate, we need an ...mption that termites die linearly with time. As shown in Figure 3.

On the basis of the above assumption, feeding rates can be calculated according to the ...lowing equation:

Feeding rate (mg/termite/week) = (weight of wood eaten by termites)/termite·test period ...eeks)

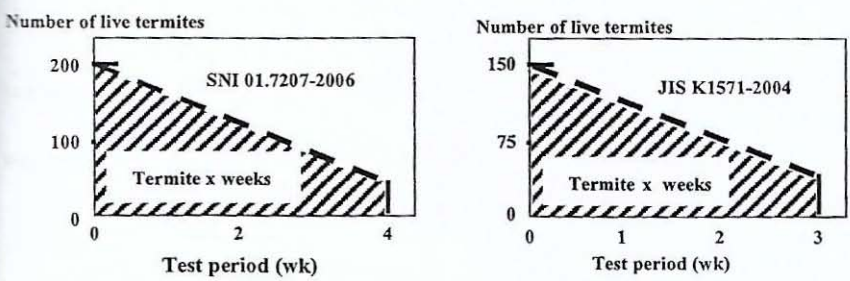


Figure 3 Theoretical linearly decrease in the number of live termites

Results and discussion

Results of SNI 01. 7202-2006

The average of mass loss percentage, mortality percentage, and wood consumption of SNI were presented in Table 1. The average mass loss percentage ranged from 11.6% to 42.1%. The lowest mass loss percentage was *A. mangium* and the highest one was *C. japonica*. According to JIS, that the control mass loss percentage must be greater than 15%. Because of this, three species were potentially be used as a control. They were *H. brasiliensis, P. falcataria*, and *P. merkusii* with a mass loss percentage of 21.0%, 24.5%, and 25.4% respectively. Only *A. mangium* colud not meet this requirement. It was assumed because the relatively high extractive content in *A. mangium*, so that *C. formosanus* was less preferable.

Table 1 Mean mass loss, mortality, and wood consumption rates determined by SNI

Wood Species	Mass Loss (%)	Mortality (%)	Wood Consumption (µg/termite/day)
Acacia mangium	11.6 ± 1.24	27 ± 4.0	43 ± 4.5
Hevea brasiliensis	21.0 ± 1.05	22 ± 5.0	79 ± 4.8
Paraserianthe falcataria	24.5 ± 1.76	23 ± 3.5	49 ± 4.0
Pinus merkusii	25.4 ± 3.35	9 ± 4.8	79 ± 9.9
Cryptomeria japonica	42.1 ± 1.91	19 ± 5.2	82 ± 5.6

The average of mortality percentage ranged from 9% to 27%. The lowest one was *P. merkusii* while the highest one was *A. mangium*. Only *P. merkusii* had mortality percentage less than 10% , while others more than 20%. They were 22%, 23%, and 27% for *H. brasiliensis*, *P. falcataria*, and *A. mangium* respectively.

Mean wood consumption per termite per day ranged between 43 µg to 82 µg. The highest one was *C. japonica* (82 µg). *H. brasiliensis* and *P. merkusii* had the same value of mean wood consumption (79 ug). This was presumably because *H. brasiliensis* has a sap (Pandit & Kurniawan, 2008) so that *C. formosanus* was preferable. Also the same thing happened with *P. merkusii*, where it had resin content and turpentine odor (Martawijaya 1989). It could be the main attraction for *C. formosanus* to consume.

Results of JIS K 1571-2004

The average of mass loss percentage, mortality percentage, and wood consumption of JIS were presented in Table 2. The Average mass loss percentage ranged from 6.1% to 21.8%. The lowest one was *A. mangium* and the highest one was *C. japonica*. According to JIS, that the control mass loss percentage must be greater than 15%. Because of this, two species were potentially be used as a control. They were *H. brasiliensis* and *P. merkusii* with a mass loss percentage of 15.8% and 16.8% respectively respectively. The average mass loss of *A. mangium* is very low (6.1%) so it could not meet the requirement. This was equivalent with SNI, where *A. mangium* could not meet the mass loss percentage requirement

The average value of mortality ranged from 7% to 32%. The lowest one was *P. merkusii* while the highest one was *A. mangium*. The average mortality percentage of two wood species was less than 10%. They were *P. merkusii* (7%), and *H. brasiliensis* (8%). The same with SNI results, *P. merkusii* had the lowest mortality percentage value.

Table 2 Mean mass loss, mortality, and wood consumption rates determined by JIS

Wood Species	Mass Loss (%)	Mortality (%)	Wood Consumption (µg/termite/day)
Acacia mangium	6.1±1.19	32±6.1	55±8.7
Hevea brasiliensis	15.8±1.29	8±3.8	129±10.0
Paraserianthe falcataria	14.2±2.23	11±3.6	66±6.5
Pinus merkusii	16.8±3.29	7±1.9	95±21.1
Cryptomeria japonica	21.8±2.33	12±4.0	98±10.6

Mean wood consumption per termite per day ranged from 55 µg to 129 µg. The highest one was *H. brasiliensis* (129 µg), while the lowest one was *A. mangium* (55 µg). Like SNI results, mean wood consumption of *P. merkusii* was also quite high (95 µg).

If we compared the results between these two methods (SNI and JIS), the mean mass loss of SNI was higher than JIS. This was because the number of worker termites that were used on the SNI test were 200. While JIS, only 150 workers termites. Furthermore SNI test took a longer period (four weeks) while JIS only three weeks. It also implicated that the mean wood consumption per day of JIS test was higher than SNI.

Conclusions

Based on this research we could conclude that *P. merkusii* was potentially used as a wood control on the durability test of wood and wood products against subterranean termites in Indonesia. This conclusion was taken based on consideration of three criteria. They were *ie mass loss* percentage, mortality percentage and wood consumption. Furthermore, *H. brasiliensis* could become a second choice.

Acknowledgements

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