Three different experiments were undertaken in Sher-e-Bangla Agricultural University, Dhaka to find out the effect of partially ultra violet (UV)-blocking films on the pigmentation and insect/disease control of some horticultural crops. The experiments were laid out in tunnels and in mini-houses covered with four different polyolefin films which can block UV-radiations shorter than 340 (<340), 350 (<350), 360 (<360) and 400 (<400) nm wavelengths. The results were compared with the crops that were grown in the outdoors and UV-transmitting film.

Effects of partially UV-blocking films on the insect infestation and plant growth of broccoli and turnip seedlings

The effect of partially UV-blocking films on the promotion of growth and insect controls as well as the proportion of herbivores-predators in the tunnels of turnip and broccoli seedlings was investigated. The experiment was comprised with six treatments, viz. outdoor, UV-transmitting, <340, <350, <360 and <400 nm, respectively with three replications. In turnip, plant height, leaf number, and leaf area increased by UV-blocking, while broccoli was not affected. Insects invaded into the tunnels were trapped using blue and yellow adhesive traps, and seven different insects, viz. aphid (Brevicoryne brassicae), brown plant hopper (BPH, Nilparvata lugens), short horn grass hopper (SHGH, Melanoplus femurrubrum), white backed plant hopper (WBPH, Sogatella furcifera), dipteran fly (DF), mirid bug (MB,
Heteroptera: Miridae), and mosquitoes were captured up to 30 days after sowing. Aphid was found as the most predominant insect followed by mosquito, DF, and WBPH. Among treatments, the largest feeding damage was found in outdoors for broccoli (26%) and turnip (22.5%). The ratio of the herbivores/sucking insects and predators was remarkable in both broccoli (35-65%) and turnip (25-75%) seedlings, respectively. The proposed films effectively reduced the feeding damage compared to outdoors, irrespective of seedling. The partially UV-blocking films had significant effect on the growth promotion and can be an important tool in Integrated Pest Management (IPM) system for Brassica seedlings specifically for aphid, DF and WBPH. The growth was enhanced by using partial UV-blocking films, so that it is much wise or commercially acceptable not to use UV-blocking films rather than partially UV-blocking films. It is found that the proportion of insect-pest and parasitoids or predators was hampered due to the use of films. The effects of UV-blocking materials on predators, such as syrphid flies, MB, Orius spp., lady-bird-beetles and lacewings have never been well established. The cost effectiveness, timing, and nature of crops might also be the effective points to consider for successful IPM system in Bangladesh.

**Effect of partially UV-blocking films on the growth, yield, pigmentation, and insect control of red amaranth (Amaranthus tricolor)**

Red amaranth (Amaranthus tricolor) was grown in tunnels covered with partially UV-blocking films (<340, <350, <360 and <400 nm) for five weeks after sowing, and plant growth, anthocyanin concentration, and insect burden were compared with those of UV-transmitting films and outdoors. The plant height, stem cell length, leaf area, and fresh weight were higher in the plants grown under higher UV-blocking conditions, while the plant dry weight was greater under lower UV-blocking conditions due to the lower dry matter percentage under higher UV-blocking conditions. The red color of the upper leaves became lighter as the UV-blocking rate increased, while there was no such distinct difference in either the lower leaves or stem. Anthocyanin concentrations of both the stem and leaves of the plant apex were significantly lower under UV-blockings than under UV-transmitting conditions and outdoors, but there was almost no significant difference among different UV-blocking rates.
Yellow and blue sticky traps were also suspended at the center of the tunnels, and twelve insects were trapped during the experimental period. The maximum invasion by insects and feeding damage of the seedlings were observed outdoors, followed by plants grown under UV-transmitting conditions. Partially UV-blocking conditions significantly reduced invasion by insects and feeding damage of the seedlings compared to outdoors and under UV-transmitting conditions, but there was no significant difference among different UV-blocking rates. The number of herbivores/sucking insects tended to decrease as the UV-blocking rate increased, while that of predators was little affected by the UV-blocking rate. The results showed that partially UV-blocking conditions were as effective as fully UV-blocking conditions, especially for controlling some herbivores/sucking insects such as aphids and white fly, and also for maintaining an advantageous proportion of predators. It was found that partially UV-blocking conditions promoted plant elongation and inhibited invasion by herbivores more than predators. On the contrary, partially UV-blocking films inhibited anthocyanin biosynthesis of the uppermost leaves and did not promote biomass production or sugar accumulation having a negative effect on some insects. Therefore, the upper-most leaves were not appropriate for commercial use because anthocyanin pigmentation was largely blocked under all UV-blocking conditions, but the pigmentation of middle to lower leaves were not markedly inhibited. This was probably due to a certain amount of UV entering the tunnels through the 15-cm opening. Therefore, it may be concluded that partially UV-blocking films can be commercially utilized and can be an encouraging tool for successful IPM programme for the cultivation of red amaranth in Bangladesh.

**Effect of partially UV-blocking films on Xanthomonas axonopoides pv. citri causing citrus (Citrus aurantifolia) canker**

The experiment was conducted to testify the hypothesis that partially UV-blocking film has the ability to suppress the development of canker disease of citrus. The quantified variables were latent period of the pathogen, temperature, relative humidity, partially UV-blocking conditions, disease incidence and disease severity. The mini-houses were constructed and covered with four types of polyolefin films that have the ability to block UV-irradiation shorter than UV-A of <400 nm (T1), <360 nm (T2), <350 nm (T3) and <340 nm (T4), and the results were compared with that of UV-transmitting (T5) and outdoors (T6). The results showed that
the leaves under <400 nm and <360 nm UV-blockings took less time (8 days) to express the symptom than outdoors (13 days). The lowest incidence (66.7%) was recorded in outdoors and highest incidence (100%) was recorded under <400 nm at 45 days after inoculation (DAI). Similarly, lowest severity (10%) was recorded in outdoors, and the highest severity (43.3%) was recorded under <400 nm at 45 DAI. Disease incidence and severity gradually decreased as the UV-blocking rates decreased. UV radiation with the combination UV-A and B may be effective for Xanthomonas axonopoides pv. citri. The temperature and relative humidity in combination with UV intensity may have potential role in disease development. In treatment T1, both the temperature and relative humidity were higher than T6 treatment that may have positive role for disease development. Moreover, in treatment T2 and T1, both the temperature and humidity were non-significant but UV intensity, disease incidence and severity were significant. The findings indicate that, higher UV intensity has potential role to reduce disease incidence and severity of citrus canker. Furthermore, temperature and humidity showed positive correlation and UV intensity showed negative correlation with disease incidence and severity. Thus, disease incidence and severity increased with high temperature, humidity and low UV intensity and vice-versa. From the findings of this study, it can be concluded that higher UV-A radiations are suitable to avoid canker disease of citrus in tropical and subtropical regions.