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Proceedings of การประชุมวิชาการ

The 4th National Meeting on Biodiversity Management in Thailand

การบริหารจัดการความหลากหลายทางชีวภาพแห่งชาติ

Science and Emerging Technology for Biodiversity Management

21-23 มิถุนายน 2560
โรงแรมกาลัย จ.อุดรธานี



Occurrence of coral diseases in shallow water reefs at Tan Island, Suratthani Province

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Abstract: A comparative study on occurrence of coral diseases in shallow water reef communities at Tan Island, Suratthani Province was conducted during the wet season (September 2016) and dry season (March 2017) using a Belt-Transect method. Results showed that a total of four coral diseases were found, comprising White Syndrome (WS), *Porites* White Patch Syndrome (PWPS), Ulcerative White Spot (UWS) and Pink Line Syndrome (PLS). WS and PLS were found during the wet season. WS, PWPS and UWS were found during dry season. Average disease prevalence at Tan Island was $19.29 \pm 2.31\%$. Disease prevalence during the wet season ($22.73 \pm 1.99\%$) was higher than that in dry season ($16.01 \pm 3.45\%$). WS was the dominant disease found during the wet season ($21.33 \pm 1.15\%$) while PWPS was dominant in the dry season ($9.55 \pm 3.17\%$). Furthermore, the dominant coral (*Porites lutea*) was the only species infected in this area. The results of this study offer a baseline on coral diseases in shallow water reefs which can be used for further monitoring of coral disease outbreaks in Thai waters.

Keywords: coral disease, prevalence, coral community

Introduction

Coral reef ecosystems around the world are being rapidly degraded due to numerous anthropogenic stresses and natural factors (Thinesh *et al.* 2009). Increased human activities on coral reefs have been implicated as contributing to increased levels of disease (Barber *et al.* 2001). Coral disease is a growing problem in coral reefs worldwide. The number of diseases has all increased within the last decade (Porter *et al.*, 2001; Green and Bruckner, 2000; Sutherland *et al.*, 2004; Weil, 2004). There is a lot of information being reported from widely studied regions however, little is known about coral disease in Thailand. In 2008, the first study of coral disease in the Andaman Sea was published, which found three categories of coral diseases; White Syndrome, Pink Line Syndrome and Black Band Diseases (Kenkel 2008). Putchim *et al.* (2012) found five categories of coral disease in *Porites lutea*, i.e., White Syndrome, Ulcerative White Spot, Focal Bleaching, Non-Focal Bleaching and Pink Spot. The previous report was found Pink syndrome and White Band disease at Koh Lan (Sutthacheep *et al.* 2009) In the same way, Donsomjit and Yeemin (2010) study patterns of pink syndrome in *Porites lutea* at Koh Lan found that four types of pink syndrome consist of Pink spot Pink circle Pink patch and Pink tumor. Kritsanapuntu and Angkhananukroh (2014) surveyed coral disease at Koh Samui found six categories of coral disease, White Plague, Pink Line Syndrome, *Porites* White Syndrome, *Porites* Trematodiasis, White Syndrome and Pacific Yellow Band Disease. Seasons were one factor that influenced pathogen, others being environmental changes such as temperature, rainfall, light, turbidity and nutrients (Delcroix and Henin, 1991; Lima *et al.*, 1996; Poulos *et al.*, 1997). Outbreak of coral diseases and disease prevalence were seasonal change and disease prevalence was high in dry season (Rosenberg *et al.*, 2007). In addition, the disease prevalence is correlated with the temperature and the outbreak of coral disease during seasons (Raymundo *et al.*, 2008). Therefore, the primary purpose of this study was to investigate seasonal variation as a factor influencing disease prevalence. It was hypothesized that the higher water temperatures of dry would cause a significantly greater incidence of disease than during wet season. The aim of this study was to offer baseline data on the occurrence of coral diseases in shallow water reefs at Tan Island, Suratthani Province, to be used for further monitoring programs of coral disease outbreaks in Thai waters.

Materials and Methods

Field surveys were conducted during the wet season (September 2016) and dry season (March 2017) at Tan Island (Figure 1). SCUBA diving was used to survey disease prevalence between seasons. Surveys on the reef flat were conducted along $2 \times 20 \text{ m}^2$ belt transects with three replicates (following English *et al.* 1997). All coral colonies with signs of disease were counted, described, photographed and identified based on diseases using Beeden *et al.* (2008), Weil and Hooten (2008) and Bruckner (2009). The disease prevalence was calculated as follows: Disease prevalence= $\frac{\text{number of diseased colonies}}{\text{total number of colonies}} \times 100$

Two ways analysis of variance (ANOVA) tests were used to compare the differences in prevalence of coral disease between the two seasons (dry and wet season) and disease type.

Result & Discussion

Surveys of the coral reefs during in two seasons presented 14 coral genera with *Porites lutea* being the dominant species in the study area and the other coral were found *Goniopora* sp. *Fungia* sp. *Favia* spp. *Acropora* spp. *Astreopora* sp. *Diploastrea* sp. *Favites* sp. *Galaxea* sp. *Goniastrea* sp. *Pavona* sp. *Platygyra* sp. *Pocillopora* sp. and *Sympyllia* sp. The coral *P. lutea* was the only coral infected with disease in this area. The overall disease prevalence at Tan Island included a total of 4 coral diseases, consisting of White Syndrome (WS), *Porites* White Patch Syndrome (PWPS), Ulcerative White Spot (UWS) and Pink Line Syndrome (PLS) (Figure 2). Average overall disease prevalence at Tan Island was $19.29 \pm 2.31\%$ (mean \pm SE). The prevalent diseases, WS and PLS were found during the wet season. WS, PWPS and UWS were found during the dry season. While disease prevalence during the wet season ($22.73 \pm 1.99\%$) was higher than in the dry season ($16.01 \pm 3.45\%$) although the differences were not significant. However, significant differences in disease prevalence were detected interaction between seasons and disease type ($p < 0.05$). The dominant disease was observed during in wet season was WS ($21.33 \pm 1.15\%$) while PWPS was dominant in the dry season ($9.55 \pm 3.17\%$). Furthermore, *P. lutea* was the only species infected of coral diseases and exhibited signs of WS, UWS, PLS and PWPS (Figure 3).

The disease prevalence was higher in the wet season than the dry season. This high disease prevalence in wet season may be attributed to the fact that the coral reef at Tan Island is under stress from human activities such as SCUBA divers, boat anchoring includes waste runoff, pollution, coastal development, (Green and Bruckner, 2000; Lamb *et al.*, 2014). The overall disease prevalence at the island may be high due to these factors. (Bourne *et al.*, 2015). Sedimentation and nutrient-rich effluent from coastal-based sources may explain the higher disease prevalence (Miller *et al.*, 2015) during wet season. In this study, WS was found during both seasons, with the dominant disease prevalence during the wet season ($21.33 \pm 1.15\%$). Willis *et al.* (2004) reported that WS is a common coral disease in the Indo-Pacific and WS is frequently observed in Thailand, in areas such as the Andaman Sea (Kenkel 2008) and Koh Samui (Kritsanapuntu and Angkhananukroh 2014), while PWPS was the dominant disease in the dry ($9.55 \pm 3.17\%$). PWPS has to date been reported in only one species of massive coral (*Porites lutea*) in the Western Indian Ocean (Séré *et al.* 2012) and has also been reported from Koh Samui in the Gulf of Thailand (Kritsanapuntu and Angkhananukroh 2014). Diseases in this coral genus *Porites lutea* have also been reported worldwide such as in the Southeastern Indian ocean (Thinesh *et al.* 2009), Philippines (Santavy *et al.* 2001), Thailand (Putchim *et al.* 2012), and other Indo-Pacific reefs (Sutherland *et al.* 2004). However, the cause of the disease has yet to be determined but further researches into these influences are needed. The results of this study offer a baseline on coral diseases in shallow water reefs at Tan Island, Suratthani Province, which is available use for further monitoring programs in coral disease outbreaks in Thai waters.

Conclusion

The survey showed that a total of four coral diseases. WS and PLS were founded in the wet season with the frequency of corals with WS was the dominant coral disease. While dry season observed WS, PWPS and UWS with PWPS was the dominant coral disease. Disease prevalence during in wet season was higher than that of dry season. *Porites lutea* exhibited the highest prevalence of the four diseases in this area.

Acknowledgement

The authors would like to thank Assistant Professor Dr. Sirusa Kritsanapuntu and Mr. Sakol Poepetch for supports during these surveys. The second author would like to thank the CU. Graduate School Thesis Grant Result Announcement for financial support during her study.

References

- Barber, R., Hilting, A. and Hayes, M. 2001. The changing health of coral reefs. Human and Ecological Risk Assessment 7: 1255-1270.
- Beeden, R., Willis, B.L., Raymundo, L.J., Page, C.A. and Weil, E. 2008. Underwater cards for assessing coral health on Indo-Pacific reefs. Coral Reef Targeted Research and Capacity Building for Management Program. Currie Communications, Melbourne, Australia 26 pp.
- Bruckner, A.W. and Hill, R.L. 2009. Ten years of change to coral communities off Mona and Desecheo Islands, Puerto Rico, from disease and bleaching. Diseases of Aquatic Organisms 87: 19-31.
- Bourne, D.G., Ainsworth, T.D., Pollock, F.J., Willis, B.L. 2015. Towards a better understanding of white syndromes and their causes on Indo-Pacific coral reefs. Coral Reefs 34: 233-242
- Delcroix, T. and Henin, C. 1991. Seasonal and interannual variations of sea surface salinity in the tropical Pacific Ocean. Journal of Geophysical Research 96: 135-22.
- Donsomjit, W and Yeemin, T. 2010. Patterns of pink syndrome in *Porites lutea* at Koh Lan, Gulf of Thailand, Proceedings of the 36th Congress on Science and Technology of Thailand.
- English, S., Wilkinson, C. and Baker, V., 1997. Manual for survey of tropical marine resources. Australian Institute of Marine Science (AIMS).
- Green, E P. and Bruckner, A.W. 2000. The significance of coral disease epizootiology for coral reef conservation. Biological Conservation 96: 347-361.
- Kenkel, C.D. 2008. Coral disease: baseline survey in the Andaman Sea and Gulf of Thailand. Phuket Marine Biology Center Research Bulletin 69: 43-53.
- Kritsanapuntu, S. and Angkhananukroh, P. 2014. Coral disease prevalence in Samui Island and the adjacent islands southern part of the Gulf of Thailand. Journal of Biodiversity and Environmental Sciences 5: 158-165.
- Lamb, J. B., True, J. D., Piromvaragorn, S., and Willis, B. L. 2014. Scuba diving damage and intensity of tourist activities increases coral disease prevalence. Biological Conservation, 178: 88-96.
- Lima, I. D., Garcia, C. A. and Möller, O. O. 1996. Ocean surface processes on the southern Brazilian shelf: characterization and seasonal variability. Continental Shelf Research 16: 1307-1317.
- Miller, A.W. and Richardson, L.L. 2015. Emerging coral diseases: a temperature-driven process? Mar Ecol 36:278-291.
- Porter, J.W and Tougas, J.I. 2001. Reef ecosystems: threats to their biodiversity. Encyclopedia of biodiversity, Vol 5. Academic Press, San Diego, 73-95 p
- Poulos, S. E., Drakopoulos, P. G. and Collins, M. B. 1997. Seasonal variability in sea surface oceanographic conditions in the Aegean Sea (Eastern Mediterranean): an overview. Journal of Marine Systems 13: 225-244.
- Putchim, L., Yamarunpattana, C. and Phongsuwan, N. 2012. Observation of Coral disease in *Porites lutea* in the Andaman Sea following the 2010 bleaching. Phuket Marine Biology Center Research Bulletin 71: 57-62.
- Rosenberg, E., Koren, O., Reshef, L., Efrony, R. and Zilber-Rosenberg, I. 2007. The role of microorganisms in coral health, disease and evolution. Nature Reviews Microbiology 5: 355-362.
- Santavy, D., Mueller, E., Peters, E., MacLaughlin, L., Porter, J., Patterson, K. and Campbell, J. 2001. Quantitative assessment of coral diseases in the Florida Keys: strategy and methodology. Hydrobiologia. 460:39-52.

- Se're', M.G., Schleyer, M.H., Quod, J.P. and Chabanet, P. 2012. Porites white patch syndrome: an unreported coral disease on Western Indian Ocean reefs. *Coral Reefs* 31:739.
- Sutherland, K.P., Porter, J.W., Torres, C., 2004. Disease and immunity in Caribbean and Indo-Pacific zooxanthellate corals. *Marine Ecology Progress Series*. 266: 273-302.
- Sutthacheep, M., Yeemin, T., Saenghaisuk, C., Pengsakun S. and Chueliang, P. 2009. Assessing coral health in the Gulf of Thailand, Proceedings of the 35th Congress on Science and Technology of Thailand.
- Thinesh, T., Mathews, G., Patterson, E.J. 2009. Coral disease prevalence in Mandapam group of islands, Gulf of Mannar. *Indian Journal of Marine Science* 38: 444-450.
- Weil, E. 2004. Coral reef diseases in the wider Caribbean. In *Coral health and disease*. Springer Berlin Heidelberg. 35-68 pp.
- Weil, E. and Hooten, A.J. 2008. Underwater cards for assessing coral health on Caribbean reefs. *Coral Reefs Targeted Research and Capacity Building for Management*. Currie Communications, Melbourne, Australia 21 pp.
- Willis, B.L., Page, C.A., Dinsdale, A.D., 2004. Coral disease on the Great Barrier Reef. In: Rosenberg, E., Loya, Y., editors. *Coral health and disease*. Springer Verlag. 69-104 pp.



Figure 1 Study site at Tan Island, Suratthani Province

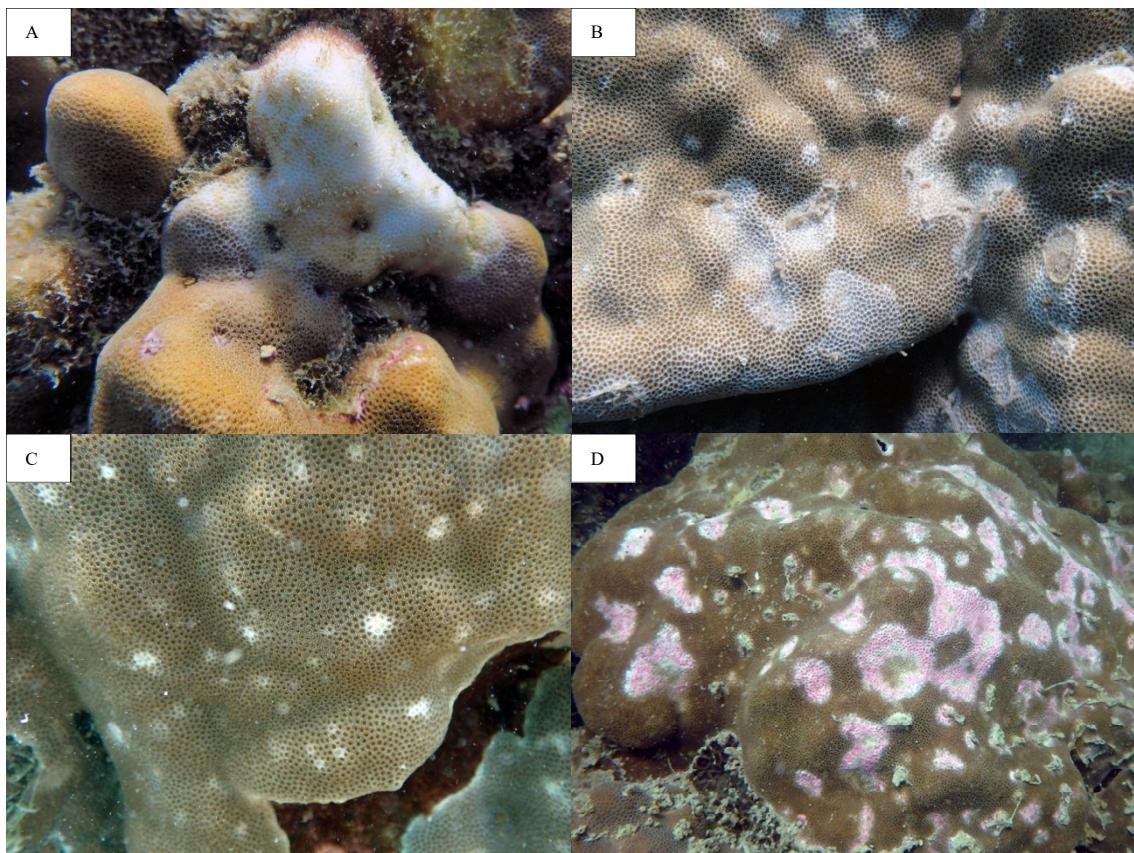


Figure 2 Coral disease types found at Tan Island. **A)** White Syndrome, **B)** *Porites* White Patch Syndrome, **C)** Ulcerative White Spot and **D)** Pink Line Syndrome.

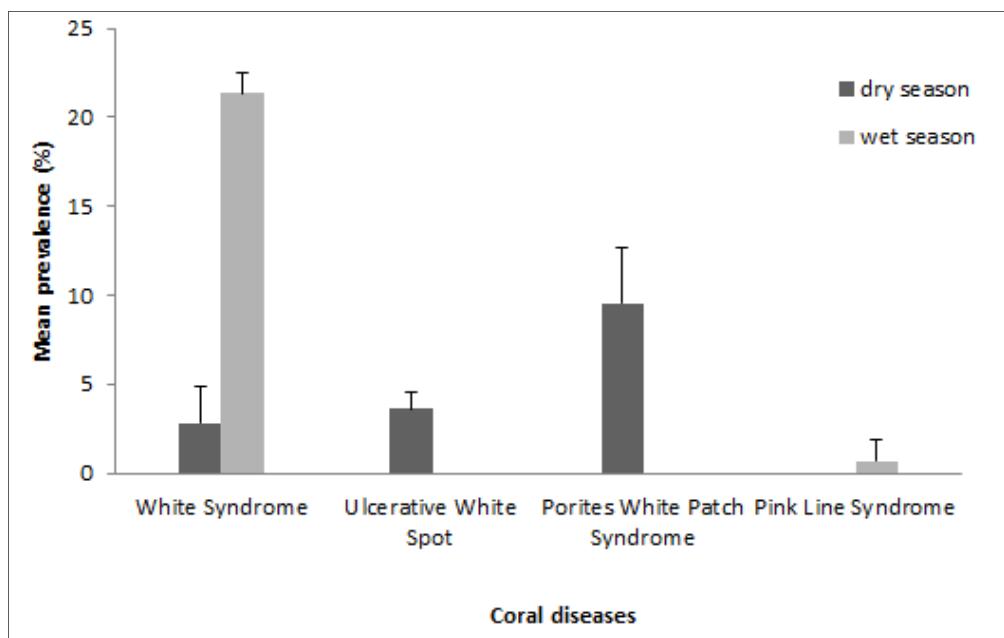


Figure 3 Mean disease prevalence observed at Tan Island (mean \pm SE)



