Discussion

For commercial papaya production, efforts to identify only hermaphrodite of different papaya cultivars in a seedling stage is extremely important prior to its transplantation to the orchard. Generally, the papaya sexes cannot be examined either by seed shape or morphology at the juvenile developmental stage, but especially identified only after 4–6 months when the plant attains to reproductive maturity (Ma et al., 2004). Therefore the aim of this research was to develop specific-molecular markers for sex determination in different papaya cultivars, grown in Thailand.

In this study, the SCAR-W11 primers were very useful for detecting male and hermaphrodite of five studied papaya cultivars (Holland, Khaek-Dam, Koko, Khak-Nuan, and Si-Sa-Ket), by giving the precise PCR product approximately 830bp length in male and hermaphrodite but not in female. This result agreed with previous findings that the SCAR-W11 has been used to determine sex among different cultivars of papaya (Carica papaya L.) such as Sunrise and Kapoho (Deputy et al., 2002) including Arka Prabhat, Dwarf Lilly, Nigeria Shilong, and Surya (Chaturvedi et al., 2014). The reason may be that the range of DNA sequences within this primer pair, located on nearly centromere of the chromosome Y (Ming et al., 2007), shared some identical sequences between male and hermaphrodite, but not in female. This was supported by the result from alignment of AY428938.1-hermaphrodite sequence (831bp) and AY428939.1-mae sequence in male (834bp) using CLUSTAL2 program.
that had base substitution in a few sites along these sequences. This might cause a point mutation during the evolution of sex determination in papaya (Yu et al., 2007).

Moreover, the new primer pair (PH2-F and PH1-R) was successfully useful to determine only in hermaphrodite of all validated cultivars of papayas (Holland, Khaek-Dam, Koko, Khak-Nuan, and Si-Sa-Ket) grown in Thailand, generating the PCR product (approximately 101bp length). This developed molecular marker might be tightly linked to Sex1 gene, determining papaya sex (Souder et al., 1996). Because the primers are located within region between SCAR-W11-F and SCAR-W11-R marker, it has genetic distance within 0.3cM from Sex1 and no crossovers between SCAR-W11 and Sex1 as previously reported by Chaturvedi et al (2014).

Conclusion

In the present study, the results clearly illustrated that two primer pairs (SCAR-W11, and PH2-F-PH1-R) can be potentially and accurately used to identify papaya-sex specificity at seedling stage. The primer pair of SCAR-W11-F and SCAR-W11-R was able to identify male and hermaphrodite seedlings, by generation male- and hermaphrodite-specific PCR product approximately 830bp length, but not in females. The primer pair of PH2-F and PH1-R was able to identify hermaphrodite seedlings, by generation hermaphrodite-specific PCR product approximately 101bp length, but not in a male and females.