(SS15) Impact of Climate Change on Aeroallergen, Asthma and Clinical Immunology

Date: August 25
Place: Room 5234 (oral), Room 6302 (poster)
Organizers: Anand Bahadur Singh & Jae-Won Oh
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Purpose: It is now well established that green house gases such as CO_2, ozone and also global temperature is increasing all over the world. Records from long term data on pollen monitoring from several countries particularly Europe and USA reveal that the concentration and duration of airborne pollen in the air are increasing and this could be due to early and prolonged flowering season of allergenic pollen. The greater increase in concentration and duration leads to increased exposure of patients with respiratory problems with acute and severe respiratory problems. The increased incidence of respiratory allergic diseases all over the world including developing countries is also partially suspected to be due to global warming.

Oral Presentation

Aug. 25 [PM3] Room: 5234

Chair: Jae-Won Oh

16:20-16:40 **The impact of climate change on pollen allergens and allergic diseases: A global scenario** SS15-O01 (480)

A.B. Singh, Christine E. Rogers

16:40-17:00 **Prospective changes in allergenic pollens in Korea based on climate change scenarios** SS15-O02 (239)

Kyu Rang Kim, Hye-Rim Lee, Young-Jean Choi, Jae-Won Oh

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17:00-17:20 **Allergic diseases in Japan with special reference to Japanese cedar pollinosis** SS15-O03 (505)

Motohiko Suzuki, Yoshihisa Nakamura

17:20-17:40 **A correlation between Japanese cedar pollen, sensitization rate and pollinosis in Jeju Island, South Korea** SS15-O04 (267)

Keun Hwa Lee

Poster Presentation

Aug. 25 [PM1] Room: 6302

13:30-14:30 **The relation between pollen concentration and symptom index of seasonal allergic rhinitis for risk grade for pollen allergy in Korea** SS15-P01 (166)

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Seasonal distribution of airborne pollen in Beijing, China and their correlation with meteorological factors SS15-P02 (282)

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Allergen specific immunotherapy for Japanese cedar pollinosis SS15-P03 (389)

Katsuyo Ohashi-Doi, Yuko Mitobe, Koji Fujinami, Hisashi Ohta, Takashi Kashiwagi

An estimation method for male flower productions of *Cryptomeria japonica* SS15-P04 (507)

Motoo Suzuki, Tatsuo Kanazashi, Shigeki Fukushima

SS15-O01 (480)

The impact of climate change on pollen allergens and allergic diseases: A global scenario

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Although increase in green-house gases, such as CO_2 and change in global climate has received increased attention, their impact on aeroallergens and increasing incidence of allergic diseases has not received same attention. Several reports suggest that climate change has had, and will have in the future, impacts on aeroallergens especially airborne pollen and fungal spores. Recent research findings show that higher temperature and mounting CO_2 stimulates plants to produce more pollen and increased fungal growth due to excessive rain. According to a study, plants are flowering significantly earlier over time and advancing the season by approximately 0.8 days per year (*Lewis et al*. 2008). Thus climate change may make the aeroallergen more prevalent, in the air, and with increased duration due to early flowering, hence increased exposure for hypersensitive patients. It is speculated that climate change will result in intense rain leading to increased moisture and temperature conducive for mold growth. As exposure to fungi is associated with allergy and asthma symptoms, it might also contribute to increased incidence of allergic diseases in times to come. However, pollen and spore counting over several years of intermittent survey in India do reveal changes in pollen concentration and exposure levels of air pollutants such as NO_2, SO_2 have synergistic effect on pollen proteins. Under experimental conditions exposure of pollen to these pollutants have shown distorted and shrunken pollen, which released proteins faster than unexposed pollen to above pollutants. The rapid increase in incidence of allergic diseases, such as bronchial asthma, allergic rhinitis and atopic dermatitis during the past few decades is attributed to various genetic, environmental & social factors. However several reports suggest that they could also be due to anthropogenic factors due to climate change in the atmosphere besides genetic predisposition.

SS15-O02 (239)

Prospective changes in allergenic pollens in Korea based on climate change scenarios

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There are increasing number of allergenic pollens induced by the global warming and air pollution, which, in turn, causes more patients with allergic diseases such as bronchial asthma, allergic conjunctivitis, and allergic rhinitis. The consequences of the increasing pollens on health due to the climate change can be predicted based on the observed relationship of pollens and their allergenicity in the changing environment including temperature and CO_2 increase. It is expected that the effects of greenhouse gas continue increasing for decades despite the efforts of mitigation measures against the climate change. Korea Meteorological Administration (KMA) operates the pollen observational network of Burkard traps for 6 cities - Seoul, Busan, Daegu, Gwangju, Gangneung, and Jeju, in cooperation with the Korean Academy of Pediatric Allergy and Respiratory Disease since 1997 and has been expanded the network to 12 cities. Based on the observed data, KMA established a system issuing day-to-day warnings of allergenic pollens from trees and weeds. Daily probability models for each pollen species were developed using the logistic model to quantify the impact of environmental conditions on the frequency and period of the pollens. Various meteorological variables were considered in developing the models and air temperature was selected as one of the significant driving variables. The models were evaluated using the control (historical) run of climate change scenarios to test the validity of the model in the application of the scenarios. In case of ragweed species in Seoul, the evaluation results showed no significant difference between the observed and predicted number of pollen days. After the initial test of the models, more experiments were conducted with the future climate runs based on the RCP 4.5 scenario. The pollen days of ragweed were predicted as 50, 61.4, and 85.6 days during 2000s, 2040s, and 2090s, respectively. In conclusion, the daily probability of pollens is closely related to the meteorological conditions including air temperature so that it can be largely influenced by the climate change of the future. The models developed in this study will provide quantitative information on the impact assessment by the changing number of pollens: one of the essential information for the adaptation to pollinosis in conjunction with the changing allergenicity.

SS15-O03 (505)

Allergic diseases in Japan with special reference to Japanese cedar pollinosis

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Allergy is one of the most common diseases all over the world. And increased prevalence of allergic diseases, which includes allergic rhinitis, atopic dermatitis, asthma, and allergic conjunctivitis, has been reported. Pollen, fungi, house dust, insects, and mites are major sources of allergens that cause allergic responses. Allergi rhinitis, or nasal allergy, is characterized by IgE-mediated inflammation induce by allergen exposure. The main symptoms of allergic rhinitis are nasal itching, sneezing, nasal discharge, and nasal obstruction. Infiltrating cells, including T cells, eosinophils, mast cell, and basophils, release several mediators responsible for the symptoms. Pollen causing pollinosis varies regionally. In Japan, Japanese cedar (*Cryptomeria japonica*), is the most important pollen causing pollinois in the spring. Japanese cypress (*Chamaecyparis obtusa*) pollen is also observed in this period. Cross reactivity between Japanese cedar and Japanese cypress has been documented. The climate affects distribution of Japanese cedar and Japanese cypress pollen, and the severities of symptoms in patients with this pollinosis are influenced. The climate is constantly changing, and the earth is warming. Energy from the sun is trapped in the earth atmosphere by the greenhouse effect. In the greenhouse effect, gases, such as carbon dioxide and methane, play an important role. These gases are largely responsible for human actions and modern industry. Climate change is one of the threats to human health. Due to climate change, plant growth may be influenced and pollinosis might face a new situation. This presentation highlights impact of climate change on scattering of Japanese cedar and Japanese cypress pollen in Japan, and on change of prevalence and severity of allergic

rhinitis and pollinosis in Japan.

SS15-O04 (267)

A correlation between Japanese cedar pollen, sensitization rate and pollinosis in Jeju Island, South Korea

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A large amount of Japanese cedar (*Cryptomeria japonica*) was planted in Jeju Island (especially the southern part of Jeju Island, Seogwipo-si) for wind breaking. Japanese cedar pollen cause pollinosis during spring season from February to April and become one of the most important health problems in Jeju Island. Most of patients suffer from sneezing, nasal discharge, nasal congestion and ocular irritation. Some paper reported that the sensitization rates to Japanese cedar extract in Jeju Island are 33.8% and this percentage is the highest in Korea (J Asthma Allergy Clin Immunol 23: 483-93, 2003). Jeju Island is located far south in Korean peninsular, and severe influence region by climate change. According to the National Institute of Metrological Research, the annual average temperature in Jeju Island is highly increased from 1990 to 2000, and by 2010 Seogwipo-si, is the southern part of Jeju, showed that at least 1~2ºC higher temperature than Jeju-si, and climate of seogwipo-si is becoming sub-tropic region. In this study we examine the geographical distribution of Japanese cedar pollen, survey the difference sensitization rates to Japanese cedar extract, and seasonal pollinosis (spring allergic rhinitis) between Jeju-si, is the northern of Jeju Island and Seogwipo-si from February to May in 2011. And we also study about the difference of climate factor (temperature or rainfall) between Jeju-si and Seogwipo-si. Through this study we want to know that the CLIMTE CHANGE (global warming) is really effect on early blooming of Japanese cedar pollen between Jeju-si and Seogwipo-si, and explore the risk of future pollinosis by climate change in Jeju Island, South Korea.

SS15-P01 (166)

The relation between pollen concentration and symptom index of seasonal allergic rhinitis for risk grade for pollen allergy in Korea

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Background: Seasonal allergic rhinitis is one of the allergic diseases which caused by airborne pollens from allergic plants. Incidence of seasonal allergic rhinitis has recently been increased in

Korea. Korean Pollen Allergy Center has used the pollen allergy scale from National Allergy Bureau (NAB) in USA for reporting pollen count. Therefore, Korean Pollen Allergy Center needs to develop risk grade for pollen allergy in Korea. This study is focused on the evaluation of the relation between pollen count and symptom index of seasonal allergic rhinitis from allergic patients in Korea and this data would be necessary to evaluate Korean own allergy risk scale for pollen forecasting system. **Methods:** Airborne particles carrying allergens were collected daily from nationwide 8 stations (Seoul, Guri, Daejeon, Daegu, Kwangju, Busan, Kangneung, and Jeju) by using 7 days-Burkard sampler (Burkard Manufacturing Co Ltd, Hertfordshire, UK) for 3 year in South Korea (March 1, 2008 - October 30, 2010). They were counted and recorded along with the weather factors. For this study, 528 allergic subjects were recruited from 8 cities near the pollen collecting stations and symptom indices were evaluated and recorded by phone calling to allergic subjects daily. **Results:** Airborne pollen has two peak seasons that is March to May and August to September in Korea. There was the tree pollen seasons from the middle of February to late July, then followed during the grasses and weed season from the middle of August to the middle of October. Among allergic subjects who, Ragweed was the plant with highest sensitization rate, followed by sagebrush, alder, birch, oak, Japanese hop in Korea. Ragweed pollen counts were gradually increased since 2000. There are significantly related between symptom indices from allergic patients and allergic pollen counts and we established Korean allergy risk scale with these data. **Conclusion:** There are significantly related between symptom index from allergic rhinitis and allergic pollen concentrations. This study completed and presented a risk grade for pollen allergy. This index would be very useful for Korean pollen forecasting system in future.

SS15-P02 (282)

Seasonal distribution of airborne pollen in Beijing, China and their correlation with meteorological factors

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This study aims is to detect the peak dispersal times of allergenic pollen grains and their correlation with meteorological factors in Beijing, China. We monitored airborne pollen from September 2009 to September 2010 at Peking University campus. Two heights,1.5m and 22m above the earth, were designed to collect airborne pollen.15m is the average height of human body at which airborne pollen coming from local plants can be breathed easily by human and cause respiratory allergic diseases. 22m is high up in the air at which airborne pollen come from a long distance. Meteorological data including temperature, precipitation, relative humidity, wind speeds, sunshine periods were measured in sampling site. 15 pollen taxa are in abundance; they are *Pinus*, *Cedrus*, Cupressaceae, *Ginkgo*, *Ulmu*, *Populu*, *Salix*, *Corylus*, *Quercus*, *Acer*, Oleaceae, *Artemisia*, *Humulus*, Chenopodiaceae/Amaranthaceae, Gramineae. These pollen taxa can be divided into three groups according to their allergen. *Artemisia*, *Humulus*, Chenopodiaceae/Amaranthaceae, Gramineae are major allergens; *Pinus*, *Cedrus*, Cupressaceae, *Ginkgo*, *Ulmu*, *Populu*, *Salix*, *Quercus* are minor allergens; *Corylus*, *Acer*, Oleaceae is less allergenic. Two main peaks for pollen dispersal seasons were observed, which generally coincided with the flowering period of anemophilous plants. Taxa and amount of airborne pollen show a similar variety tendency at two heights of 1.5m and 22m above the earth. Airborne pollen abundance was affected obviously by temperature, relative humidity and wind speeds but have a complex relationship with the sunshine periods and precipitations. Various meteorological factors have diverse effect on different airborne pollen taxa.

Keywords: aerobiology, pollen calendar, atmospheric conditions, allergy, Beijing.

SS15-P03 (389)

Allergen specific immunotherapy for Japanese cedar pollinosis

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Allergen specific immunotherapy (AIT) is well established as a curative treatment for allergies caused by allergens including house dust mite and tree/grass pollens in contrast to symptomatic treatments such as use of anti-histamine agents and steroids. Subcutaneous immunotherapy (SCIT) has been introduced to treat rhinitis and/or asthma caused by allergic sensitization as early 1960s in European country and Japan. It has successfully reduced symptoms such as rhinitis and asthma, and developed long-term tolerance against allergens. However, the major drawbacks for SCIT are necessity of repeated painful injections and hence repeated hospital visits as well as the risk of anaphylaxis, since an allergen is given by subcutaneous injection. To minimize these drawbacks for patients, the alternative concept inspiring the search for effective non-injective route, namely sublingual administration of allergen has emerged in Europe since late 1990s. Sublingual immunotherapy (SLIT) appears to be associated with a lower incidence of systemic reaction because either solution or tablet of allergen is placed under the tongue (sublingual administration). To date, SLIT has received much attention as an advanced clinical application in AIT. Japanese cedar (*Cryptomeria japonica*) pollinosis is one of the most serious type I allergic diseases caused by Japanese cedar pollen. In recent decades, the prevalence rate in cedar pollinosis has been increased to 10 to 30% in the Japanese population and such prevalence rate is much higher than those with grass or ragweed pollinosis in Japan. The symptoms of Japanese cedar pollinosis persist for about 3 months in spring, becoming a significant social issue either adults or children who are suffering from rhinitis, symptom as sneezing and nasal blockage. Recently, SLIT has been tested to treat Japanese cedar pollinosis and demonstrated its effectiveness and safety (*Allergology international 2008, Int. Arch. Allergy Immunol. 2008*). Based on these early reports, a large clinical trial with standardized Japanese cedar pollen extract is underway. In the presentation, we will discuss the details of SCIT and SLIT as well as potential mechanism of AIT for Japanese cedar pollinosis.

Keywords: Japanese cedar pollinosis, allergen, immunotherapy, sublingual treatment, rhinitis.

SS15-P04 (507)

An estimation method for male flower productions of *Cryptomeria japonica*

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The relationship between male flower production of Japanese cedar and meteorological factors is known as that the flower production has a positive relationship with sun duration in previous summer and has a negative relationship with precipitation in previous summer. On the other hand, it is known that the male flower production has a rich and poor cycle because of the shortage of nutrients inside of trees (if trees produced lots of flowers, inside nutrients were consumed greater). In this research, we focused on the relationship between net primary production estimated from meteorological factors and the cost distribution ratio for individual growth, male flower production, and seed fruition. Through the research, we established an estimation method of male flower production with meteorological factors and a cost balance model of net primary production. For a photosynthetic production, we adopted the Michaelis-Menten hyperbolic function model (Farquhar). For an estimation of aspiration volume at branches and roots, we adopted an exponential function. And for an estimation of aspiration volume at leaves, we adopted a linear function based on the assumption that leaves' aspiration is proportional to the maximum carboxylation rate. Additionally we considered the effect of stomatal conductance variance with humidity and the thermal dependency of photosynthesis. For the estimation of masting, we input a net primary production estimated by above functions in the Resource Budget model (Isagi et al, 1997). In the estimation, we supposed the distribution ratio for male flower production and seed fruition (male flower production/ seed fruition) was 0.6 to 0.8, estimated from dry weight ratio of flowers and seeds and from dispersion of individuals. We estimated the male flower production from 2001 to 2007 with meteorological factors observed at Tokyo meteorological observatory and these models. The estimated production had a strong positive relationship with the actual flower production observed. The cost for male flower production was estimated 0.4 to 8.9 mgCO_2 at square meter, the production of male flowers was 1,090 to 15,240 flowers at square meter, and the cost for one male flower production was estimated 0.0006 mgCO_2.

Keywords: pollen productivity, net primary production, Michaelis-Menten, masting, resource budget.