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Abilities of Brown Planthopper Immigrant Transmits Rice Ragged Stunt Virus on Rice of Some District of Java-Indonesia

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Abstract: The research was carried out in the WS 2009/2010 up to WS 2011/2012 divided to three activities: Monitoring of population of brown planthopper (BPH) and symptom of rice ragged stunt virus (RRSV), the abilities of BPH immigrant macropterous and BPH nymph viruliferous transmits RRSV. The results showed that the BPH and RRSV attack rice plant in Java almost two years respectively due to planted of susceptible rice varieties, resistance rice varieties had broken down, failure of insecticides used, and the suitable of meteorological factors. IR64, Ciherang, and Inpari 1 as vulnerable varieties to RRSV and a good source of viral disease inoculums showed disease incident between 86.7 up to 94.4%. The highest, moderate, and the lowest BPH population was on IR64, Inpari 1 and Ciherang varieties respectively, although RRSV symptom insignificance different to each others. Abilities of BPH immigrant macropterous and nymphs viruliferous transmits RRSV depend on existence of inoculums and origin of BPH. BPH from Klaten and Demak transmit RRSV with the symptom were 90% and BPH from Subang, Pati, Pemalang, Grobogan, Sukohardjo, Sragen, and Solo transmits RRSV with the symptom were 45-70% , and the lowest by BPH from Karawang. In the other hand BPH immigrant viruliferous still produce progeny viruliferous that had been able to transmits RRSV with low symptom.
Keywords: Brown planthopper, ragged stunt virus, transmit, outbreak, rice

INTRODUCTION

The brown planthopper (BPH), *Nilaparvata lugens* Stal. is one of the most serious rice pests, causing extensive damage by using a special mouth for piercing and sucking the phloem sap and transmitting viruses as rice ragged stunt virus (RRSV) and rice grassy stunt virus (RGSV). Types and severity of disease symptoms varied among plants mix-infected with RGSV and RRSV [1], one plants showed only yellowing, bronzing, and stunting but no profuse tillering, while other plants showed profuse tillering typical of grassy stunt. The rice damage by virus sometimes greater than the attack of vector it self [2]. In Southern Vietnam from 2005 to 2006, more than 485,000 ha of rice production area were severely affected by viral diseases seemingly spread by BPH, resulting in the loss of 828,000 tons of rice valued at US$120 million [3].

The symptom pathology of RRSV does not differ markedly from healthy-plant one in color, but they are stunted to various degrees at all growth stage. The difference in number of tillers between disease and healthy-plant. The rice planting time of the North coastal of West Java formerly unsynchronize, although the rice harvested in the dry season 2009, was still normal and the rice production reached 8-10 t/ha. In the wet season 2009/2010 the rice production was decreased to 5-6 t/ha and in some places are not harvested due to the BPH hopperburn. In the DS 2010 the rice plantation in these areas was attacked by BPH with high population. Abundance and BPH outbreak in 2010 due to by 10 factors those are climate change and rhythm of BPH outbreak cycle for 12 years, unsynchronized planting pattern (farmers overtook rice planted to each other), stagger of susceptible rice varieties of both hybrid and inbred, bad of cultural practices especially luxury fertilizer and water flooded all stage, BPH biotype change and weakness of resistance rice varieties, highly intrinsic rate of natural increase of BPH, farmers forgotten to integrated pest management (IPM) and low appreciate to extension worker, increase of BPH resistance to insecticides, used insecticides in dose or concentrate weakness, and no safety to blanket hot spot area.

The objective of this research to monitoring BPH development and RRSV symptom in rice field. In the others objective to investigated the abilities insect vector BPH immigrant and it progeny transmits RRSV to the rice plant.

MATERIALS AND METHODS

The research was carried out in the Indonesian Center for Rice Research (ICRR) in the wet season (WS) and dry season (DS). The WS is from October to March (Ocmar) and the dry season (DS) is from April to September (Asep). The research with three activities namely monitoring BPH and RRSV symptom, ability of BPH nymph viruliferous transmits RRSV, and ability of BPH immigrant- viruliferous transmits RRSV. The detail research activities as follow:

Monitoring BPH and RRSV Symptom

Monitoring BPH and RRSV symptom was carried out at West Java, Central Java, and East Java provinces in the WS 2009/2010, DS 2010, WS 2010/2011, DS 2011 and WS 2011/2012. Especially in West Java monitoring was carried out at research station Sukamandi and around of it station (Seed Center Sang Hyang Seri (Ciasem village), Bueur village, Rancabango village, and Patokbesi village in the DS 2010. Sukamandi is the location of Indonesian Center for Rice Research (ICRR). This ICRR have rice area of 400 ha, while some of the surrounding villages within 5-10 km from the ICRR bureau. Monitoring was done every 5-7 days interval to the rice plant of Ciherang, IR64, and Inpari 1 varieties. In the one-time of observation get 10 hills samples of each variety and record abundance of BPH and incident of RRSV.

Ability of BPH nymph viruliferous from the rice field transmits RRSV

Ability of BPH nymph viruliferous to transmit RRSV was carried out in the DS 2010 for BPH from West Java around the ICCR bureau. The research use randomized block design with 5 treatments of BPH location (origin) and 10 replications. The 5 origin of BPH nymphs viruliferous from ICCR, Bueur village, Rancabango village, Seed center (Ciasem village), and Sengon rice area. Collect BPH nymphs instars 3-4 from field by sweeping net and aspirator, especially from the BPH outbreak area and attacked by RRSV. BPH nymph from each location moved into plastic vial of 2 l in volume covered the top vial with gauze and at left-right vial there are windows of gauze. All of BPH in vials were brought to the laboratory of ICCR.

Every one BPH nymph infested to test tube with one healthy-seedling Pelita I/1 variety of 20 days old and then every test tube covering by gauze. After 24 hours, the BPH nymph removed and then the seedlings planted in the mud in plastic box of 38 x 26 x 12.5 cm in size. Observed the symptom of RRSV at 10, 15, 20, 30 days after infestation. All data were analyzed by analysis of variance (ANOVA) and differences in the value was tested by Duncan's Multiple Range Test = DMRT) in 5% least significant difference (LSD) level.

Ability of progeny nymph from BPH immigrant viruliferous transmits RRSV

The firs activity, collect BPH immigrant macropterous (long-wing) from Subang that caught in the light trap and reared in the Pelita I/1 healthy-seedling. About 20 progeny nymphs of similar age were infested to 20 test tubes (1nymph/tube) with one healthy-seedling of Pelita I/1 variety of 20 days old and then every test tube covering by gauze. After 24 hours, the BPH nymph removed and then the rice seedling planted in the mud in plastic box of 38 x 26 x 12.5 cm in size. Observed the symptom of RRSV at 10, 15, 20, 30 days after infestation.

Ability of BPH Immigrant Viruliferous transmits RRSV.

Ability of BPH immigrant viruliferous transmit RRSV was carried out in the WS 2010/2011 usage randomized block design with 11 treatments location (origin) of BPH and 20 replications. The 11 origin of BPH immigrant from West Java (Subang and Karawang districts), Central Java (Demak, Pati, Pemalang, Klaten, Grobogan, Sukohardjo, Sreagen, Solo districts) and East Java (Banyuwangi district) (Fig 1).

Collect BPH immigrant macropterous by sweeping net from the outbreak area of rice hopperburn and attacked by RRSV, except BPH from Subang-West Java that caught in the light trap and BPH from Solo-Central Java from lamp light near the Arini hotel-Solo. BPH from each location moved in to plastic vial of 2 l volume, covered the top vials with gauze and at left-right there are windows of gauze. All of BPH vials bring to the laboratory of ICCR.

Every one BPH immigrant macropterous female infested to test tube with one healthy-seedling of Pelita I/1 variety of 20 days old and than every test tube covering by gauze. After 24 hours, the BPH removed and then the seedling planted in the mud in plastic box of 38 x 26 x 12.5 cm in size. Observed the symptom of ragged stunt virus and nymphs of BPH progeny at 10, 15, 20, 25, 30, and 35 days after infestation. All data were analyzed by analysis of variance (ANOVA) and differences in the value being tested by Duncan's Multiple Range Test = DMRT) in 5% least significant difference (LSD) level.

Distribution Of BPH outbreak and RRSV infected-rice plant in Java Island

1. Sukamandi/ICRR	7.Sukohardjo
2. Subang	8. Sragen
3. Karawang	9. Grobogan
4. Pemalang	10. Demak
5. Klaten	11. Pati
6. Solo	12. Banyuwangi

Fig-1: Samples of BPH immigrant from three provinces in Java. DS 2010 (April-September =Asep)

RESULTS AND DISCUSSIONS

Monitoring BPH and Symptom RRSV

Starting from the WS 2009/2010, rice crops in Indonesia attacked by BPH, especially in rice production centers in Java. The rice damage not only by BPH but also by RRSV cause a decrease in rice production. In 2010 the BPH in Indonesia attack rice crops covering area of 137,768 ha and among of 4,602 ha were hopperburn and rice damaged by RRSV was 6,074 ha. In 2011, BPH attacks increased to 218,060 ha and among of 34,932 ha were hopperburn.

The situation Asep rice cropping DS 2010 in West Java, particularly in Sukamandi- Research Station of ICRR and 5 surrounding areas experiencing have two times of planting and replanting in the one season without harvested. This is due to explosion of BPH and RRSV in the early season on rice 1.5 month aged after transplanting and the performance of rice was very bad almost more than 1500 ha show RRSV symptom.

The highest BPH population was on IR64, moderate and the lowest were on Inpari 1 and Ciherang respectively (Fig 2), this data show that IR64 had broken down rice resistant and was susceptible to BPH. The BPH control by some insecticides unsuccessful, because they did not reduced the growth rate of BPH or may be some insecticides urge to resurgence and the others were resistant to BPH.

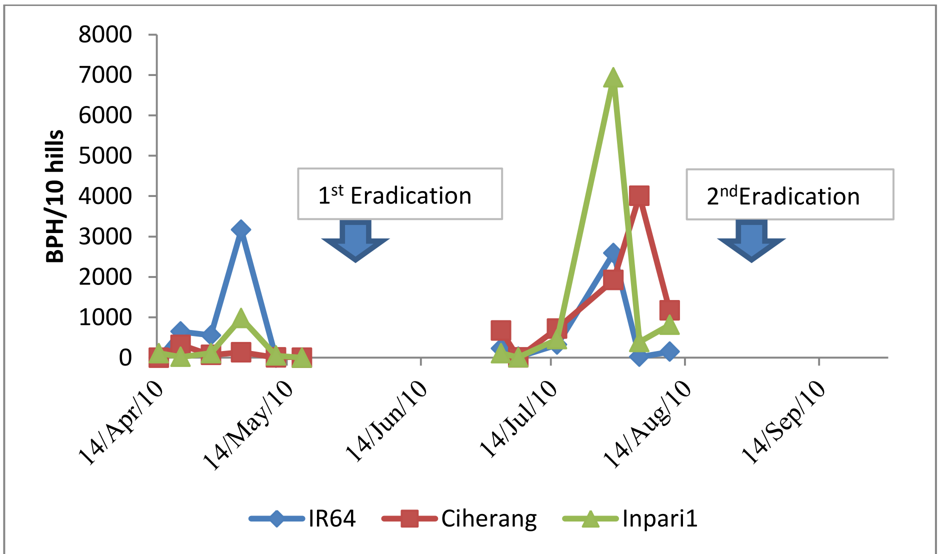


Fig-2: Chronologies of Asep (April-September) rice cropping destroyed by BPH in the DS 2010

In all observation time the incident of RRSV in IR64 always the highest compared to RRSV on Ciherang and Inpari 1. Existence of RRSV on Inpari 1 is the lowest, but in the last observation (16 May 2010) existence RRSV on Inpari 1 reach 86.7%, while in the IR64 and Ciherang were 94.4 and 80.9% respectively (Fig. 3). IR64, Ciherang, and Inpari 1 as vulnerable varieties to RRSV and a good source of viral disease inoculums showed disease incident. BPH development reached the peak population on the 4 May 2010, after that the abundance of BPH slow down up to low population in the 16 May 2010, but the viewed rice crops had damaged and then on May 21, the government and almost all farmers make decisions for eradication by plowed back, begin to make seed bed and replanting in the second-third week on June DS 2010. In the other hand any farmers in the early DS2010 did not plowed back because did not believed that the rice crops was attacked RRSV because the rice leaves is still green.

In the early of replanting after first eradication in July 2010, the BPH population still low, but continuous increasing and reach peak population, especially on Inpari 1 about 7000 BPH/10 hills in the 30 July 2010 (Fig 2). This situation almost same with India, that incidence of BPH in the beginning was very low and as soon as the rain stopped in last week of September then the population increased with the vegetative stage of crop and reached highest in third week of October [4].

In the other hand the RRSV on the 2 July 2010 increasingly and reach the upper symptom in the 9 August 2010 (Fig. 3). At this time the age of rice was 40 DAT and the rice performance is very bad almost all of the rice hills of more than 1000 ha have RRSV symptom. The RRSV symptom on IR64, Ciherang, Inpari 1 varieties do not significance difference, while trend of BPH population increasing different one to another. Two decision making after lookout the rice damage by BPH and RRSV was done second eradication or rice plants damage were left in a state of fallow until the next planting season WS 2010/2011.

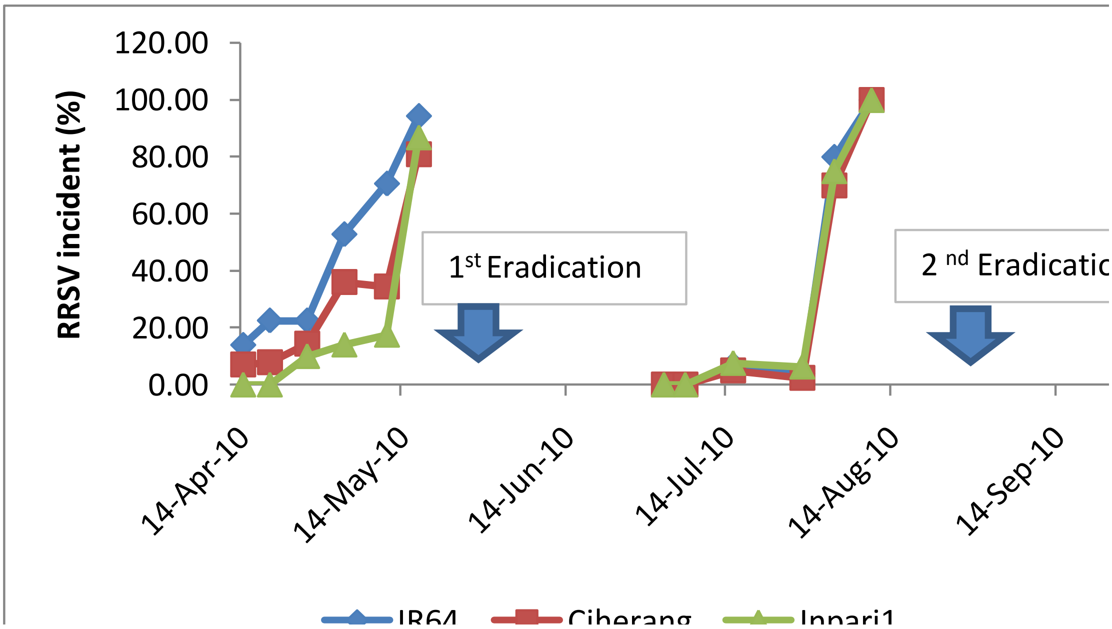


Fig-3: Chronologies of ASEP rice cropping destroyed by RRSV in the DS 2010

Likewise RRSV incident in rice plantation around Sukamandi research station showed a high attack of pest and disease. At the beginning of the observation incident has reached 40-60% and continues to increase with age of the rice plant. Incident RRSV in the area Seed Center, Bueur, and Patokbeusi reached 100% since 8 April 2010. On the other hand RRSV incident in the area of rice field in Rancabango less than 80% until the end of the observation (Fig. 4).

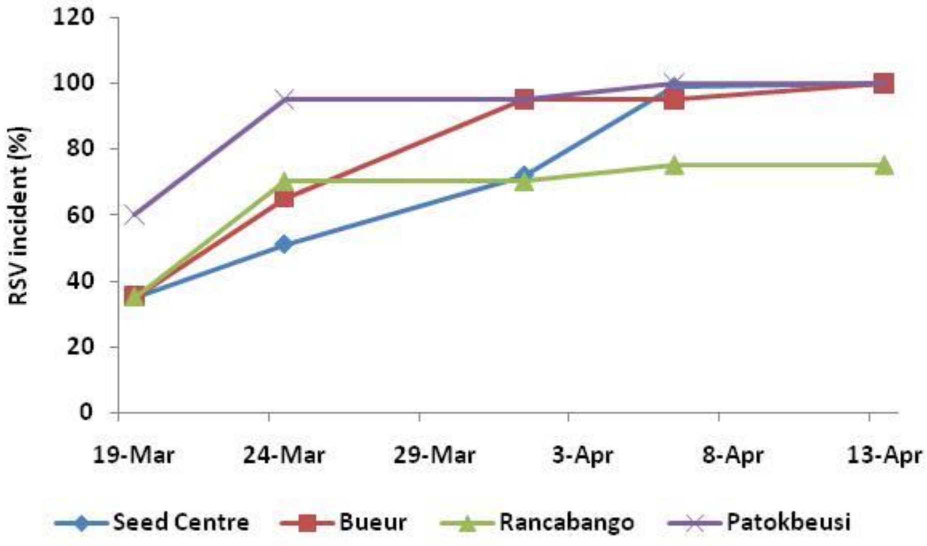


Fig-4: Situation of ragged stunt virus transmitted by BPH in the field around ICRR West Java on DS 2010

BPH outbreak and RRSV in the wet season was urged by La Nina situation of 2010 and the effect of La Nina still felt up to May 2011, because BPH still destroyer in some rice area (Baehaki *et al*., 2013). The both BPH and RRSV outbreak occurred in Banten and West Java provinces on WS 2009/2010 and DS 2010. In Central Java province in WS 2009/2010, DS 2010, and WS 2010/2011. In East Java occurred in WS2009/2010, DS2010, WS 2010/2011 and DS 2011. The distribution of RRSV was s different among province, in West Java was dominated by RRSV, in Central Java symptom of RRSV and RGSV in balance, and in East Java was dominated by RGSV.

Incident of RRSV in the WS 2009/2010 quite low at just 15, 25 and 20% for West, Central, and East Java respectively. In the DS 2010 incident RRSV very high in three provinces with a severity from low to outbreak. In the WS 2010/2011 RRSV incident in West Java decreased to 20%, but incident for Central Java and East Java are still high. On the DS 2011 incident RRSV in West Java decreased to 0% incident, in Central Java only 50%, while in East Java is still high. In the WS 2011/2012 the symptoms of RRSV in all provinces almost zero (Fig. 5). The data shows that RRSV survive almost 2 years since WS 2009/2010 until DS2011.

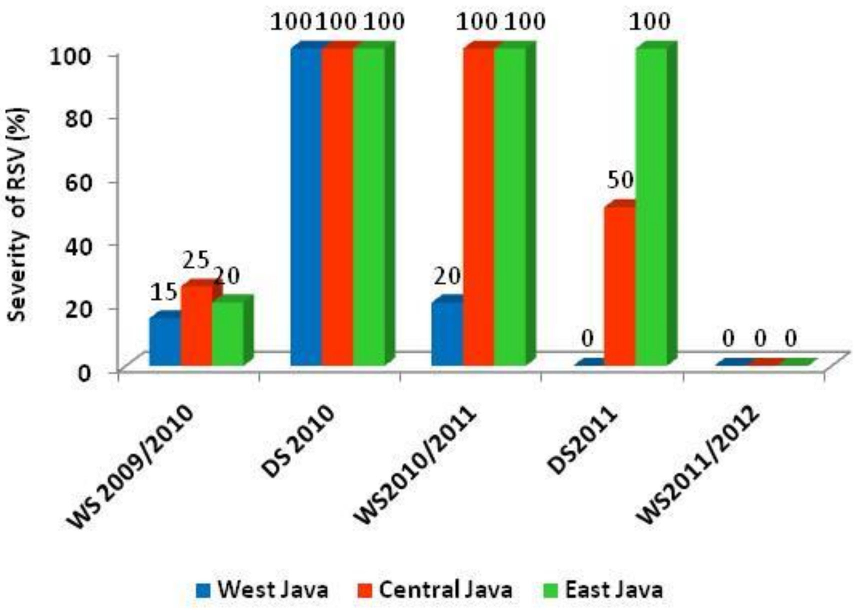


Fig-5: Incident RSV in three province of Jawa

In southern Vietnam between 2005 to 2006, more than 485,000 ha of rice production area were severely affected by viral diseases seemingly spread by BPH, resulting in the loss of 828,000 tons of rice valued at US$120 million [3]. During the surveys in 28 provinces of southern Vietnam in 2007, the proportion of RGSV-carrying BPH was higher than 50% in 8 provinces, and the proportion of BPH carrying both RGSV and RRSV was higher than 30% in 9 provinces [1]. The RGSV and RRSV widely observed in southern Vietnam has been called "yellowing syndrome" from the characteristic symptom of leaf yellowing. Rice yellowing syndrome was later found highly associated with infection with RGSV or co-infection of RGSV with RRSV, both transmitted by BPH, although the symptoms vary depending on varieties ,virus species, timing and sequence of infection [3].

The long duration of RRSV attack due to susceptibility and break down resistance rice varieties, decreased sensitivity of BPH to insecticides, and supported by suitable weather factors. Control of viral vector BPH unsuccessful, because the common rice varieties IR64 and Ciherang already susceptible and insecticide used is less effective and some was resistance to BPH. Baehaki *et al*., (2016) [5] reported that BPH in Subang, West Java province were moderately resistance to imidacloprid and cypermethrin, and then was low resistance to buprofezin, but were decreased susceptibility to fipronil, thiamethoxam and cyhalothrin. Furthermore Baehaki *et al*., (2016) [6] reported that LD_{50} of imidacloprid to BPH of East Java was 96.608-216.000 ng/g body weight and response BPH from East Java were tend to decreased susceptibility to imidacloprid.

BPH in China susceptible to dinotefuran, but was resistance to imidakloprid [7] and Matsumura *et al* [8] reported that BPH was resistance against imidacloprid occurred only in East Asia and Indochina but not in the Philippines. Higher insecticide usage in (*high yielding varieties* = HYVs) appeared to be responsible for persistence of BPH menace partially due to destruction of natural enemies and more importantly through development of insecticide resistance and resurgence [9].

The fluctuation of BPH were correlated with temperature and showed higher correlation with rainfall patterns during the first cropping season. Second cropping season coincide with dry season, there was no rainfall and hopper population was observed to be correlated to temperature and relative humidity. Thus temperature, rainfall, and relative humidity were observed to influence plant hopper population during the two different rice growing seasons [10]. In the other hand Baehaki *et al.* [11] reported BPH flight that caught in the light trap of CFL bulbs insignificance effect by temperature, rainfall, and relative humidity, but the flight of leaf folder had significant positive influenced by air temperature and soil temperature at 0 cm, while had significant negative influenced by relative humidity and rainfall.

The decline RRSV incident in the WS 2010/2011 rice crop of West Java due to simultaneously eradication, then held simultaneously rice planting. Likewise incident of RRSV in Central Java with a decreased BPH and RRSV due to simultaneously rice planting in triangle rice production area (Klaten-Boyolali-Sukoharjo). Simultaneously rice planting in Pemalang was success, while rice planting in Lamongan-East Java is still unsimultaneously that resulted RRSV incident can not be suppressed in that period.

Ability of BPH Nymph Viruliferous Transmits RRSV

The BPH nymphs of ICCR transmits RRSV on Pelita 1/I with symptoms began at 10 days after inoculation (dai) with the incident was 0.83%. BPH nymph of Seed Center transmits virus with RRSV-symptoms at 15 dai, and BPH nymphs of Rancabango and Bueur with the RRSV-symptoms at 20 dai. BPH nymphs of Rancabango, Bueur, and Sengon transmit RRSV with symptoms were 100% at 30 dai. BPH nymphs of ICCR and Bueur transmit virus with RRSV-symptom reached 94.17 and 98.75% respectively, but insignificantly different from the 3 origin of hopper was mentioned above (Table 1).

Table-1: Ability of BPH nymph viruliferous transmits RRSV. West Java, DS 2010

Lokasi (village)	Symptom Ragged stunt virus (%)*			
	10 dai	15 dai	20 dai	30 dai
ICCR	0.83 a	19.33 a	93.33 a	94.17 a
Bueur	0 a	0 a	82.50 a	98.75 a
Rancabango	0 a	0 a	60.00 b	100.00 a
Seed center	0 a	3.75 b	90.00 a	100.00 a
Sengon	0 a	0 a	86.25 a	100.00 a

*Value in a column followed by the same letter are not significantly different by DMRT at 5% level

The data shows that the BPH nymphs from the outbreak area of BPH and RRSV are viruliferous-nymph can transmits RRSV from infected plants to healthy rice plants. The symptom RRSV is begun at 10 dai and the peak symptom at 30 dai. In the DS 2010 all of BPH nymph from all location be able transmits RRSV almost 100% incident.

In the other activity, show that the progeny BPH immigrant from Subang that caught in the light trap be able transmits RRSV to healthy-seedling. The symptom in infested-seedling appears after 20 dai was 2% and at 25 dai was 4%. Symptom at 30 and 35 dai stagnant in 10%. In here shown that the BPH immigrant viruliferous is still produce progeny and that progeny of BPH immigrant viruliferous RRSV be able to transmits RRSV with low symptom (Fig 6).

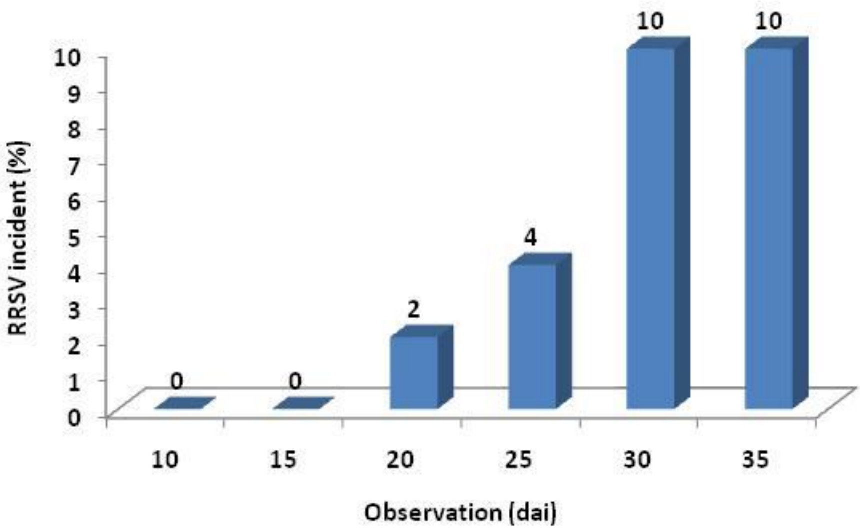


Fig-6: Nymph progeny of BPH immigrant transmits the RRSV

Ability of BPH Immigrant Viruliferous Transmits RRSV

The BPH immigrant from Subang in the early wet season that caught in the light trap had been able to transmits RRSV to healthy-seedling. The symptom at 10 dai lest than 15% and then slowly increase up to 30 dai. The peak symptom can be seen at 35 dai reach 70%. The BPH immigrant from Karawang rice field do not transmits RRSV, because in Karawang almost out of inoculums of RRSV. The BPH immigrant from Central Java (Demak, Pati, Pemalang, Grobogan, Sukohardjo, and Sragen districts) which collected from the rice hopperburn and BPH-Solo collected from night lamp had been able to transmits RRSV begun 10 dai and the peak symptom at 35 dai. BPH from Klaten and Demak immigrant transmits RRSV with incident symptom were 95 and 90% respectively. BPH immigrant from Pati, Pemalang, Grobogan, Sukohardjo, Sragen, Solo were lower symptom between 40-65%. BPH immigrant from Banyuwangi transmits RRSV begun less than 25 dai and the peak symptom only 20% at 35 dai (Table 2). Both forms of BPH transmits RRSV was found to be 49% for the macropterous and 34% for brachypterous form [12], but in IRRI, reported 0-100% and l6-100% for macropterous and brachypterous forms respectively [13].

Table-2: Ability of BPH immigrant viruliferous transmits RRSV . WS 2010/2011

Lokasi	Symptom Ragged stunt virus (%)*					
	10	15	20	25	30	35
Subang	15 bcd	15cd	20bc	30 cd	40 bc	70 abc
Karawang	0 d	0 e	0d	0 e	0 d	0 e
Pemalang	30 abc	40 bcd	45bc	55 bc	55 b	55 c
Klaten	0 d	90 a	95a	95 a	95 a	95 a
Solo	40 ab	45 bc	55b	60 b	60 b	60 c
Sukoharjo	25 abcd	30 cd	40bc	45 bc	45 b	55 c
Sragen	35 abc	35 bcd	35bc	45 bc	45 b	45 cd
Grobogan	45 a	45 bc	50b	55 bc	55 b	55 c
Demak	50 a	85 a	85a	90 a	90 a	90 ab
Pati	10 cd	60 a	60b	60 b	60 b	65 bc
Banyuwangi	0 d	0 e	0d	10 e	15 cd	20 de

*Value in a column followed by the same letter are not significantly different by DMRT at 5% level

BPH immigrant from all location had produced BPH nymphs as well were caught in the lamp light or BPH immigrant from rice field. The progeny of BPH Pemalang was the highest compare to the BPH progeny from the other district (Fig. 7). The progeny of BPH Solo was the lowest compare the BPH progeny from the other district. The lowest number of BPH progeny did not caused BPH from lamp light, because progeny BPH from Subang was high, although caught in the light trap. Hereby, show that progeny number determined by location of BPH origin and source of inoculums.

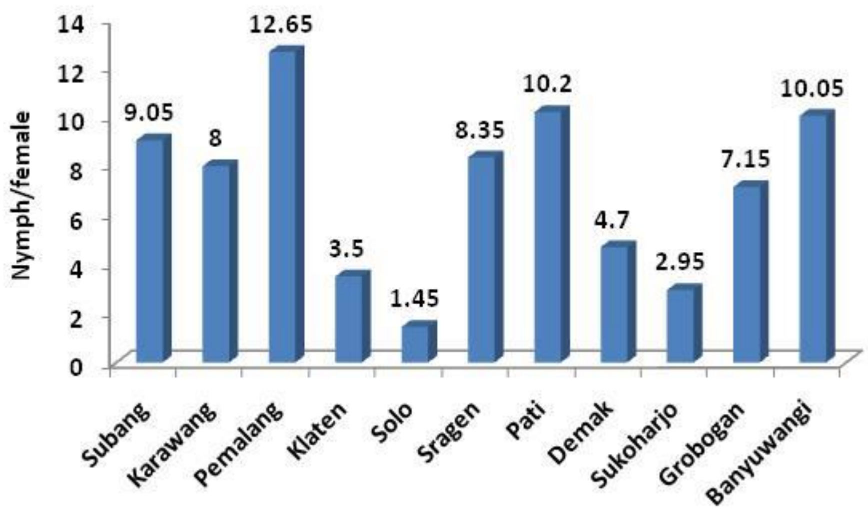


Fig-7: Progenies of BPH immigrant after transfer RSV. WS 2010/2011

RRSV is a member of the Oryzavirus group of the family Reoviridae [1] transmitted by BPH in a persistent propagative manner. In this study, sequential infection of RRSV in the internal organs of its insect vector after ingestion of virus was investigated by immunofluorescence microscopy. RRSV was first detected in the epithelial cells of the midgut, from where it proceeded to the visceral muscles surrounding the midgut, then throughout the visceral muscles of the midgut and hindgut, and finally into the salivary glands[14]. Persistent propagative plant virus that is transmitted by an insect vector following ingestion during feeding on diseased plants, RRSV must enter the epithelial cells of the alimentary canal in its insect vector, replicate and assemble progeny virions to move into the salivary glands from which RRSV can be introduced into a plant host during feeding [15]. The BPH transmits both RGSV RRSV in a persistent manner without transovarial passage. In South Vietnam, the two viruses infect the rice plant together and cause the rice yellowing syndrome [1].

RRSV-infected plants show stunting, abnormal leaves with serrated edges and/or twisted tips, and vein swelling or galls on the underside of the leaf blades and outer surface of the leaf sheaths. The other symptom of rice plants infected with RRSV show stunting, dark-colored leaves with serrated edges or twisted tips, and vein swelling or galls on the underside of leaf blades and outer surface of the leaf sheaths [3]. The predominant symptom is ragged, tattered, torn, or serrated leaves [17]. The ragged edge generally appears on one side of the leaf blade before it unrolls. The virus does not transmitted by pinprick method, and can not transmitted through out soil, and there is also no evidence of the transmission of RRSV through rice seed.

The gall results from hyperplasia and hypertrophy of the phloem tissue. Plants infected with RRSV at the seedling stage develop new leaves with distinct symptoms such as twisting and serration 2 weeks after inoculation and thereafter develop leaves showing milder or no definite symptoms. At the flowering stage, the upper leaves and flag leaves may show twisting symptoms. Panicles of infected plants are fully exserted. Electron microscopic observation of diseased tissue revealed that RRSV is localized in the phloem and gall tissues. Inclusion bodies consisting of a viroplasmic matrix and numerous virus particles were observed in infected cells [17]. Rice plants co-infected with both viruses displayed enhanced stunting, earlier symptoms, and higher virus titers compared with singly infected plants. Furthermore, white-backed and brown planthoppers acquired SRBSDV and RRSV, respectively, from co-infected plants at higher rates [18, 19]. In Chinese fields increased RRSV incidence is partly due to synergism between SRBSDV and RRSV [18]. At the vegetative stage, RRSV attacks causing rice leaves become ragged, torn, tattered, or serrated, sometimes white, stunting the plant height reduction of between 24-67%, out panicles slowed to 10 days. Exit panicles abnormally (not full out), and distortion at the flag leaf. When ripening, the grain is not filled and emptied [20]. The new symptoms of RRSV in Java besides those mentioned above, there are still encountered symptoms in the other forms, as shown in Fig. 8.

RRSV disease control in the area of explosive disease with insecticides is only successful when done at the time planthopper population is very low. If done during the economic threshold based on the natural enemies or when there are no symptoms RRSV, the control will not be successful. From Thailand reported that the brown planthopper, RGSV, and RRSV diseases cause yield losses up to 60% [21]. In Bann District Nerngroi and Cai-Ngarm Vietnam, brown planthopper populations at low tillering stage, but the two viral infection reaches 70-80% [22].

In the WS 2011 occurrence of RRSV symptom in East Java lower than Central Java, because in East Java is dominated by RGSV, whereas in Central Java is dominated by RRSV. In the same time in West Java was low BPH population and almost nothing inoculums of RRSV, because was implemented control for handle BPH with the "Model Action of Plan Continuous" (MAPC) (Model Rencana Tindak Lanjut = MRTL). This Model was released by ICRR to Indonesian government at DS 2010 and success in West Java and Central Java to suppress BPH and RRSV in the WS 2010/2011 and DS 2012.

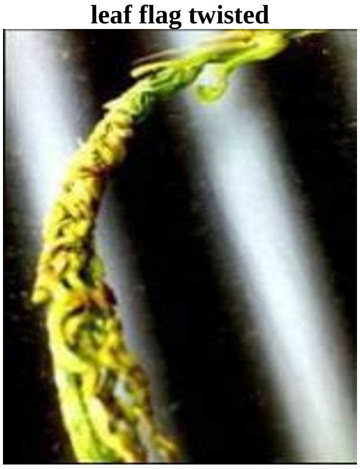
Laef tip twisted, serrated leaf

Young leaves ragged, jagged, pale color, leaf oval form

Tillers and panicles oppressed, leaf flag twisted

The leaf flag Narrows and roll up, panicle dead and draped sheath

Branched stems, young leaves narrow and die



The panicle roll up, changes grain form and unfill

Panicle hands clenching form and leaf flag as a finger pointing, twisted at the basal leaf flag

On the surface stem a lot of gall white rod

Stem at the panicle node branched, panicles deformed perfect and die, twisted at the basal leaf flag, leaf narrow

Fig-8: Some RRSV symptom on Rice in Java. DS2010-WS2010/2011

CONCLUSIONS

Rice plant in West Java, Central Java and East Java was attacked by BPH and RRSV within a period of two years starting from WS 2009/2010 until the DS-2011. In that period, outbreak of both BPH and RRSV had destroyed the vegetative rice stage had resulted to fail harvest. Especially in the DS 2010, as the dramatics Asep (April-September) rice cropping that was destroyed by BPH and RRSV along two times rice planted in one season without harvested.

BPH and RRSV outbreak was supported by susceptible rice varieties and resistance rice varieties had broken down, failure of insecticides used, and suitable of the meteorological factors. IR64, Ciherang, and Inpari 1 varieties vulnerable to RRSV and those varieties a good source of viral disease inoculums with showed disease incident between 86.7 up to 94.4%. The highest BPH population was on IR64, the moderate was on Inpari 1 and the lowest was on Ciherang varieties, although RRSV symptom to those varieties insignificance different to each others.

The BPH immigrant macropterous viruliferous and BPH nymph viruliferous from the outbreak location of both BPH and RRSV and the BPH immigrant macropterous that caught in the light trap had been able to transmit RRSV. BPH immigrant from Klaten and Demak were highest RRSV symptom up to 90% incident, BPH immigrant from Subang, Pati, Pemalang, Grobogan, Sukohardjo, Sragen, and Solo were lower symptom between 45-70% symptom, and BPH from Karawang was the lowest RRSV symptom. In the other hand BPH immigrant viruliferous still produce progeny viruliferous that has been able to transmit RRSV with low symptom.

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