

臺灣二〇〇八年國際科學展覽會

科 別：動物學

作品名稱：紫蝶幻影

學校 / 作者：國立武陵高級中學
國立武陵高級中學

陳瑋杰
劉友文

作者簡介



作者：陳瑋杰

憑藉著對小動物的好奇心及從小就喜愛種植花草草，本人自從兒時便決定往生命科學方面發展。懵懂無知不僅促使我用雙手去感受植物生長的千萬奧妙，更使我用生命去體會小動物在手心中撼動人心的心跳。從國民中學畢業後，慶幸自己有機會在高中時期接觸到不同的科學相關活動。無論是時常需要動手實際操作的生物實驗，還是緊張刺激的學科能力競賽及奧林匹亞競試，或是耗時最久卻也最有成就感的科展報告，我都全力以赴。最令我印象深刻也是科展，因為我從中認識了更多好朋友，學會如何發現問題並找出解決之道。在相互討論中，更是用心去學習待人處事。從科展，我用心體會到人類現有科技的偉大及珍貴，並期許自己能延續之。

作者：劉友文

自己從小就對大自然很有興趣。喜歡觀察生物的行為、結構及彼此的互動。有時閱讀一些科學家的傳記，發現他們藉由大量的觀察思考來發現問題，及精心設計的實驗來印證假設的學說。自己也漸漸希望能有一日去發現與解決問題。於進入高中後，自己很幸運地有能夠參加實驗及科展的機會。雖在一路上跌跌撞撞，仍是儘力完成作品，希望能成為其他人研究上的小小經驗。

摘要

(一)英文摘要(Abstract)

The main purpose of this experiment is to discuss the characteristics of iridescent colors of Taiwanese *Euploea*'s wings, inclusive of the relations between the colors of wings and squamas. According to the results from scanning electron microscope, we discovered that the iridescent colors had a close relation to nanostructure and arrangements of squamas. We inferred that both the nanostructure and the arrangements would influence the formation of iridescent colors and the basic colors on wings. In addition, the basic colors on wings are related to different types of scales. To compare with the diverse formations of different sorts of Taiwanese *Euploea*'s wings, we took SEM pictures of *Elymnias hypermnestra* as well, discovering that its iridescent colors had similar relation with scales. And there was the regulation that *Elymnias hypermnestra* had only one type of scales at iridescent area, and two different scales at not-iridescent area as well as *Euploea*'s.

(二)中文摘要

本實驗目的為探討台灣地區紫斑蝶蝴蝶翅膀幻色的特性，以及翅膀幻色與鱗片的相關性。由結果得知，幻色實驗中利用掃描式電子顯微鏡發現紫斑蝶幻色的形成和其鱗片的細微結構與排列方式有密切相關。我們推論紫斑蝶的鱗片細微結構與排列皆會影響其幻色的形成，而顏色的不同則與不同類型的鱗片相關。除此之外，我們亦對同具幻色的紫蛇目蝶進行拍照分析，發現其幻色亦與鱗片有相關性。紫蛇目蝶的幻色區具有單一種鱗片構成的規則性，非幻色區則有兩種鱗片，與紫斑蝶相同。

研究報告

一、前言

(一)實驗動機

偶然間由公視頻道播出的【紫斑蝶特輯】得知，台灣本島有數種紫斑蝶會進行季節性的島內遷徙，且據報導及相關資料我們發現，紫斑蝶具有其他斑蝶科的同類所不具有的美麗「幻色」，這引發我們對斑蝶翅膀鱗片的好奇心。於是我們進一步與台灣蝶會研究員詹家龍先生討論得知，台灣有許多人正進行著蝴蝶標放的工作，且台灣向來更有「蝴蝶王國」的美喻。因此，在考量了眾多因素並分析實際狀況後，配合高一基礎生物第一章第四節【生物間的交互作用】，我們決定以台灣的斑蝶為主題，探討台灣現有的四種紫斑蝶及同具幻色的紫蛇目蝶翅膀表面結構及其顏色、幻色特性，以期進一步對蝴蝶翅膀的幻色現象進行相關研究。

(二)實驗目的

由於蝴蝶翅膀的多種特性可能都會對幻色和基本成色造成不同的影響，因此本實驗主要目的為針對四種紫斑蝶翅膀進行顯微拍照分析，並設計幻色拍照實驗比較各種紫斑蝶翅膀的 RGB 值，最後再進一步分析比較翅膀表面微細結構，希望能獲得蝴蝶翅膀顯微構造的基礎資料。除此之外，我們也將探討紫斑蝶翅膀幻色部位呈色原因，以期對斑蝶幻色有更深入的了解。

二、研究方法與過程

(一)實驗器材

五種蝴蝶樣本
光源

Corel Draw 12 軟體
電源供應器

掃描式電子顯微鏡
自製暗室

數位照相機

◎ 斑蝶照片與名錄：



圓翅紫斑蝶
Euploea eunice hobsoni (Butler)



小紫斑蝶
Euploea tulliolus koxinga Fruhstorfer



斯氏紫斑蝶
Euploea sylvester swinhoei Wallace & Moore



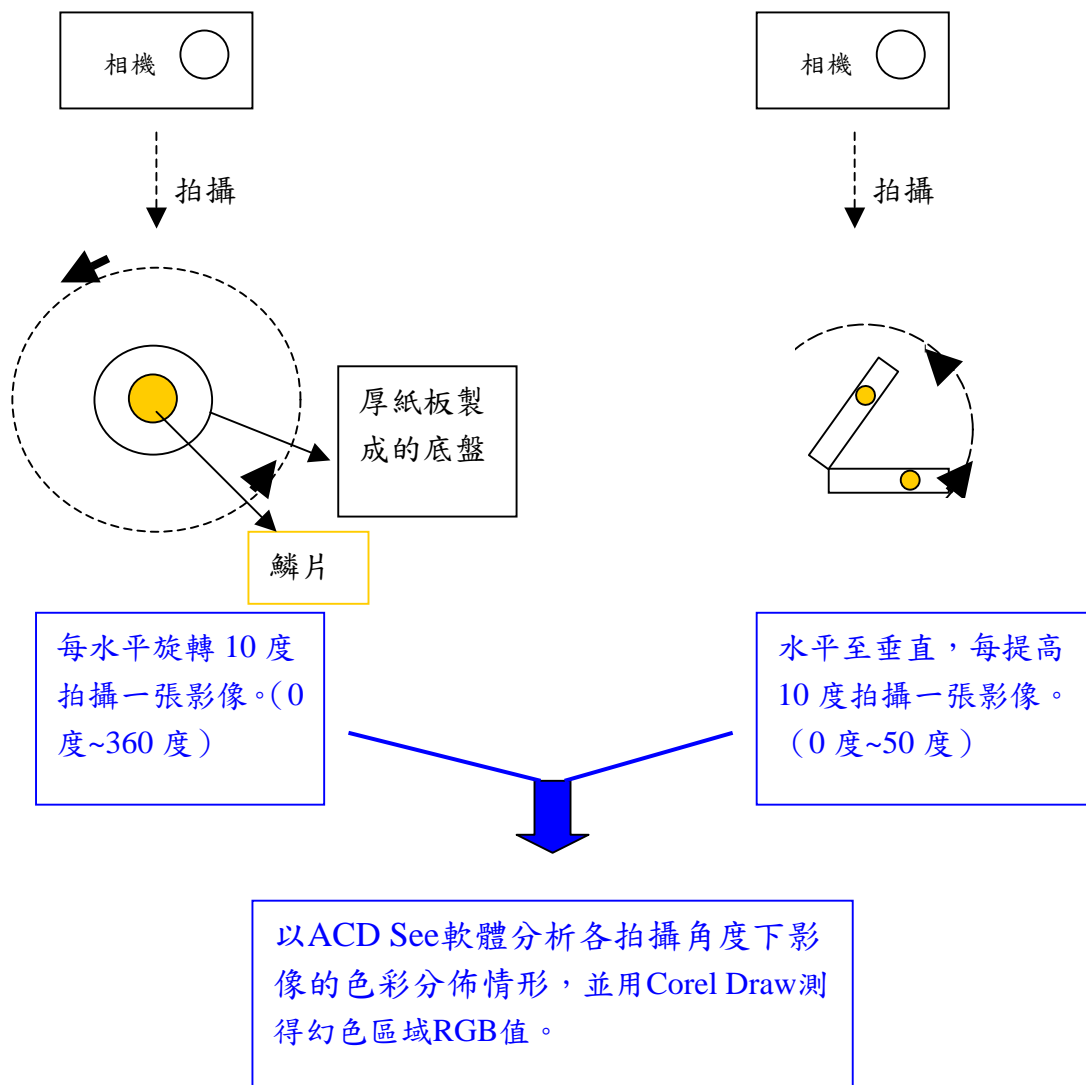
端紫斑蝶
Euploea mulciber barsine Fruhstorfer

(二)實驗過程

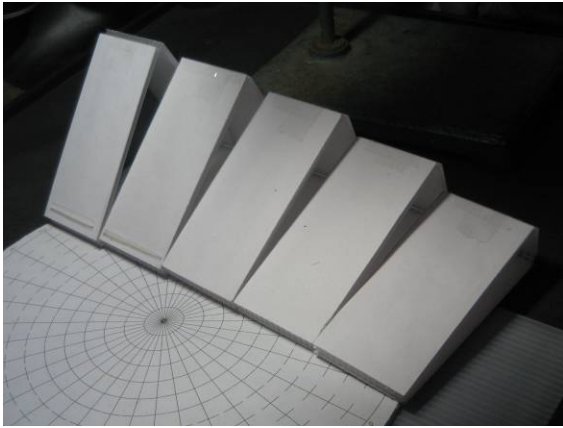
一、 探討四種紫斑蝶的幻色現象與鱗片表面的微構造：

(一) 以不同入射角的可見光照射鱗片，觀察鱗片反射後的成像結果並加以量化

1. 於自製的暗室內將蝴蝶翅膀置於360度平面旋轉盤上，正上方架設數位照相機與穩定的光源。
2. 每水平旋轉10度拍攝一張影像、垂直角度10度拍攝一張影像，直至水平360度旋轉完一周、垂直50度拍攝完成為止
3. 以ACD See軟體分析各拍攝角度下影像的色彩分佈情形，並用Corel Draw測得幻色區域RGB值(三元色-紅、綠、藍三色值)。

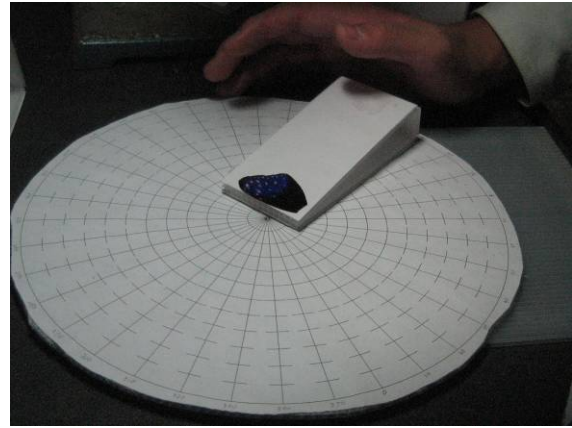


自製暗室



測量底座（仰角十度至五十度）

自製暗室內部



仰角十度、水平三十度的端紫斑蝶樣本

(二) 以掃描式電子顯微鏡觀察紫斑蝶鱗片微構造並探討其物理色成因

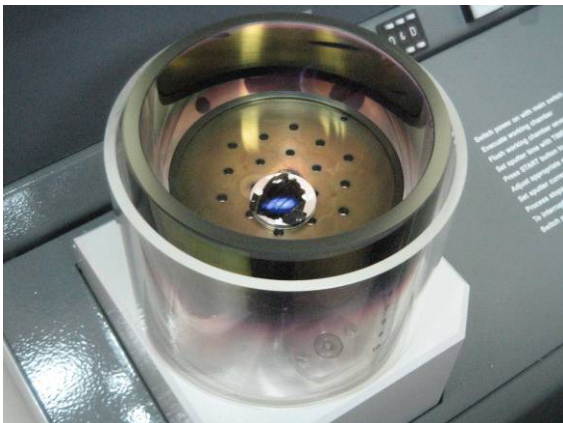
1. 準備四種紫斑蝶及紫蛇目蝶翅膀樣本。
2. 將欲選取區域之樣本取下（同時含幻色區與無幻色區）。
3. 利用掃描式電子顯微鏡擷取相關影像檔。
4. 分析影像檔並加以整理。



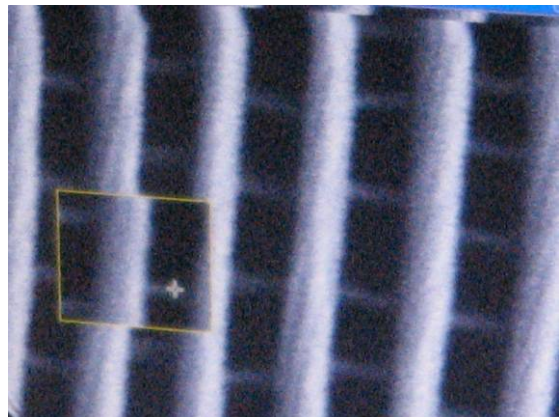
SEM掃描式電子顯微鏡



擷取欲測區域的翅膀樣本



將蝶翅樣本置於鍍金機內



聚焦中的影像

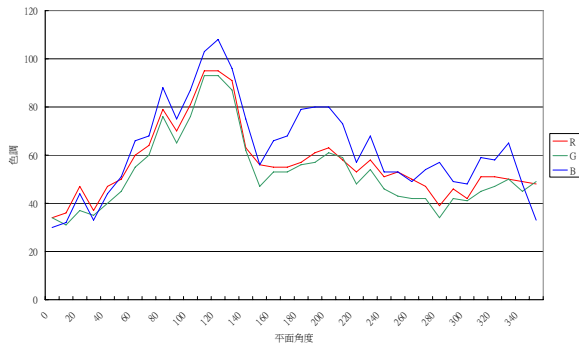
三、研究結果與討論

(一)研究結果

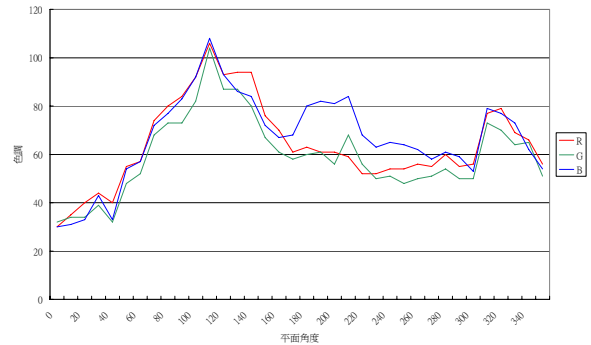
一、 探討四種紫斑蝶的幻色現象與鱗片表面的微構造：

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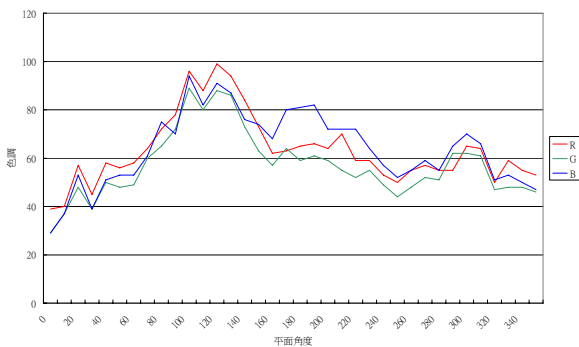
斯氏紫斑蝶



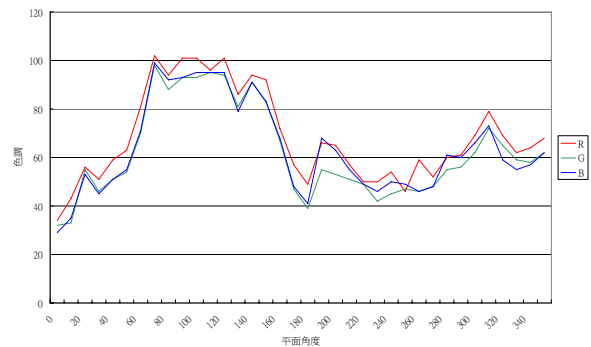
(仰角十度)



(仰角二十度)



(仰角三十度)



(仰角四十度)

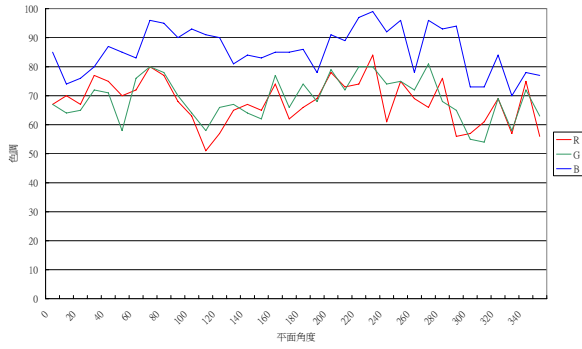


(仰角五十度)

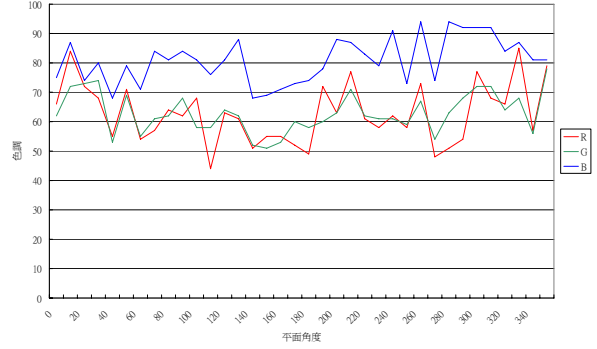
圖一 斯氏紫斑蝶幻色區域由仰角十度至仰角五十度之R G B值

【說明】隨著仰角的升高，斯氏紫斑蝶B曲線（藍色即肉眼所見之色）越較R、G曲線低，且尖峰較平緩（幻色明顯的平面角度擴大）。亦即隨著仰角的升高，幻色越趨模糊。

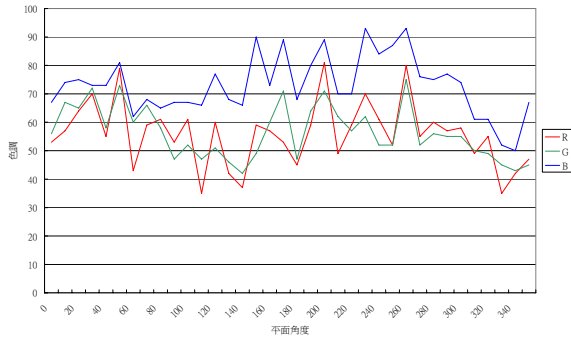
小紫斑蝶



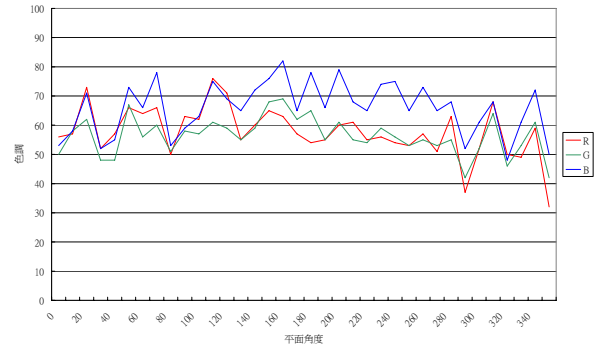
(仰角十度)



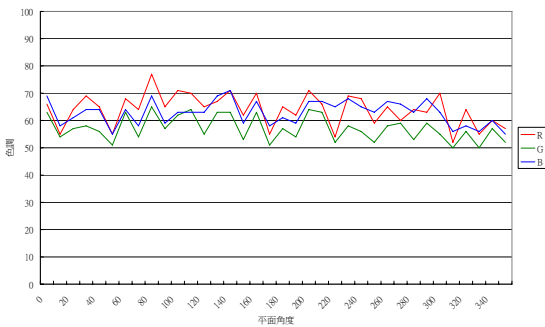
(仰角二十度)



(仰角三十度)



(仰角四十度)

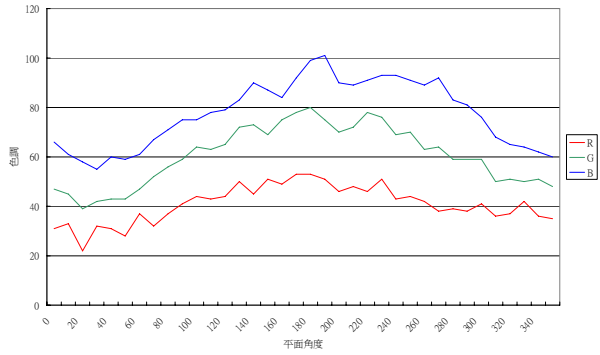


(仰角五十度)

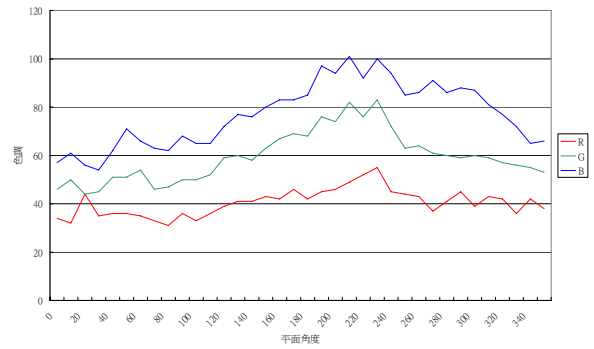
圖二 小紫斑蝶幻色區域由仰角十度至仰角五十度之RGB值

【說明】整體而言是平面角度三百六十度皆幻色明顯。隨著仰角的升高，小紫斑蝶B曲線（藍色即肉眼所見之色）不斷降低且從遠高於R、G到混雜於其中。意即隨著仰角的升高，幻色越趨不明顯。

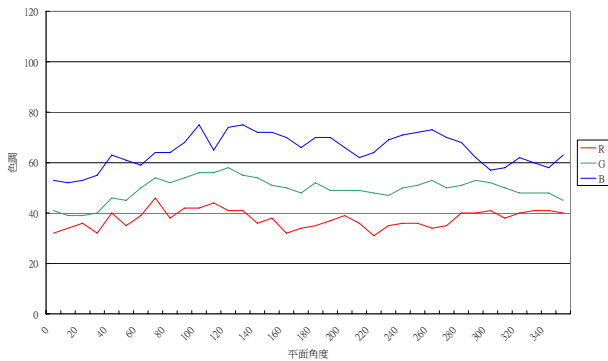
圓翅紫斑蝶



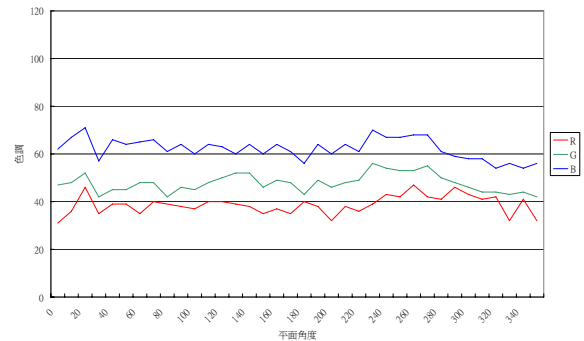
(仰角十度)



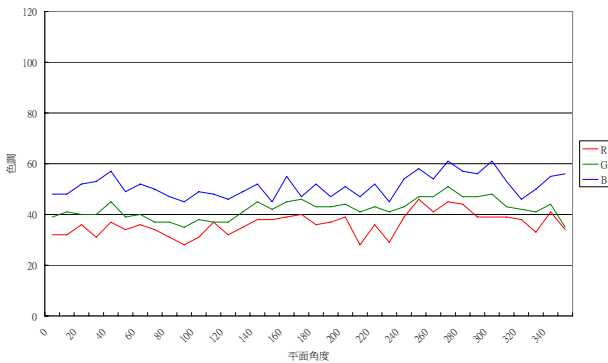
(仰角二十度)



(仰角三十度)



(仰角四十度)

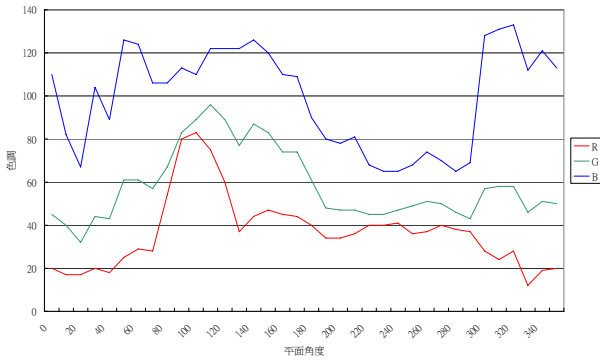


(仰角五十度)

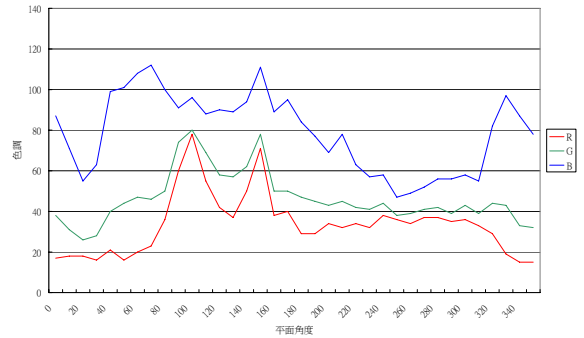
圖三 圓翅紫斑蝶幻色區域由仰角十度至仰角五十度之R G B值

【說明】整體而言 B 曲線無論在平面三百六十度皆高於 R、G 曲線，意即藍色較其他色明顯。隨著仰角的升高，圓翅紫斑蝶不僅 B 曲線（藍色即肉眼所見之色）降低，且 R、G 曲線也同時降低。亦即隨著仰角的升高，不單是幻色越趨模糊，且整體顏色趨於黯淡。

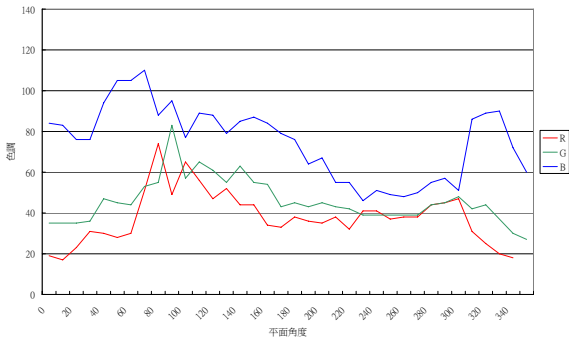
端紫斑蝶



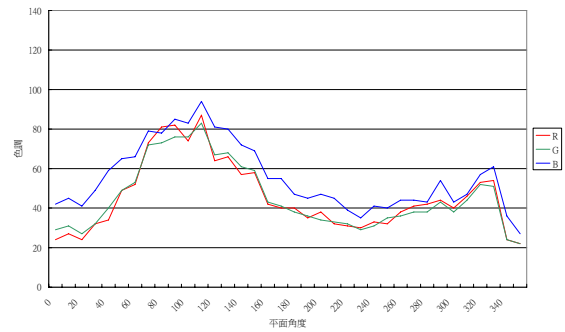
(仰角十度)



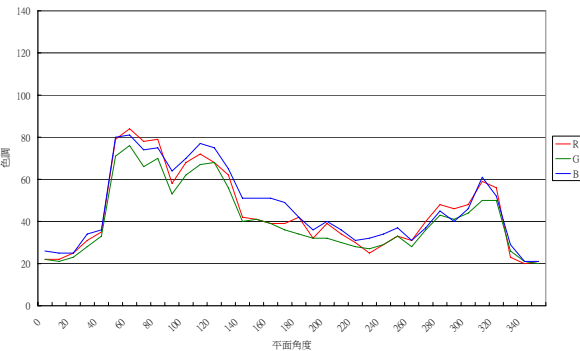
(仰角二十度)



(仰角三十度)



(仰角四十度)



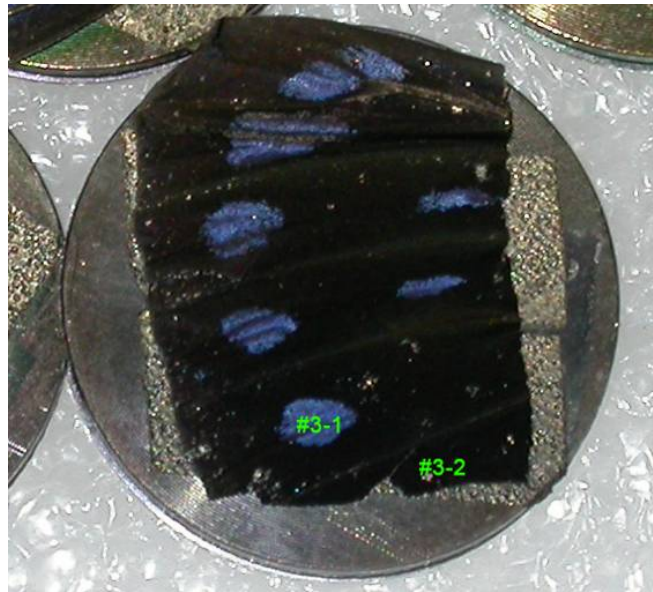
(仰角五十度)

圖四 端紫斑蝶幻色區域由仰角十度至仰角五十度之RGB值

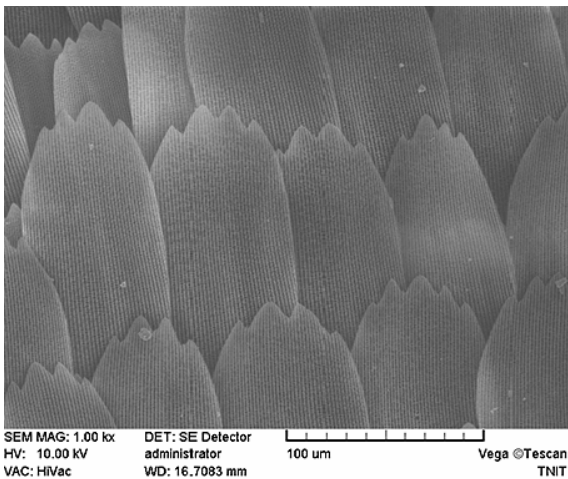
【說明】端紫斑蝶在仰角較低的時候，很明顯的可以看出B曲線遠高於R、G曲線，亦即此時幻色極為明顯。然而，隨著仰角的升高，整體的RGB值也降低，不僅幻色變得較不明顯，整體也變的較暗。而幻色區最明顯的平面角度並無大幅的改變。

結果：斑蝶中的紫斑蝶具有美麗的幻色，對人眼而言紫斑蝶其幻色的「色」即為藍或紫色。由擷取出幻色區域的RGB值可得知，隨著仰角的提升，不僅幻色逐漸變的較不明顯，連整體的顏色都較仰角較小時黯淡（RGB值「整體」若大，代表越接近白色，顏色越亮，應該反射出來的光線會較多）。並且，隨著仰角的增高，RGB值最高與最低之間的差異也漸漸縮小。鱗片會因為光線不同的照射情況而顯現出不同的顏色，而翅膀上不只有一種鱗片，因此才有幻色區域與無幻色區域之差別。鱗片在不同角度光照下，因為細微結構所造成的不同反射光，在巨觀下即可測得不同的RGB值。

(二) 以掃描式電子顯微鏡觀察紫斑蝶鱗片微構造並探討其物理色成因

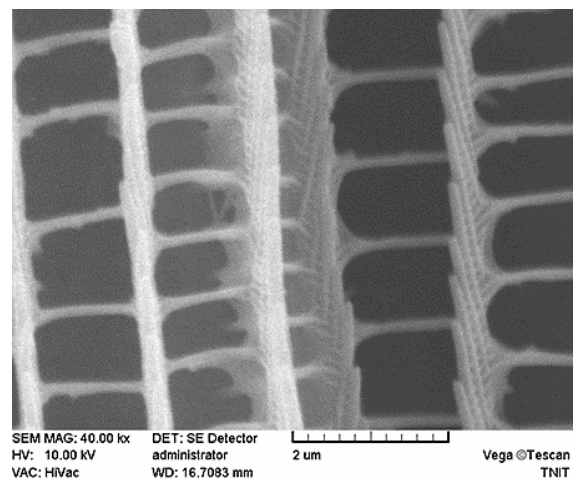


圓翅紫斑蝶取樣位置示意圖

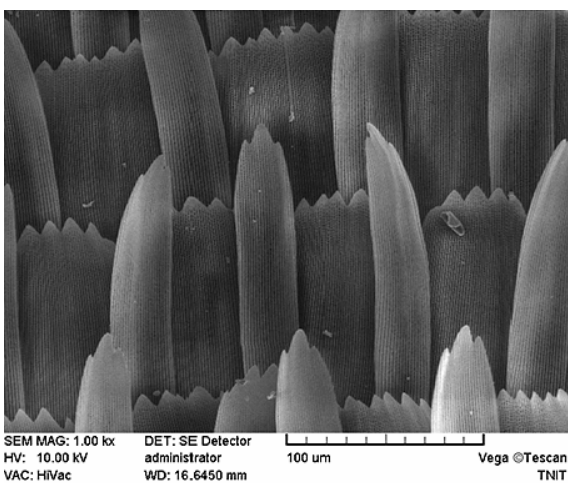


圓翅紫斑蝶 #3-1 (1000 倍)

【說明】寬圓鱗片緊密排列。

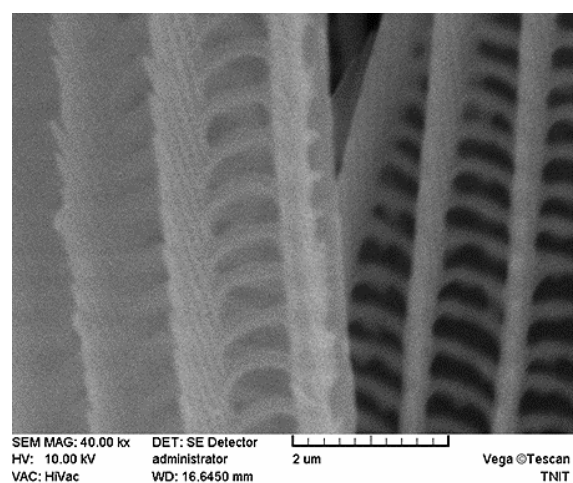


圓翅紫斑蝶 #3-1 (40000 倍)



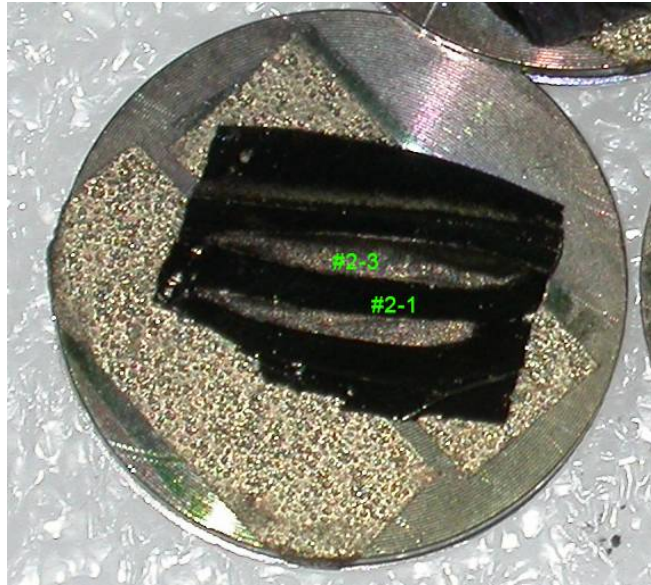
圓翅紫斑蝶 #3-2 (1000 倍)

【說明】寬圓與細長兩種鱗片緊密交錯排列。

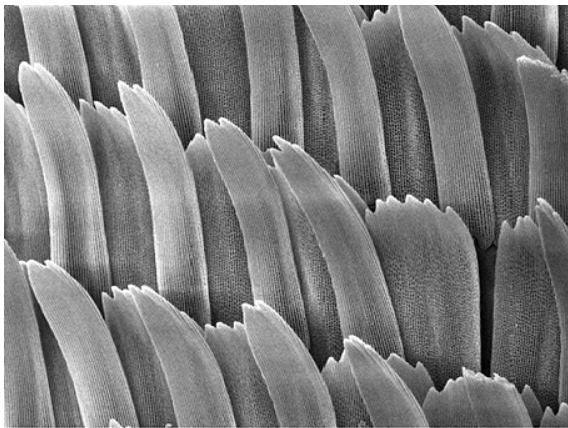


圓翅紫斑蝶 #3-2 (40000 倍)

圖五 以電子顯微鏡觀察圓翅紫斑蝶翅膀不同區域與不同倍率下的細微結構

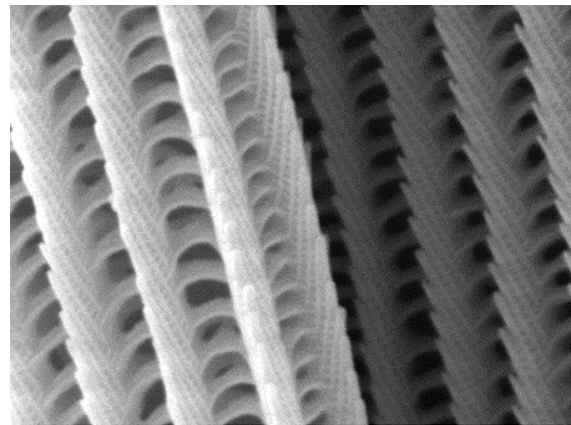


斯氏紫斑蝶取樣位置示意圖



SEM MAG: 1.00 kx DET: SE Detector
 HV: 10.00 kV administrator
 VAC: HiVac WD: 16.5033 mm 100 um Vega ©Tescan
 TNIT

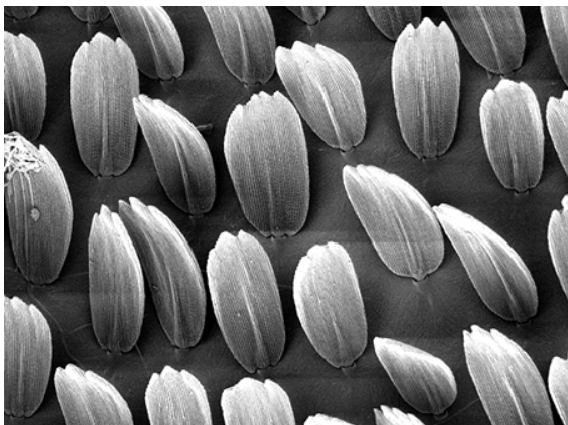
斯氏紫斑蝶 #2-1 (1000 倍)



SEM MAG: 40.00 kx DET: SE Detector
 HV: 10.00 kV administrator
 VAC: HiVac WD: 16.5033 mm 2 um Vega ©Tescan
 TNIT

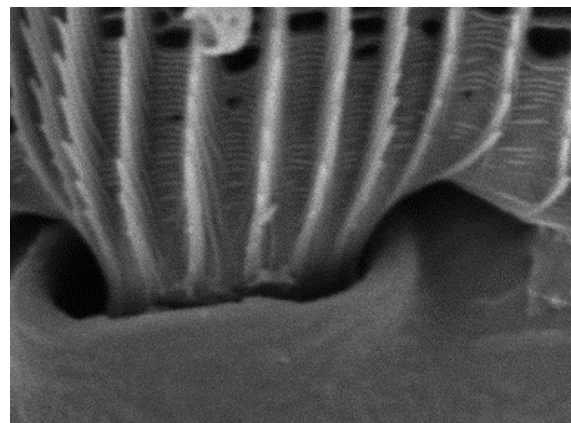
斯氏紫斑蝶 #2-1 (40000 倍)

【說明】寬圓與細長兩種鱗片緊密交錯排列。



SEM MAG: 1.00 kx DET: SE Detector
 HV: 5.00 kV administrator
 VAC: HiVac WD: 21.2890 mm 100 um Vega ©Tescan
 TNIT

斯氏紫斑蝶 #2-3 (1000 倍)

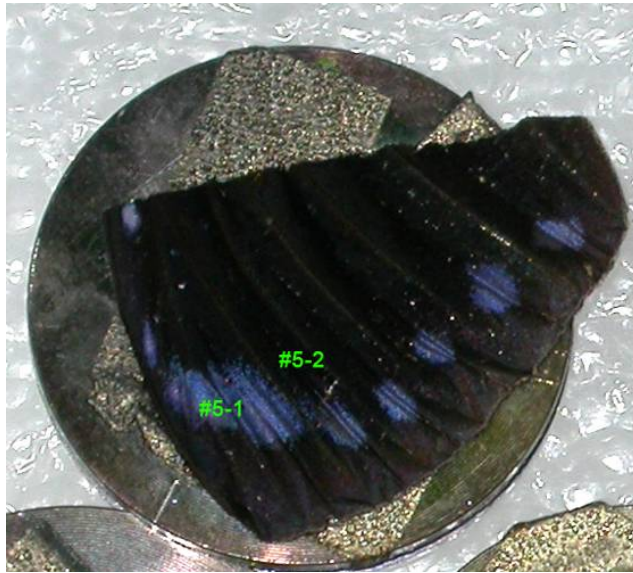


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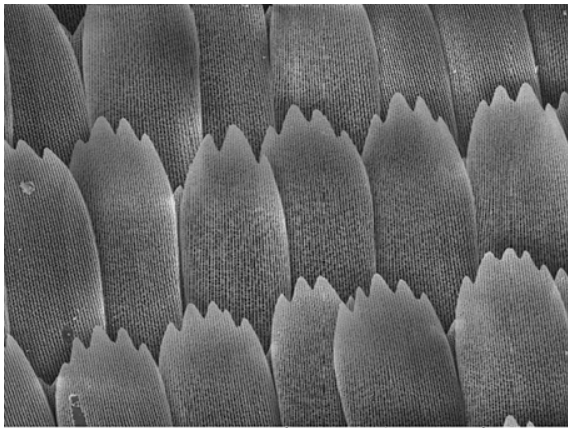
斯氏紫斑蝶 #2-3 (30000 倍)

【說明】寬圓鱗片及疏鬆排列。

圖六 以電子顯微鏡觀察斯氏紫斑蝶翅膀不同區域與不同倍率下的細微結構



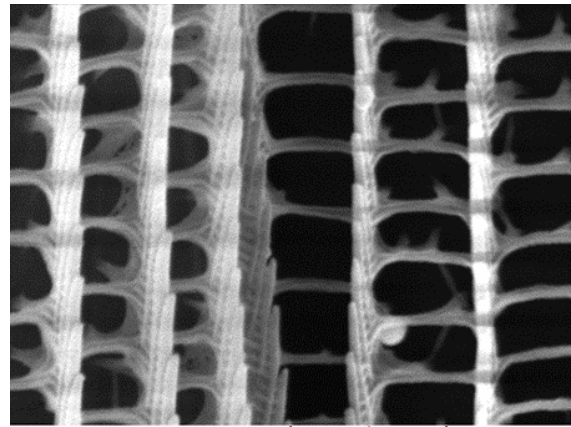
小紫斑蝶取樣位置示意圖



SEM MAG: 1.00 kx DET: SE Detector
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 TNIT

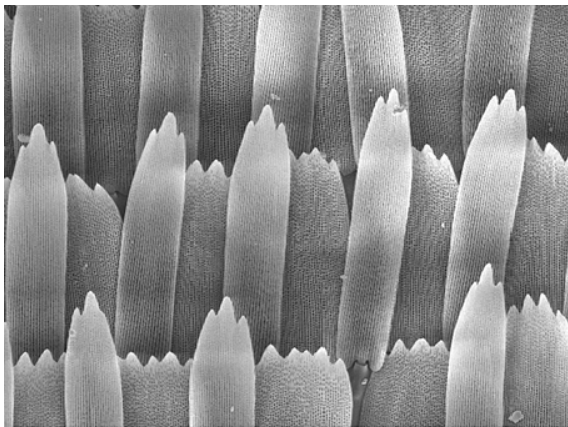
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【說明】寬圓鱗片緊密排列。



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 TNIT

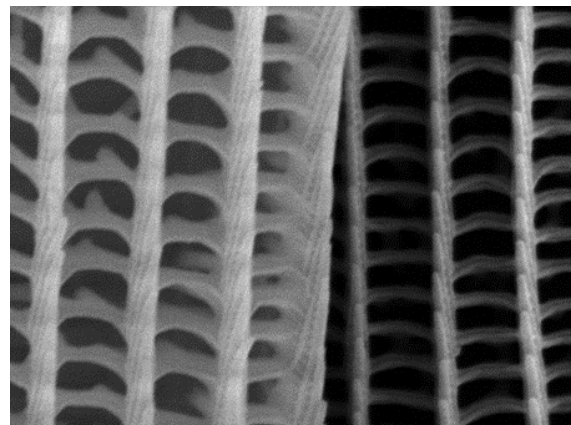
小紫斑蝶 #5-1 (40000 倍)



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 TNIT

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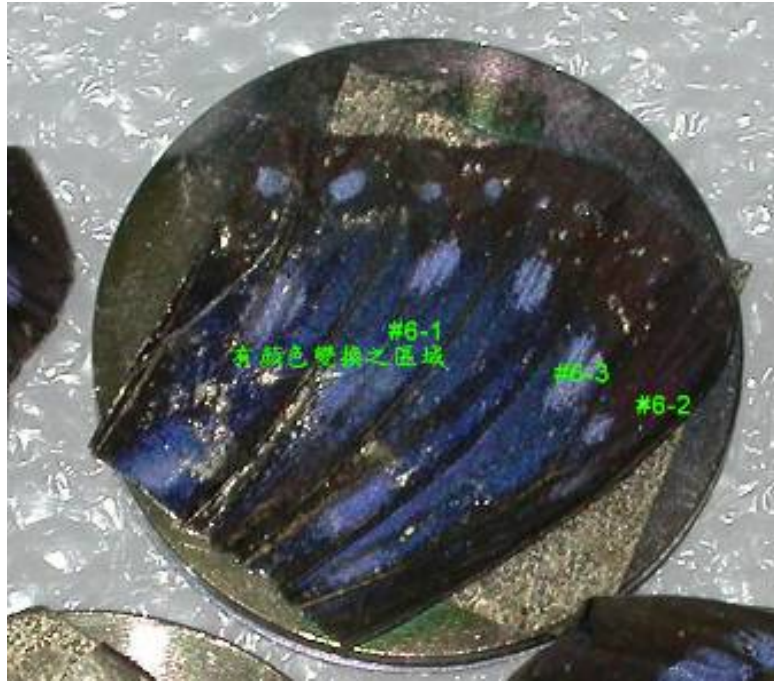
【說明】寬圓與細長兩種鱗片緊密交錯排列。



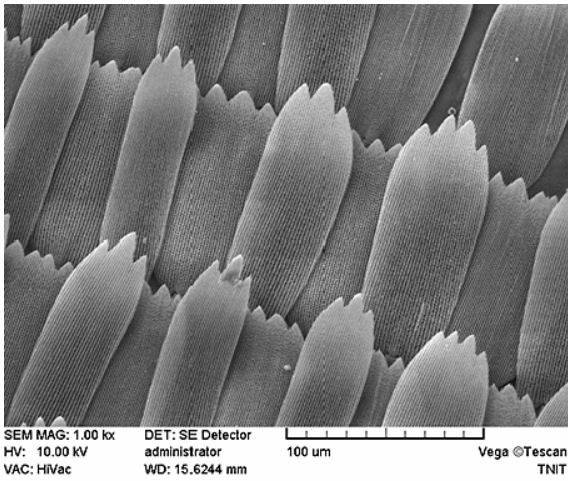
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 TNIT

小紫斑蝶 #5-2 (40000 倍)

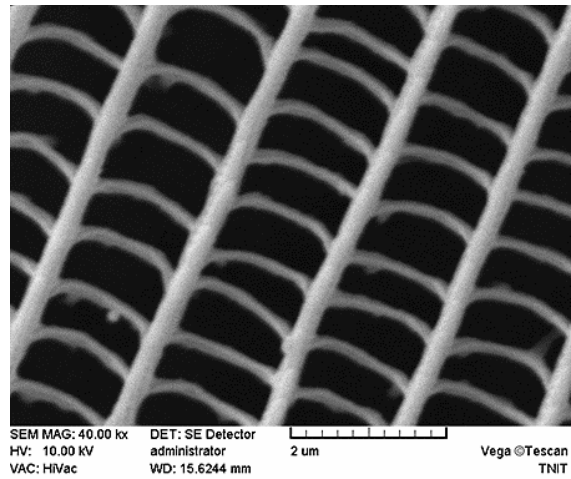
圖七 以電子顯微鏡觀察小紫斑蝶翅膀不同區域與不同倍率下的細微結構



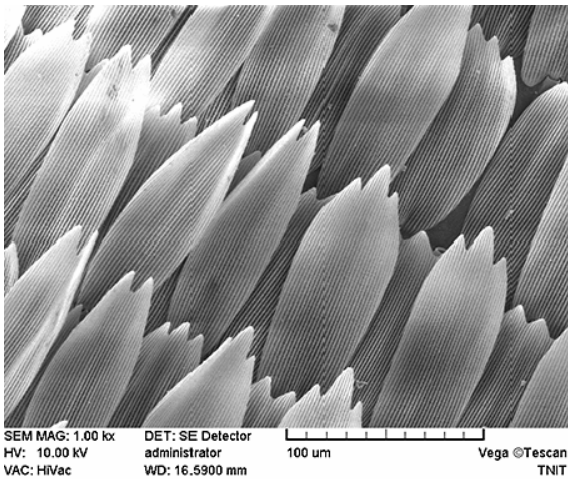
端紫斑蝶取樣位置示意圖



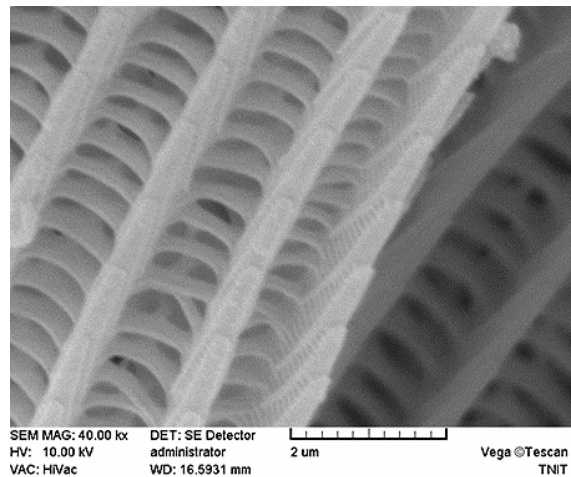
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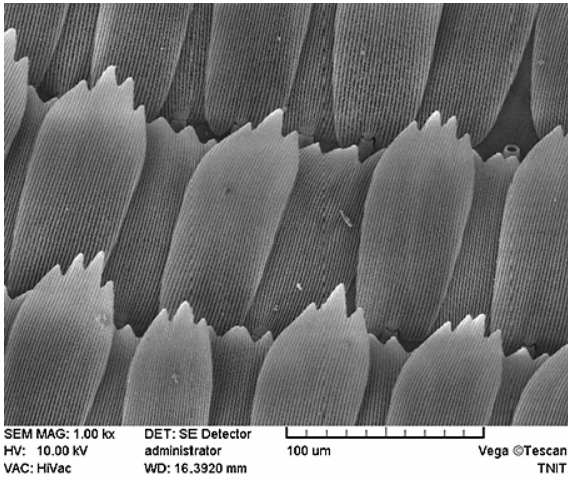
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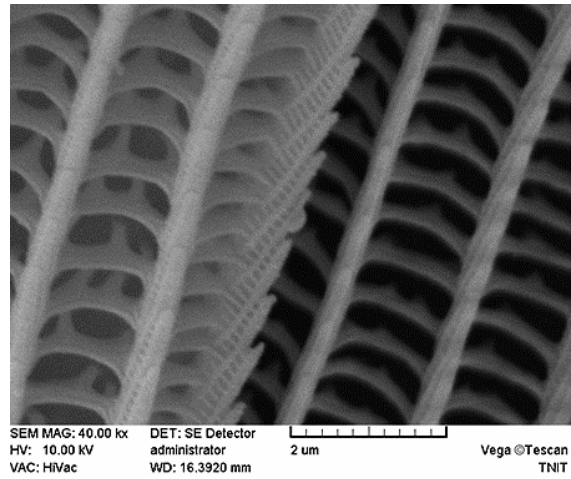
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端紫斑蝶 #6-2 (40000 倍)



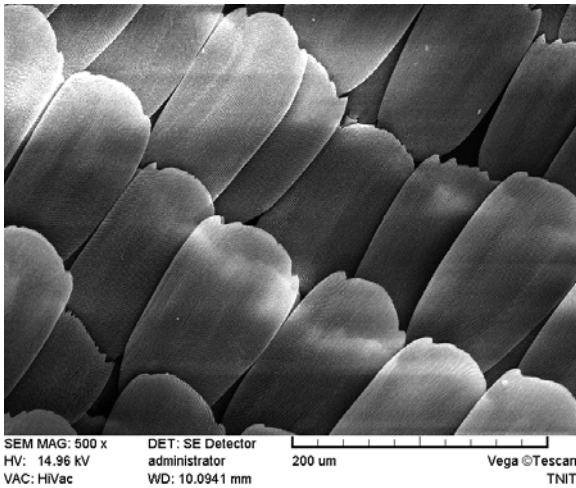
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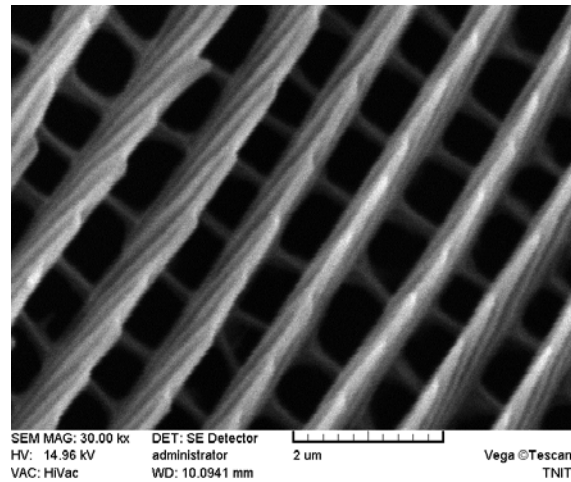
端紫斑蝶 #6-3 (40000 倍)

圖八 以電子顯微鏡觀察端紫斑蝶翅膀不同區域與不同倍率下的細微結構

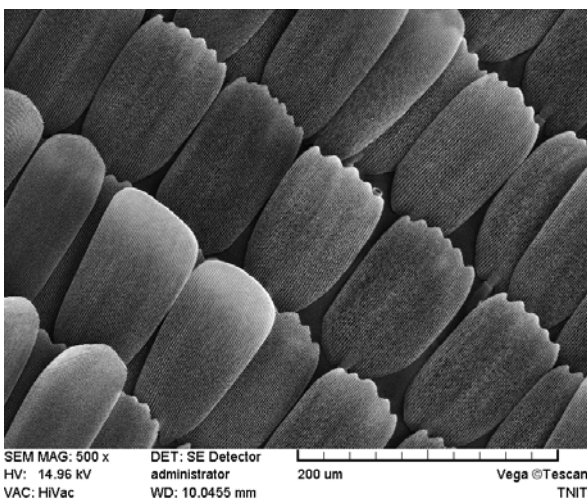
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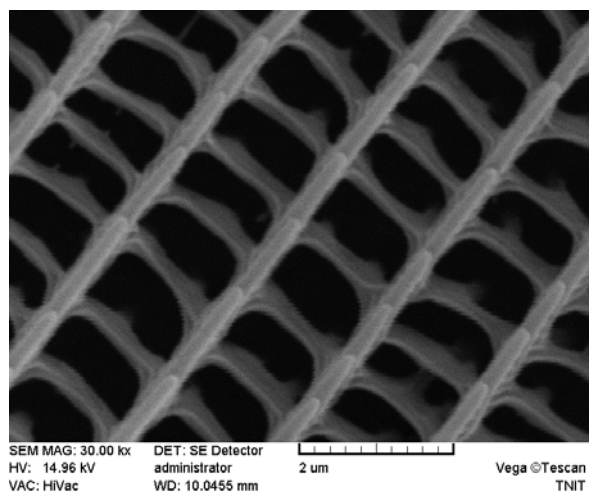
紫蛇目蝶 #非幻色區 (500 倍)



紫蛇目蝶 #非幻色區 (30000 倍)

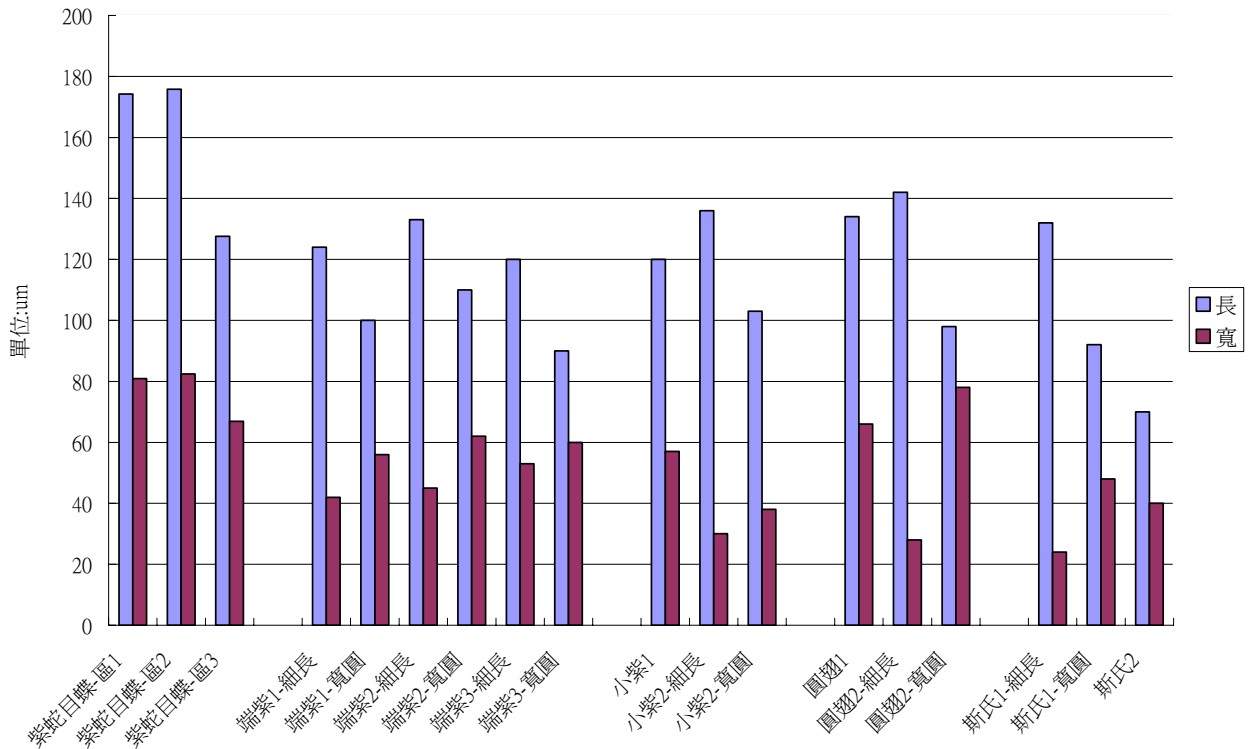


紫蛇目蝶 #幻色區 (500 倍)



紫蛇目蝶 #幻色區 (30000 倍)

圖九 以電子顯微鏡觀察紫蛇目蝶翅膀不同區域與不同倍率下的細微結構



圖十 鱗片大小比較

結果：我們認為紫斑蝶幻色與無幻色區域的差別乃因其翅膀細微結構與排列方式不同所造成。具有幻色區域其細微結構不論格子狀的大小或格子狀的排列方式均相似(例如：圓翅紫斑蝶#3-1、小紫斑蝶#5-1、端紫斑蝶#6-1 與#6-3)。另外，四種紫斑蝶的翅膀上亦具有自己獨特的鱗片。即使同為紫斑蝶，皆具有幻色的特徵，但在掃描式電子顯微鏡下可明顯看到不同區域具有不同的鱗片排列：可能是單一種鱗片緊密排列、兩種以上鱗片交錯排列彼此有間距不規則散佈、抑或是彼此交疊重合。我們也發現，在無幻色區域中擷取的影像明顯由兩種（細長與寬圓形狀）鱗片構成，幻色區乃由同種寬圓鱗片組成。並且，鱗片排列的疏密程度又因不同種紫斑蝶而異。由此我們推論幻色與無幻色的因素的確不單單只是鱗片在形狀、大小的不同，鱗片分布的位置、疏密、重疊程度，甚至是鱗片傾斜的角度等種種物理性質皆有可能影響到其在陽光下所反射至外界的不同色彩，而幻色明顯程度也隨著先前所提到「蝴蝶拍翅時的角度」而有所差異。我們推論紫斑蝶幻色之差異性乃肇因於鱗片的結構與排列方式所造成。

幻色現象乃因為鱗片反射不同角度的入射光時，鱗片上物理性質的不同而造成。有的鱗片既寬且圓、邊緣具鋸齒狀；有的鱗片則是細窄且尖端明顯。同時，我們所觀察到的翅膀無論是靠近前緣、邊緣、還是近身體基部多皆有不同的鱗片同時存在一有的緊密排列，有的彼此有較大的間距。基本上，我們先前曾設想是否因為蝴蝶飛行時是前翅前原先接觸到風，所以可能導致此部位的鱗片種類與分布等較其他部位為不同；然而，經由比較後我們僅發現：鱗片的分布並沒有隨著取樣部位的不同而有明顯的改變，大部分的區域皆同時擁有兩種以上的鱗片緊密交錯排列，由寬圓和細長的鱗片相互交疊而成，而少部位由單一種鱗片構成。同一種顏色區域不單單由同一種顏色也同形狀的鱗片所構成，可能由不同種形狀的鱗片交互排列而成。此外，並非肉眼所見白色區域即由白色等淺色鱗片組成，它可能尚有其他黑色等較深色的細長鱗片散落其中。同時，我們也發現

鱗片頂端的鋸齒狀也是會隨鱗片不同而有所差異的，例如細長的鱗片鋸齒可能有二到四個，而較寬圓的鱗片則是有多個起伏較平緩的鋸齒，更是有所謂尖細無鋸齒的、渾圓無鋒利處的。較近邊緣的區域分布著寬圓與細長的鱗片緊密交錯排列，而內部偏單一種寬圓鱗片排列。我們推想是否較細長、較尖與寬圓鱗片交錯排列的區域在飛行時能產生較大的阻力，可能與其位於邊緣區域有關。而翅膀上則會因為鱗片是多種同時存在、重疊排列、傾斜角度不同而無法做單一比較。僅能肯定的是：翅膀上的確是有許多不同的鱗片，彼此在色彩（反射入射光）、形狀（寬圓、尖細等）、構造（鋸齒狀頂端）有可辨識的差異，此乃需要更精確、更深入的探討與研究。（由於我們的實驗器材有限，因此我們無法對鱗片排列情形進行精密的測量區分，因此只能以現有的器材，進行較為主觀的判斷）。

另外，經由 SEM 照片的觀察，我們發現紫蛇目蝶的幻色區亦具有單一種鱗片構成的規則性，非幻色區則有兩種鱗片，與紫斑蝶相同。在幻色區之中，有末端圓弧形左右各帶一個鋸齒的鱗片重疊排列，此在其他種紫斑蝶的幻色區內並沒有出現相似的鱗片。而在非幻色區中，則有末端圓滑形及具鋸齒狀的兩種鱗片交錯排列。

(二)討論

由於蝴蝶飛行的機制極複雜，故本實驗均以蝴蝶翅膀標本為材料，並非取用活體進行檢測，以期單純探討鱗片特性與顏色、幻色之間的相關。我們認為斑蝶的鱗片排列情形除了會影響幻色之外，可能對其飛行也會造成影響。因為整體而言，鱗片排列的方向沿翅膀與身體垂直、從翅膀基部延伸至翅緣，途中因翅脈形成不同的區隔，造成排列角度的偏斜（非一直與身體垂直九十度延伸），而且每隻蝴蝶的翅膀生長時與身體並不呈現一定的角度。同時，鱗片尚會隨著不同的區塊（顏色、翅脈分隔區間等）而有不同的重疊高度，這也會影響到我們幻色實驗中所產生的不同色彩。

經由紫蛇目蝶的 SEM 與其他四種紫斑蝶的照片比較後，我們發現即使是親源較遠的紫蛇目蝶也具有幻色區為單一種鱗片排列，於是推測蝴蝶的幻色也許是一種特化的鱗片形成的，而不是由不同種、不同顏色等的鱗片所共同形成的。

生物微結構的研究是生物模仿學中重要的研究之一。在自然界中，生物微結構扮演著重要的角色。如 *Morpho sulkowskyi* 此種蝶類，其翅膀上之微結構會因為光線不同的照射情況而顯現出不同的顏色，此種特性提供了 *Morpho sulkowskyi* 自我保護及警告天敵之能力。此外，微結構的另一項功能則為自我清潔能力，*Morpho sulkowskyi* 翅膀可因此種特殊之結構而提高其表面的疏水性，使其翅膀上的水珠易於排除而不至於影響其飛行。部份的植物與雁、鴨等動物類似的自清潔機制：雁鴨的羽毛表面主要組成成份亦為油脂類，而羽毛的層狀微結構中又藏有空氣，所以雁鴨即使在水中也不會弄濕羽毛，不會造成其飛行時的阻力，在空中飛翔時更可藉此來降低與空氣間的摩擦力，使飛行時更省力。而蝴蝶翅膀的微小構造皆有像蓮花般的粗糙結構，其粗糙度比較均勻，經光照反射形成亮麗的顏色與奈米粗糙度有相當的關聯性，故翅膀表面微結構仍是影響我們實驗結果的主要變因之一。

四、結論與應用

(一)結論

- 一、不同紫斑蝶之間相對於人眼的幻色程度又有所不同，隨著仰角的提升，不僅幻色逐漸變的較不明顯，連整體的顏色都較仰角較小時黯淡。而且，仰角越高，越難辨識其幻色與不幻色的差別。
- 二、翅膀之所以有幻色現象則是因鱗片等微結構的不同。其中圓翅紫斑蝶、小紫斑蝶在幻色區域是由同種較寬圓的鱗片排列而成，無幻色區由細長與寬圓鱗片交錯排列而成；端紫斑蝶則是皆由兩種鱗片交錯排列；斯氏紫斑蝶則在無幻色區域是由兩種較寬圓的鱗片交錯排列而成，幻色區由寬圓鱗片排列而成。
- 三、紫蛇目蝶的幻色區亦具有單一種鱗片構成的規則性，非幻色區則有兩種鱗片，與紫斑蝶相同。在幻色區之中，有末端圓弧形左右各帶一個鋸齒的鱗片重疊排列，此在其他種紫斑蝶的幻色區內並沒有出現相似的鱗片。而在非幻色區中，則有末端圓滑形及具鋸齒狀的兩種鱗片交錯排列。

(二)未來展望

- 一、以掃描式電子顯微鏡進行更多其他種斑蝶的鱗片分析，進而比較其微結構與飛行時造成的阻力之關係。

五、特別感謝

- 一、台灣蝶會研究員詹家龍先生提供斑蝶樣本及斑蝶遷徙相關資料。
- 二、東南技術學院李志偉教授提供掃描式電子顯微鏡。
- 三、牛伯伯蝴蝶園區提供蝴蝶諮詢。

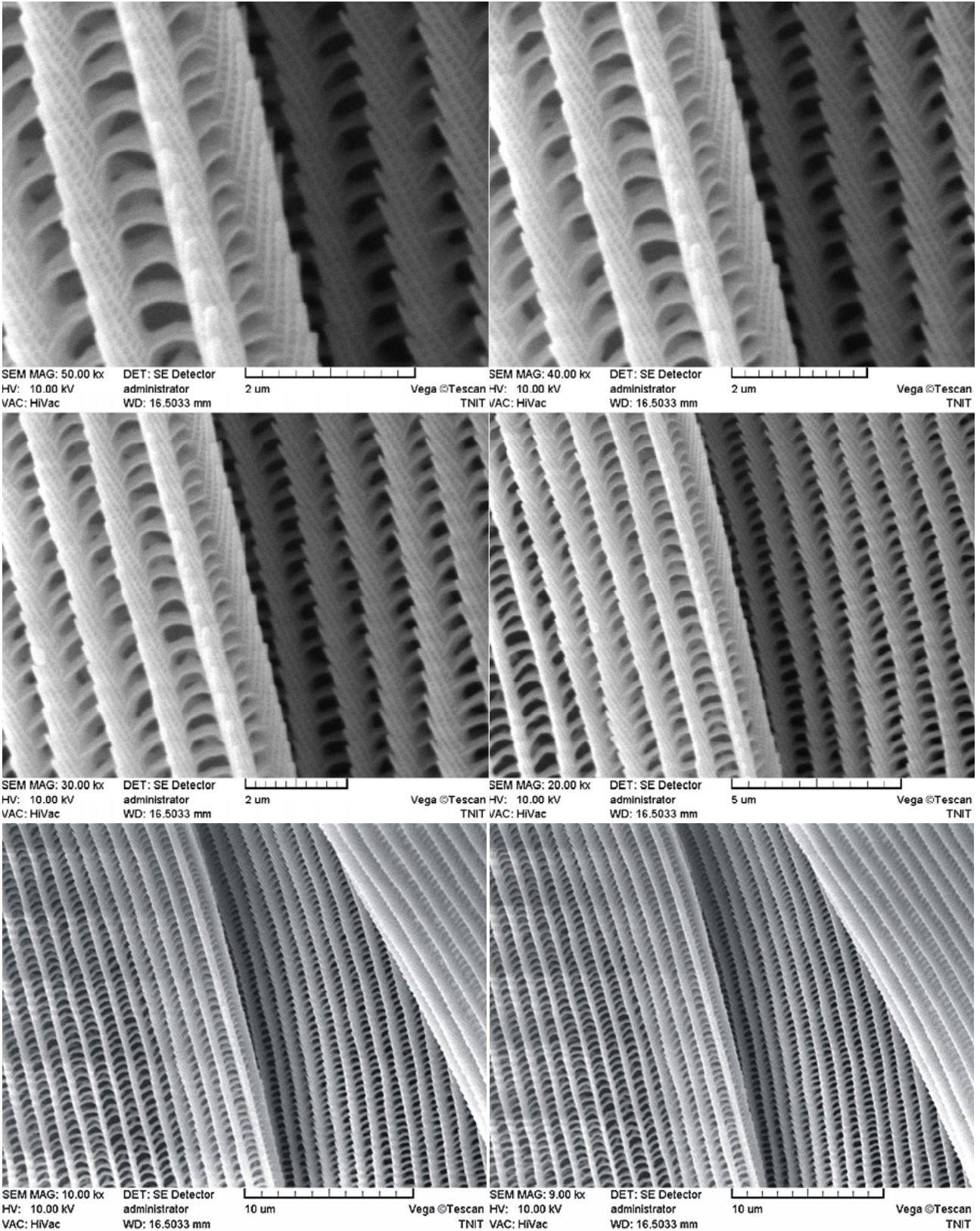
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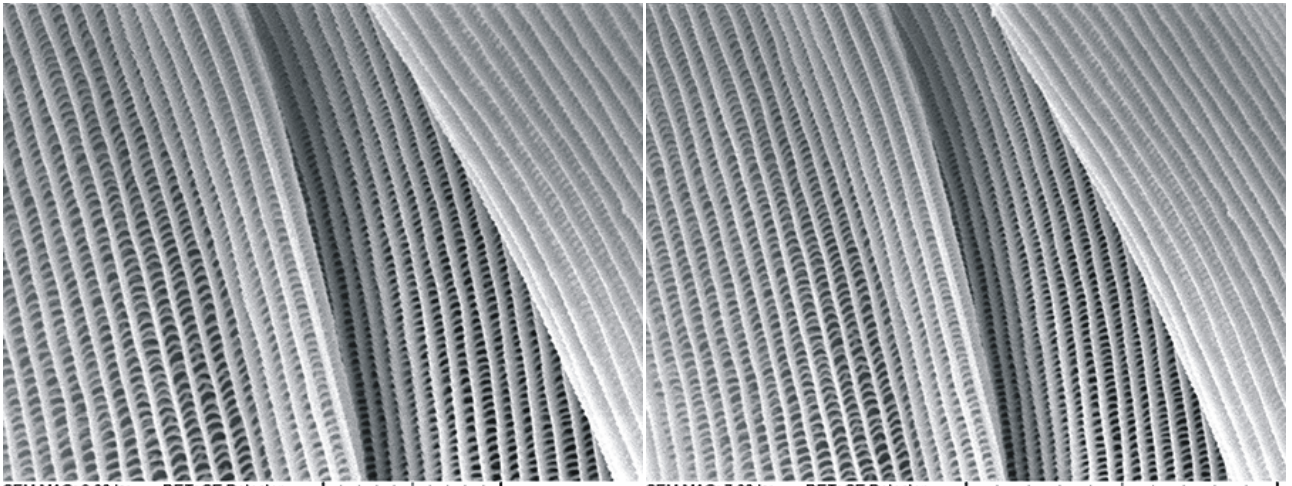
附錄

斯氏紫斑蝶 #2-1

2-1

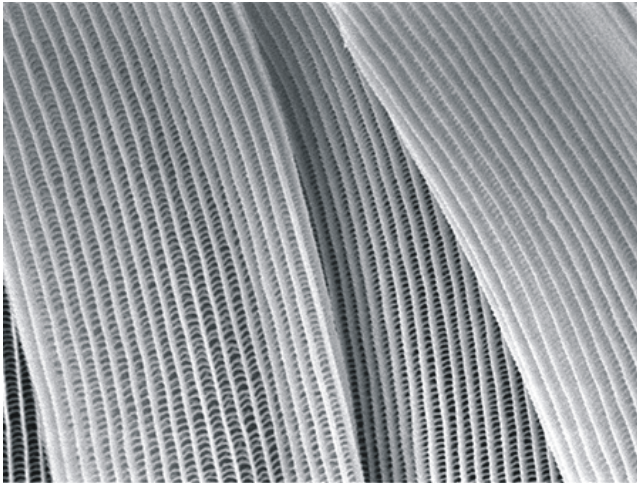


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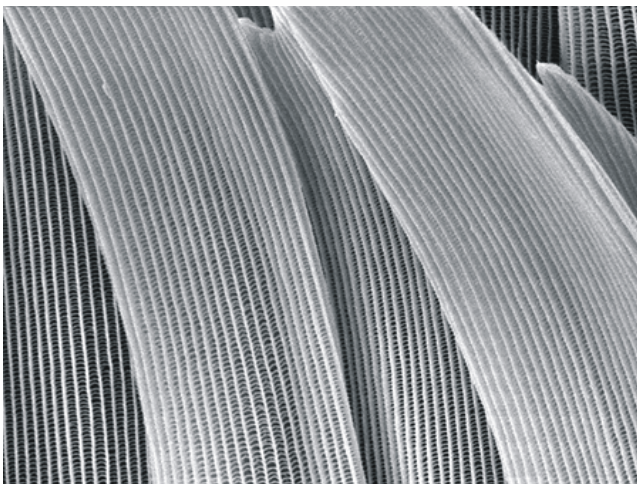
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Vega ©Tescan TNIT



SEM MAG: 6.00 kx
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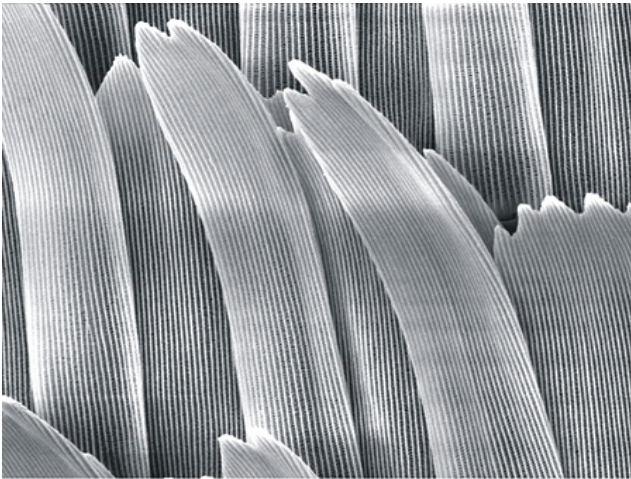
Vega ©Tescan TNIT
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Vega ©Tescan TNIT



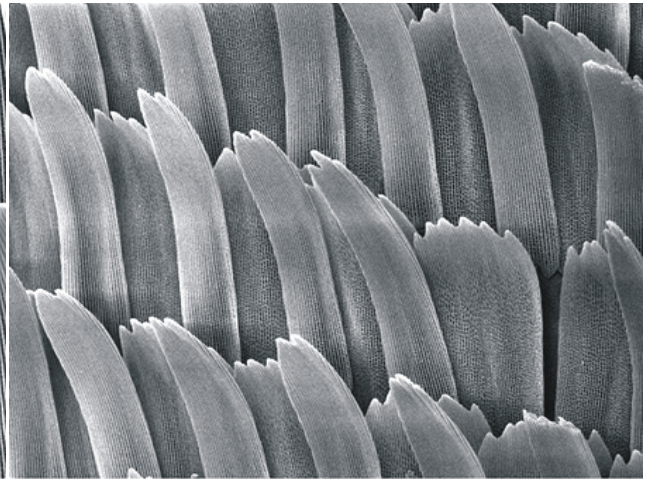
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Vega ©Tescan TNIT
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Vega ©Tescan TNIT

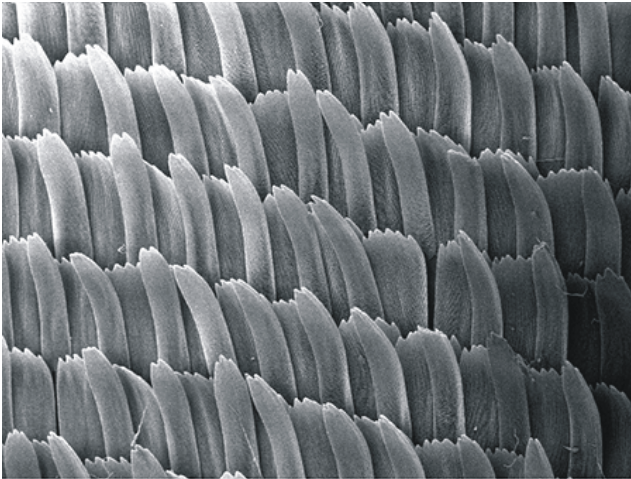
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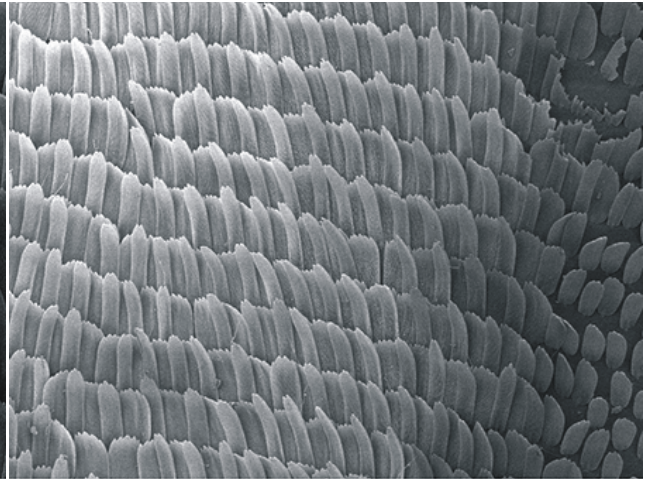
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Vega ©Tescan
TNIT



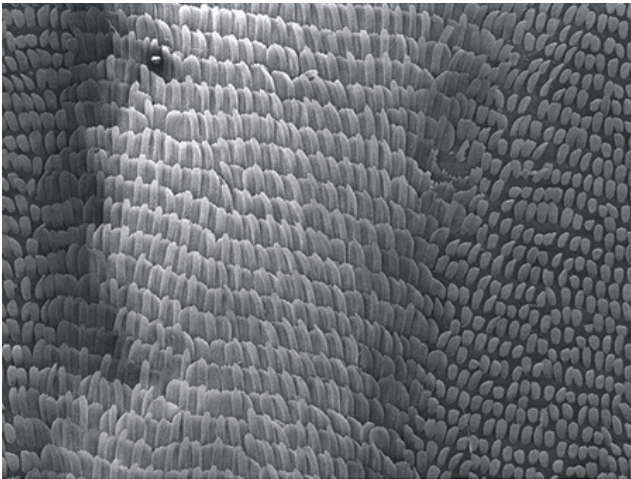
SEM MAG: 1.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.5033 mm
100 um
Vega ©Tescan
TNIT



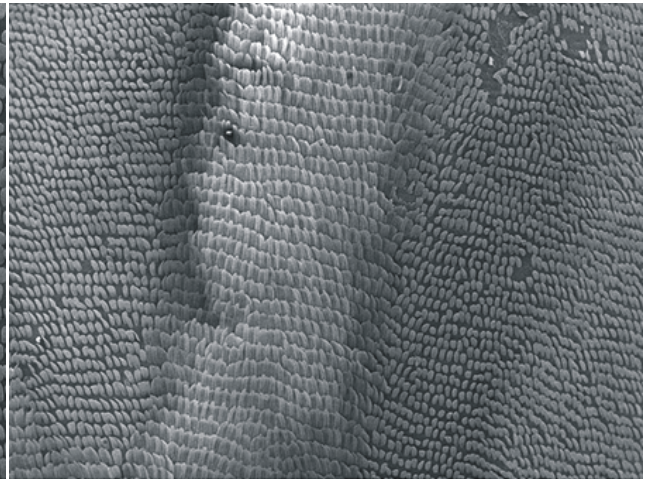
SEM MAG: 500 x
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.5033 mm
200 um
Vega ©Tescan
TNIT



SEM MAG: 250 x
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.5033 mm
500 um
Vega ©Tescan
TNIT



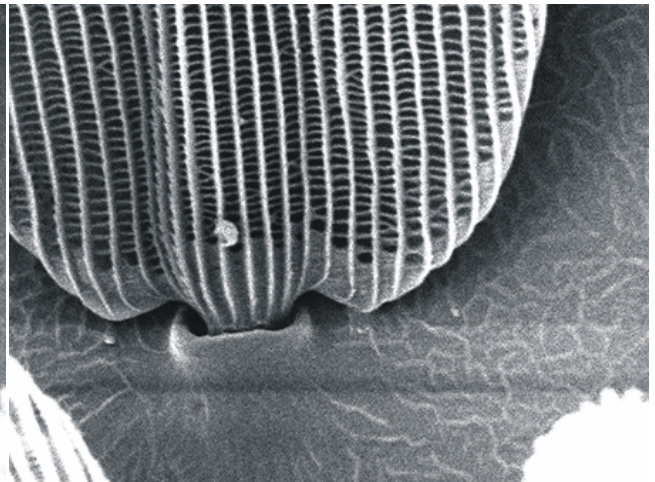
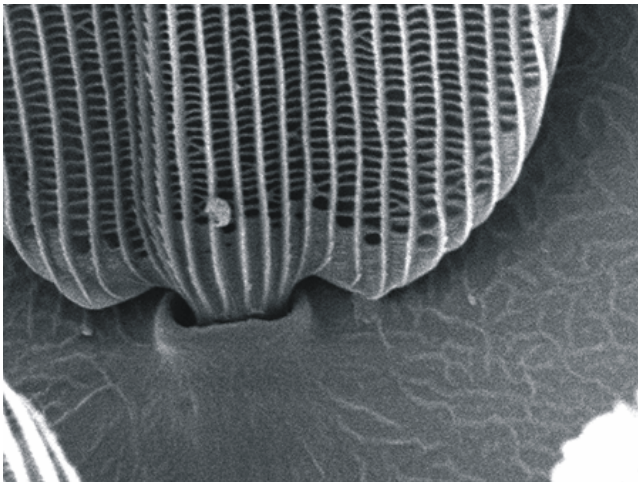
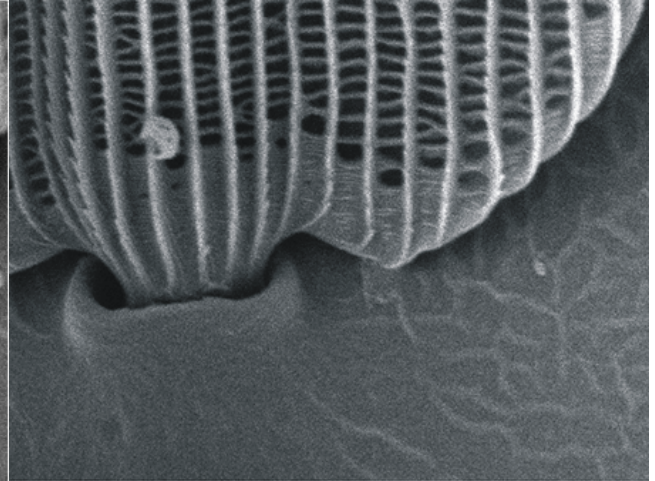
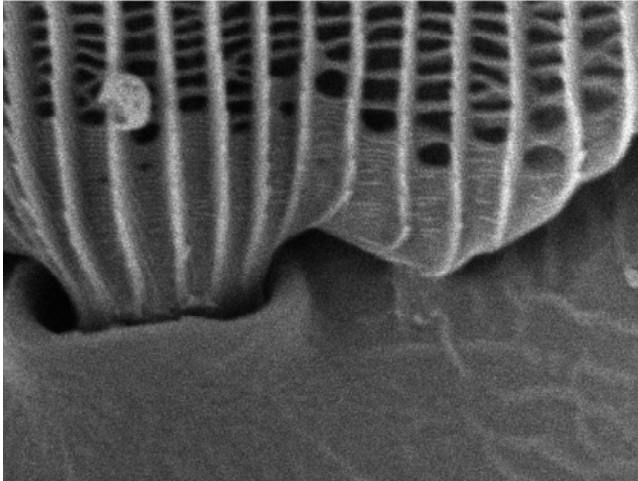
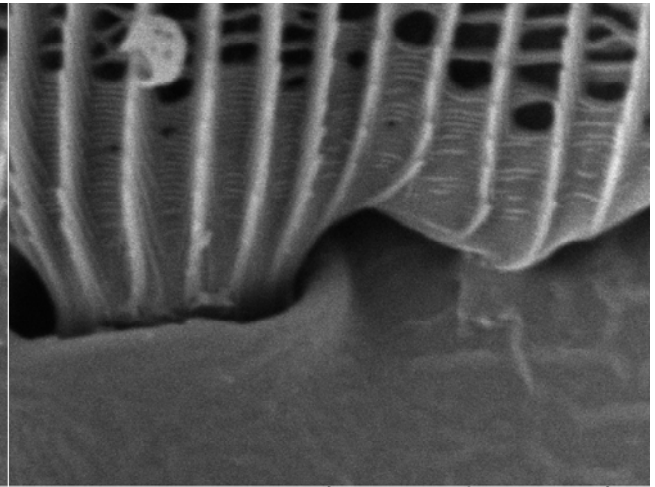
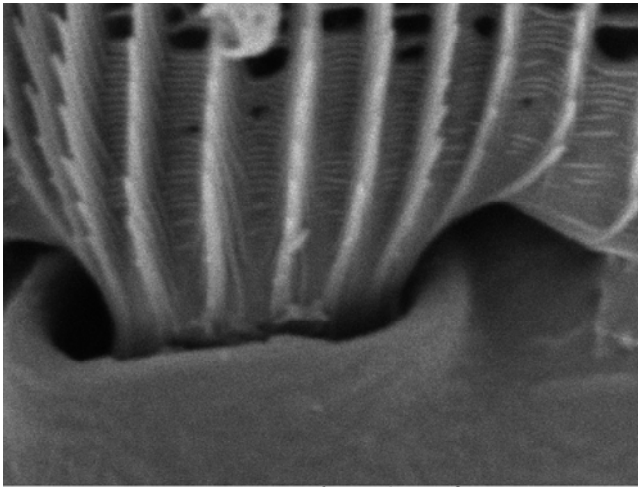
SEM MAG: 125 x
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.5033 mm
1 mm
Vega ©Tescan
TNIT

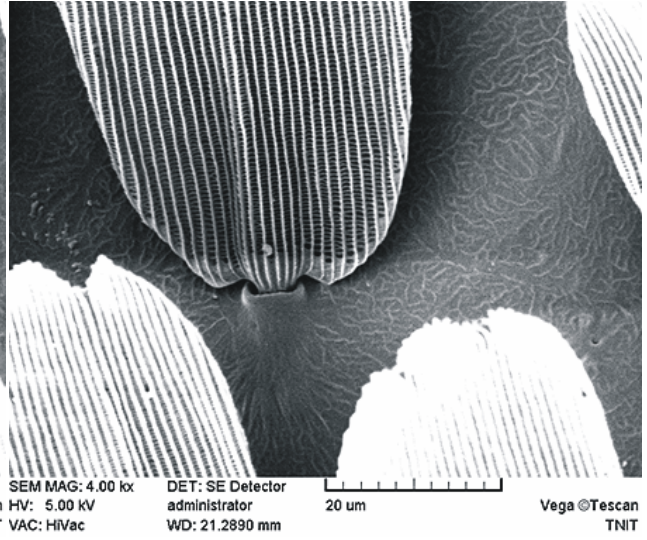
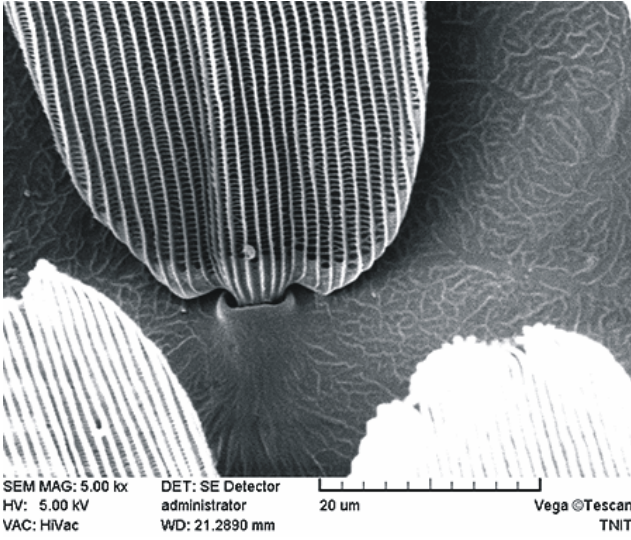
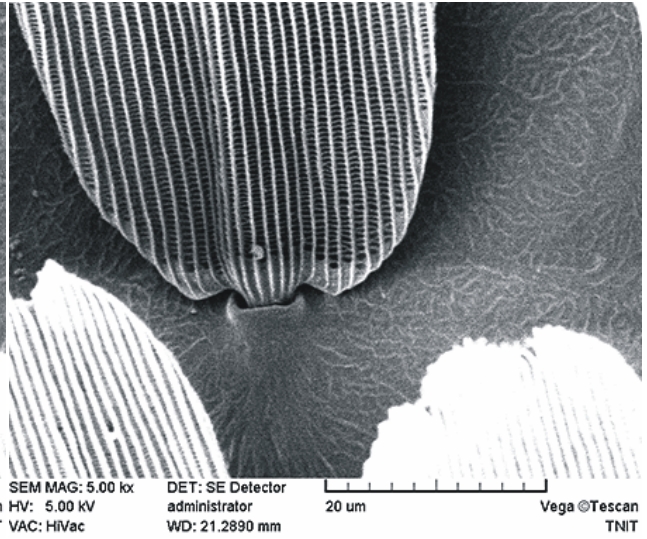
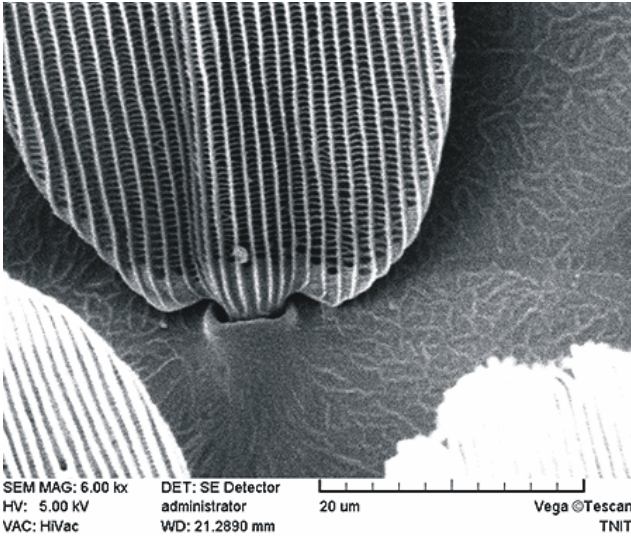
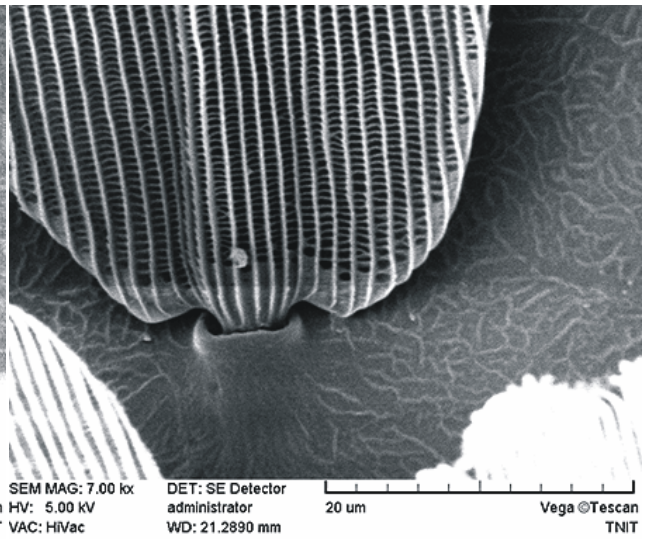
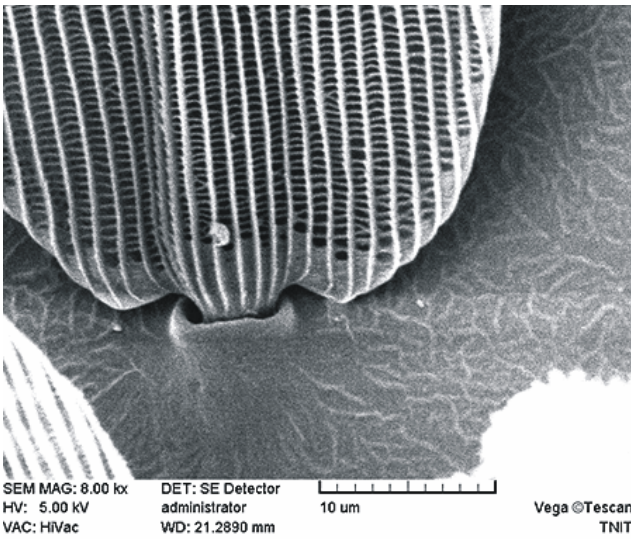


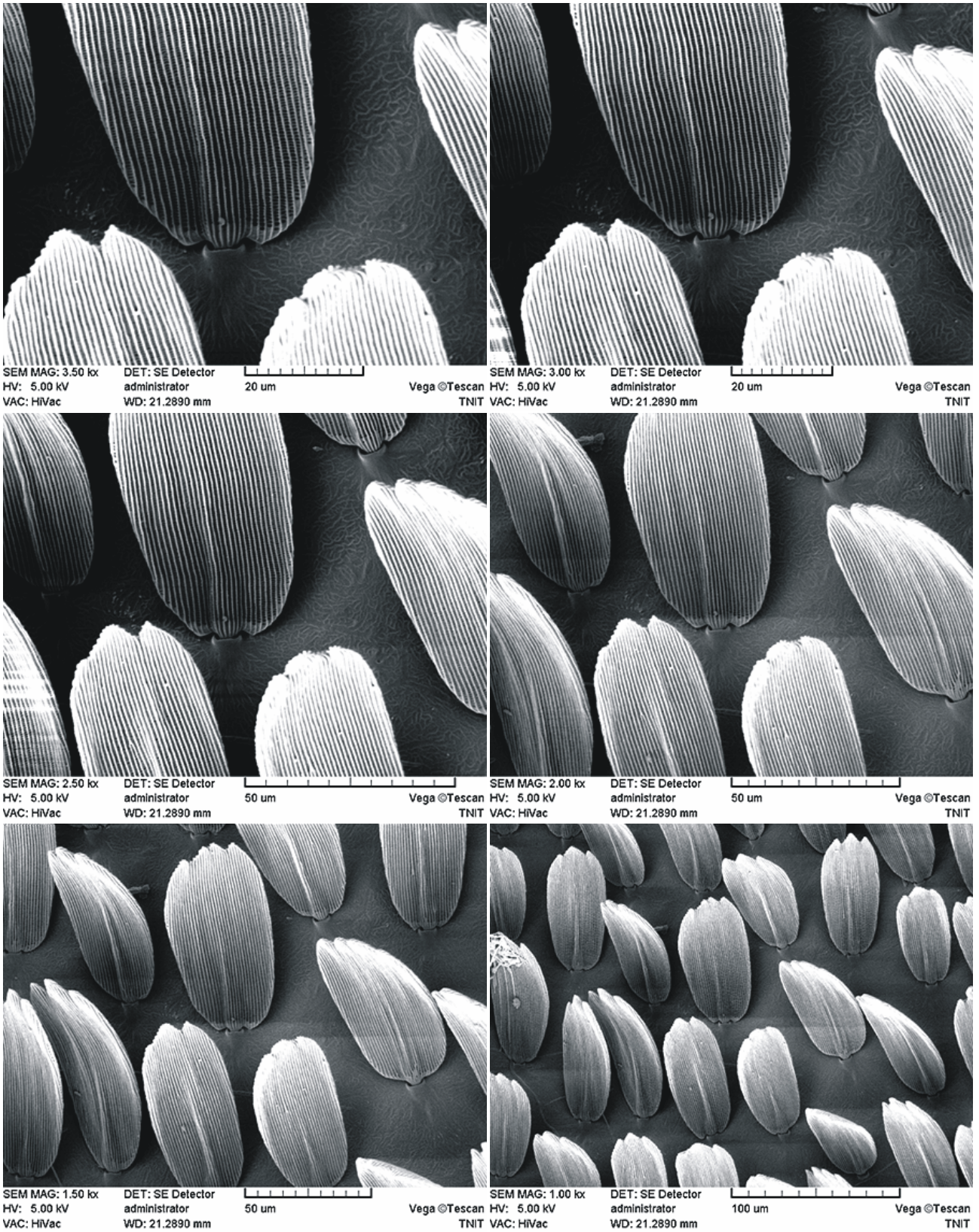
SEM MAG: 74 x
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.5033 mm
1 mm
Vega ©Tescan
TNIT

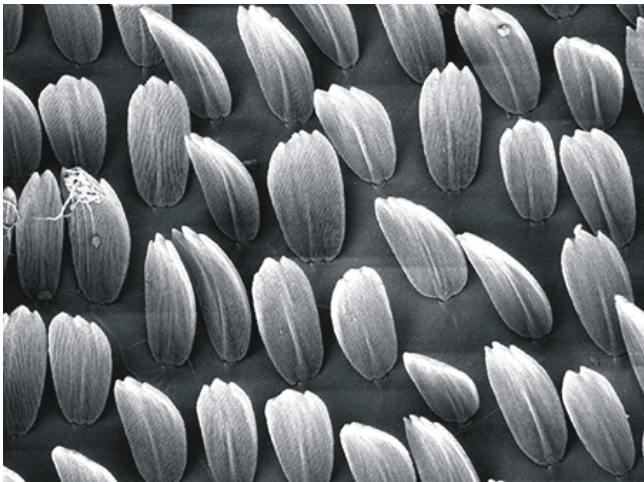
斯氏紫斑蝶 #2-3

2-3



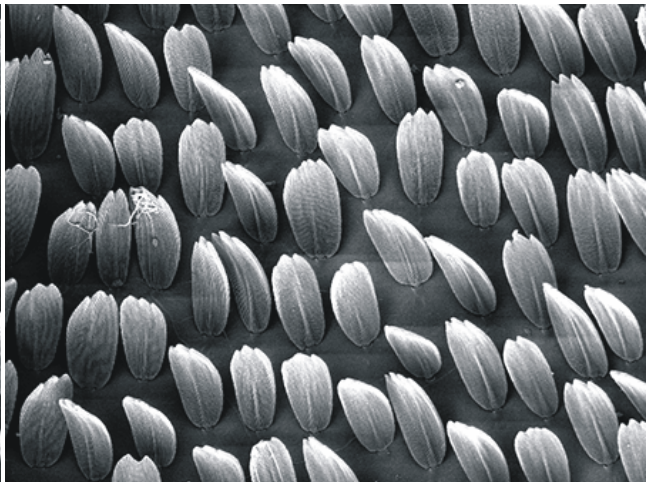






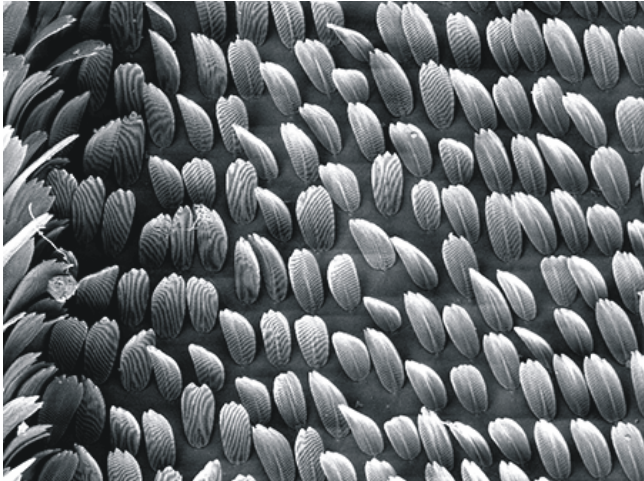
SEM MAG: 800 x
HV: 5.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 21.2890 mm
100 um

Vega ©Tescan
TNIT



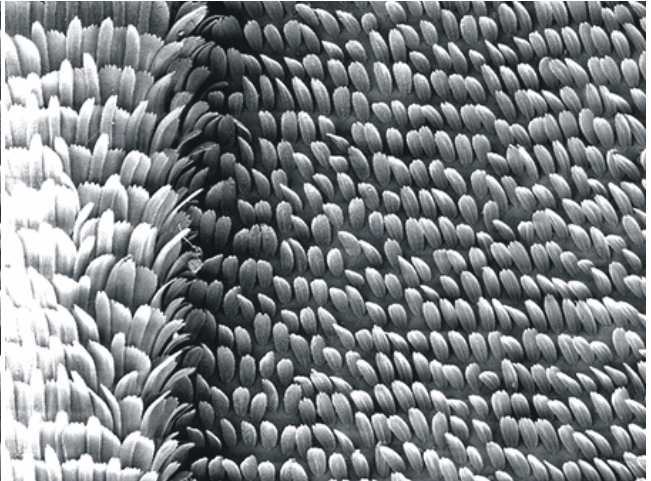
SEM MAG: 600 x
HV: 5.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 21.2890 mm
200 um

Vega ©Tescan
TNIT



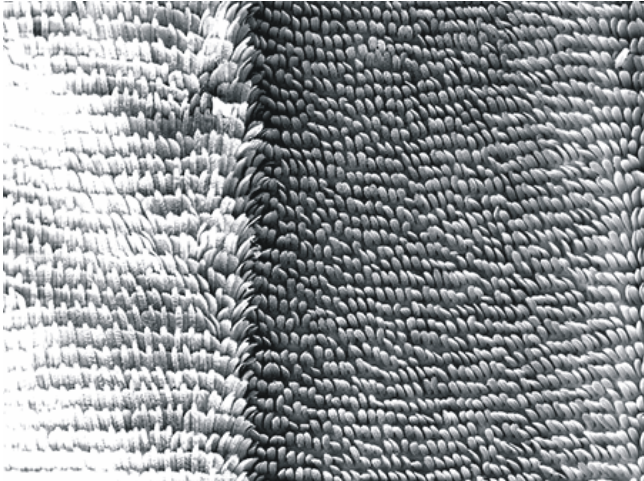
SEM MAG: 400 x
HV: 5.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 21.2890 mm
200 um

Vega ©Tescan
TNIT



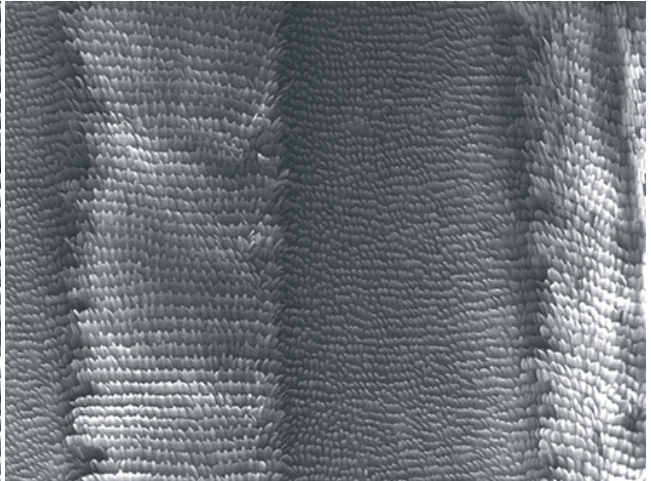
SEM MAG: 200 x
HV: 5.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 21.2890 mm
500 um

Vega ©Tescan
TNIT



SEM MAG: 100 x
HV: 5.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 21.2890 mm
1 mm

Vega ©Tescan
TNIT

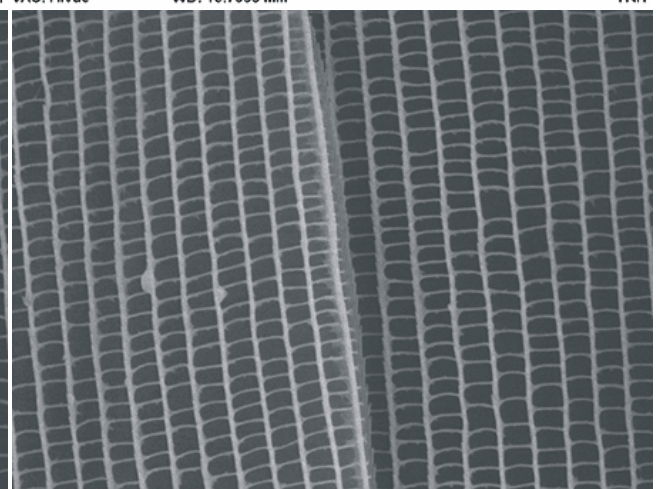
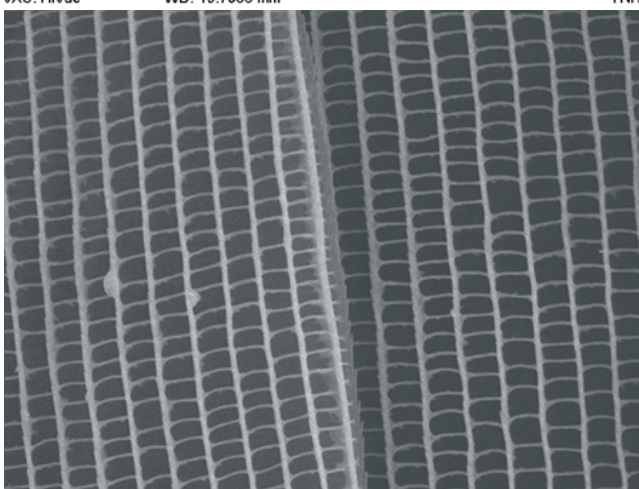
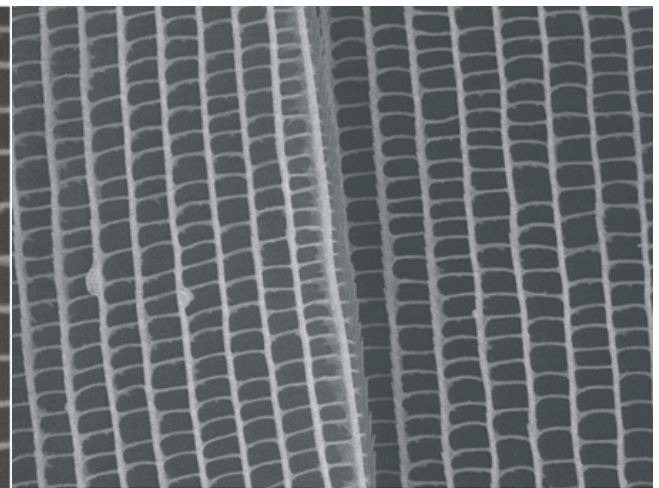
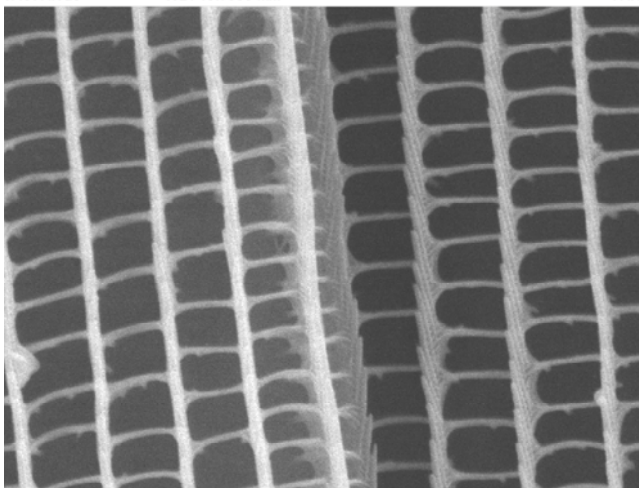
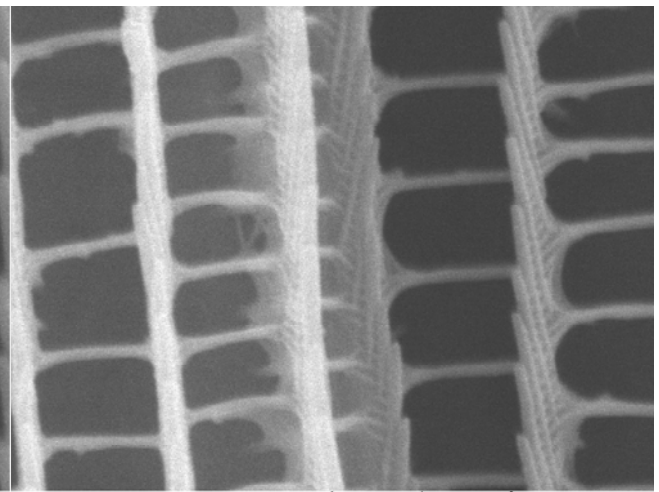
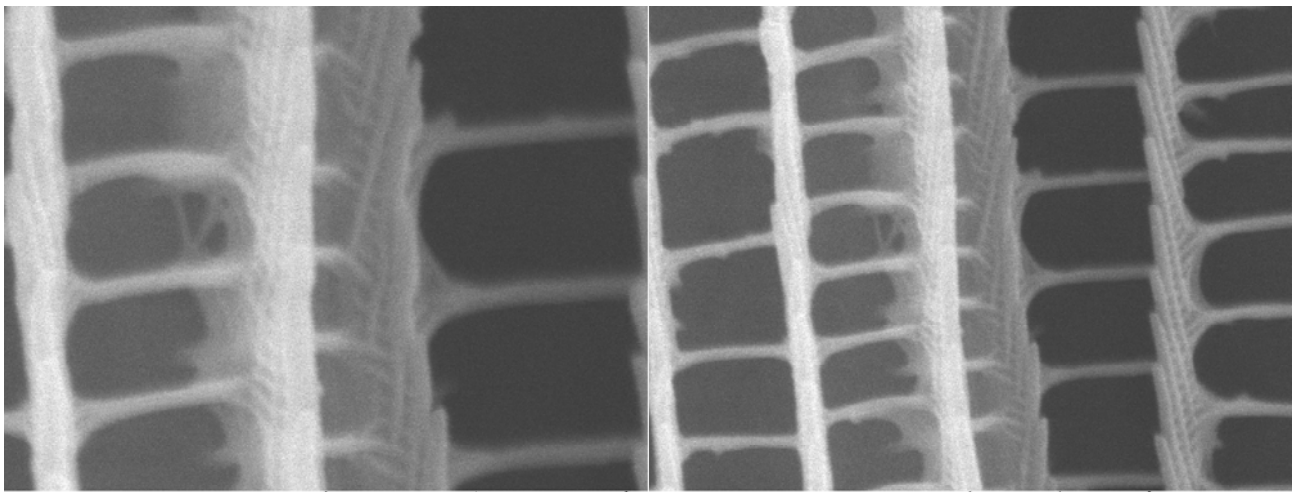


SEM MAG: 62 x
HV: 5.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 21.2890 mm
2 mm

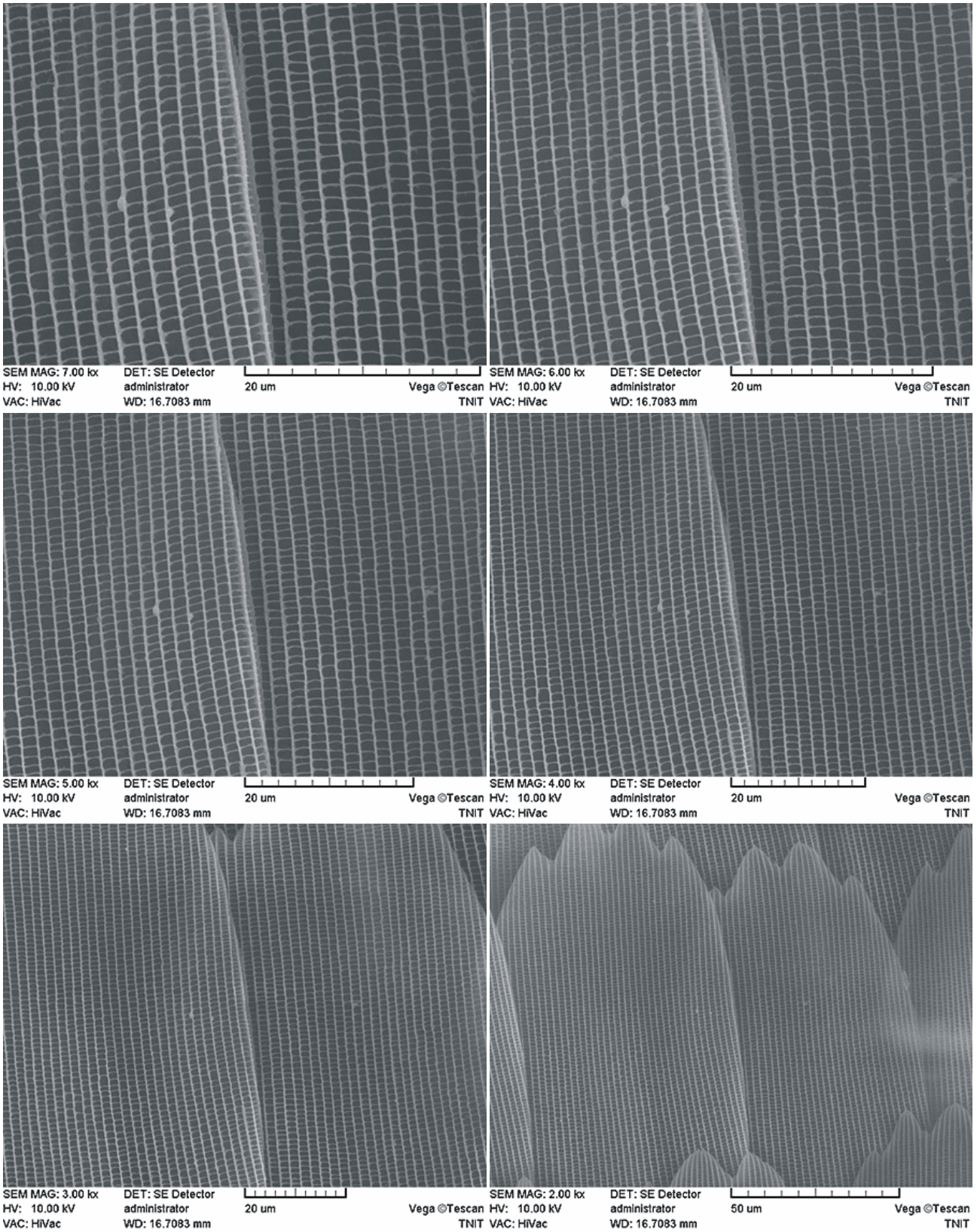
Vega ©Tescan
TNIT

圓翅紫斑蝶 #3-1

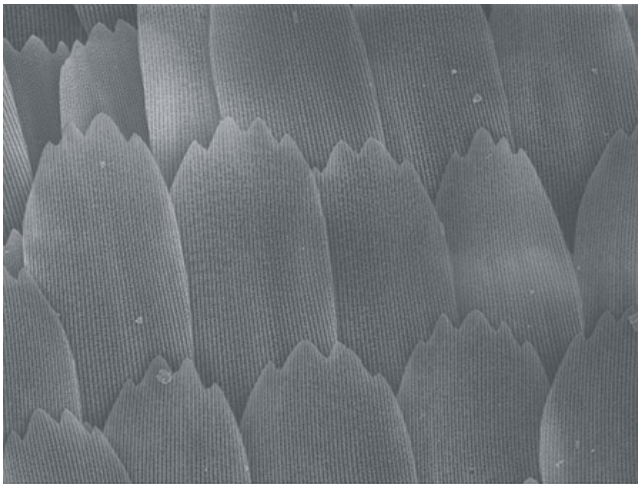
3-1



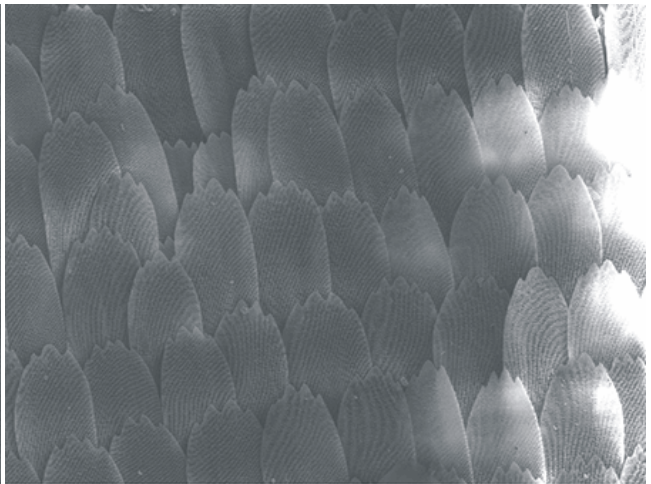
3-1



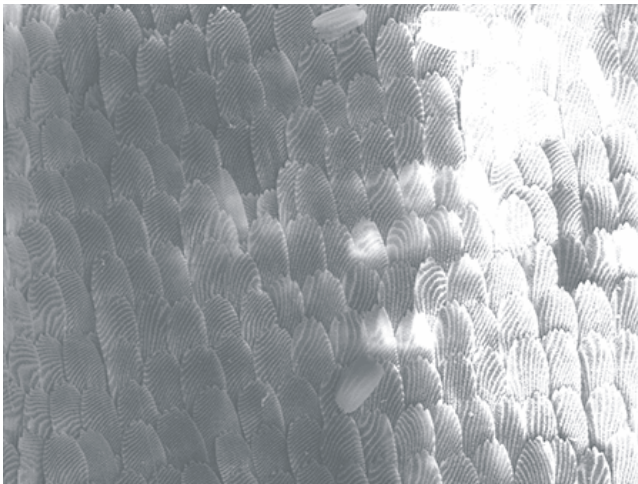
3-1



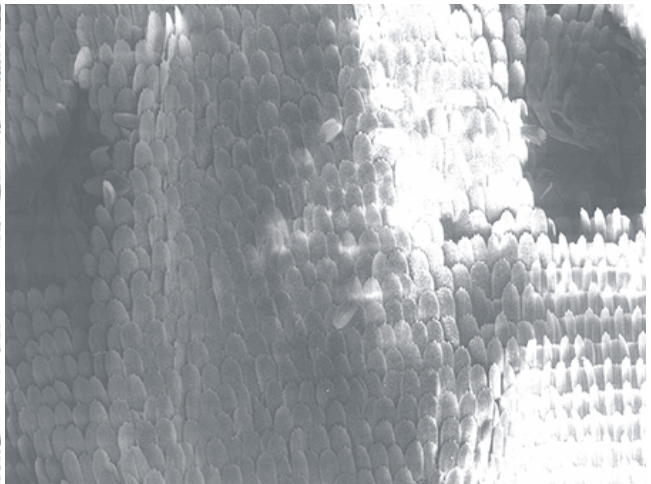
SEM MAG: 1.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.7083 mm
100 um
Vega ©Tescan
TNIT



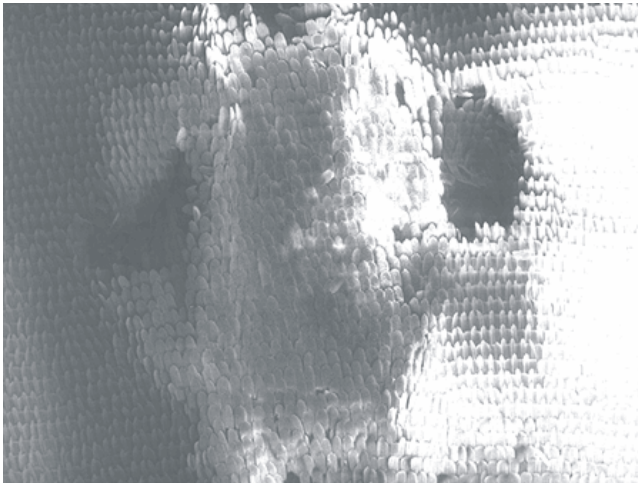
SEM MAG: 500 x
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.7083 mm
200 um
Vega ©Tescan
TNIT



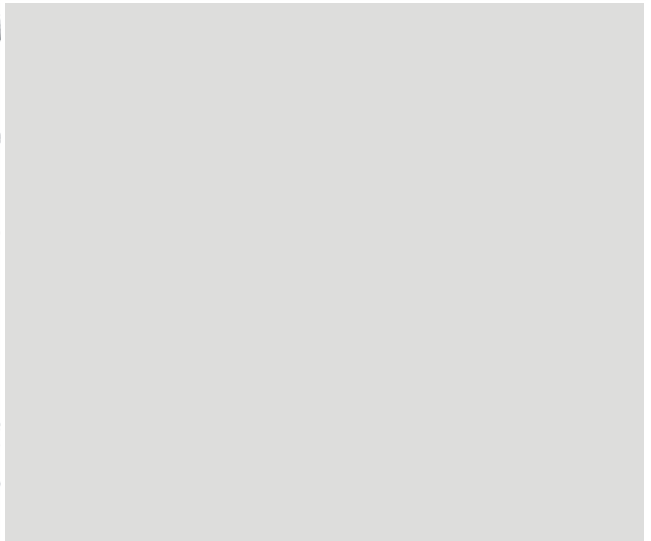
SEM MAG: 250 x
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.7083 mm
500 um
Vega ©Tescan
TNIT



SEM MAG: 125 x
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.7083 mm
1 mm
Vega ©Tescan
TNIT

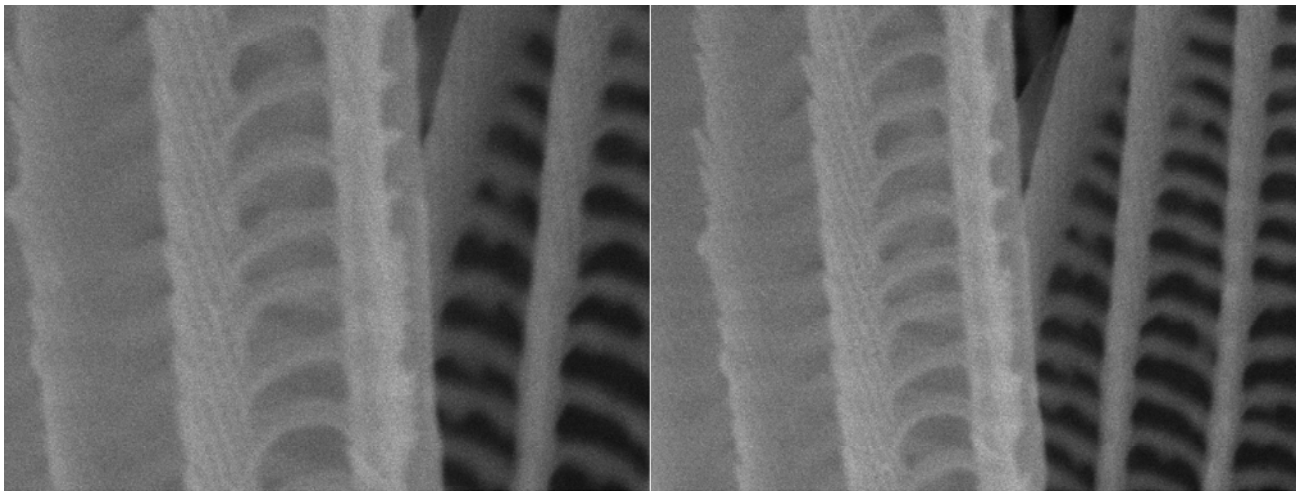


SEM MAG: 74 x
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.7083 mm
1 mm
Vega ©Tescan
TNIT

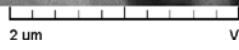


圓翅紫斑蝶 #3-2

3-2

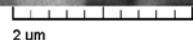


SEM MAG: 51.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.6450 mm

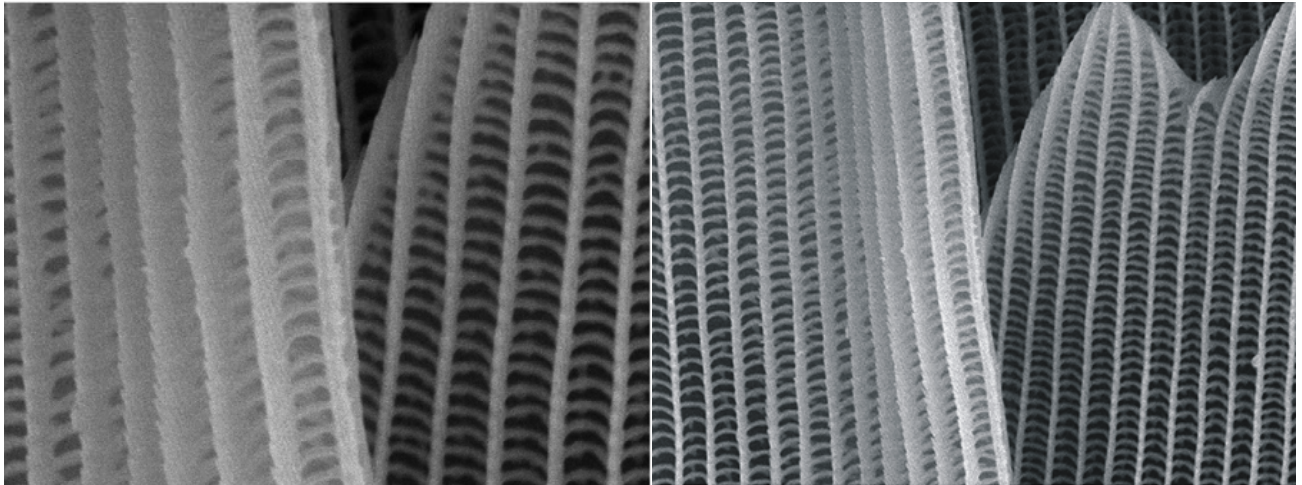


Vega ©Tescan
TNIT

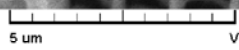
SEM MAG: 40.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.6450 mm



Vega ©Tescan
TNIT

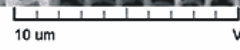


SEM MAG: 20.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.6450 mm

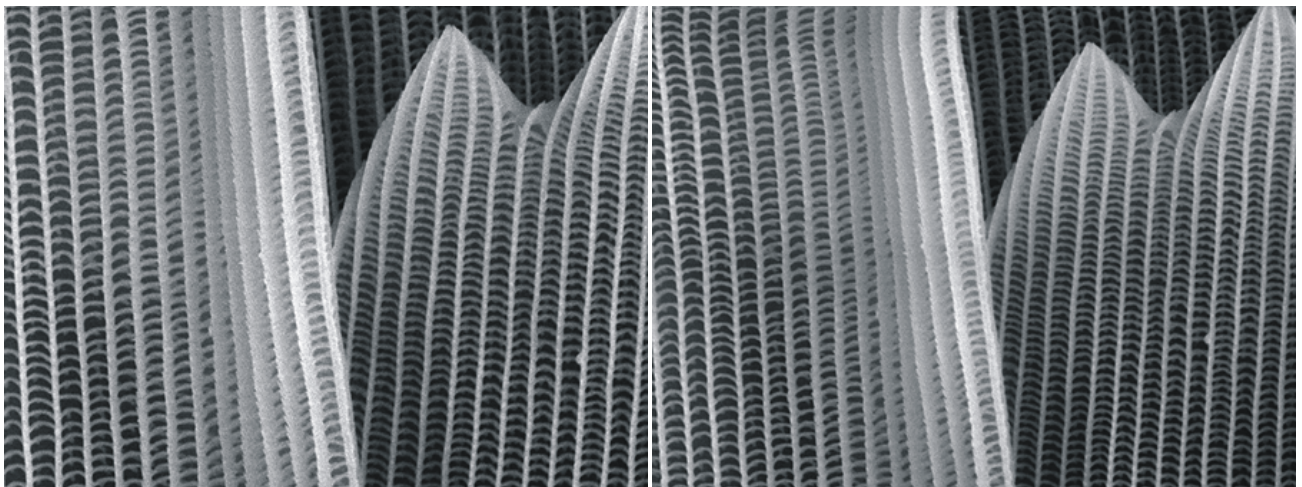


Vega ©Tescan
TNIT

SEM MAG: 10.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.6450 mm



Vega ©Tescan
TNIT



SEM MAG: 9.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.6450 mm



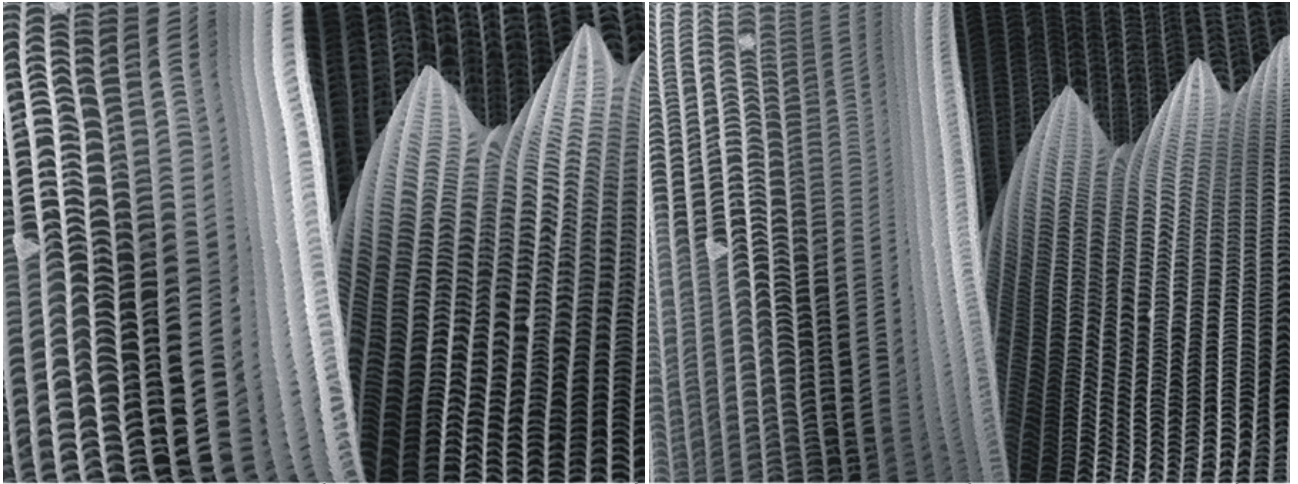
Vega ©Tescan
TNIT

SEM MAG: 8.04 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.6450 mm



Vega ©Tescan
TNIT

3-2



SEM MAG: 7.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.6450 mm

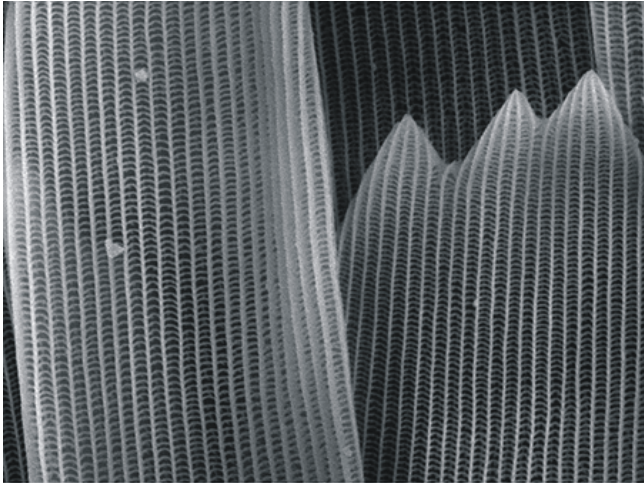
20 um

Vega ©Tescan
TNIT

SEM MAG: 6.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.6450 mm

20 um

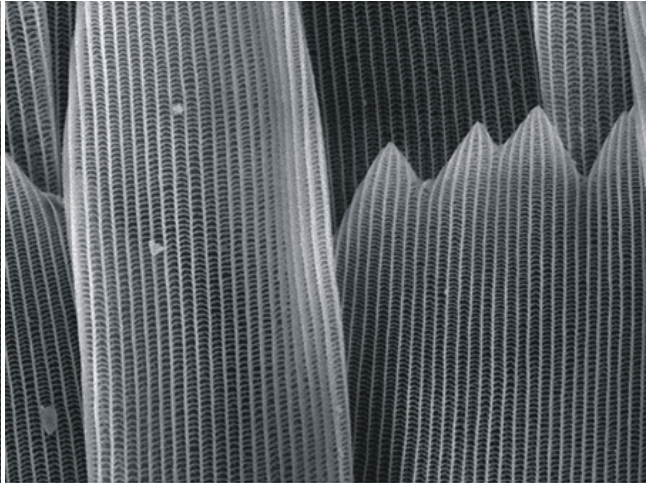
Vega ©Tescan
TNIT



SEM MAG: 5.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.6450 mm

20 um

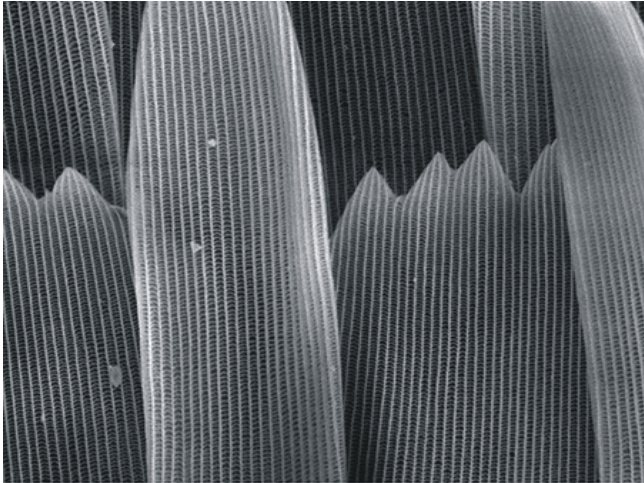
Vega ©Tescan
TNIT



SEM MAG: 4.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.6450 mm

20 um

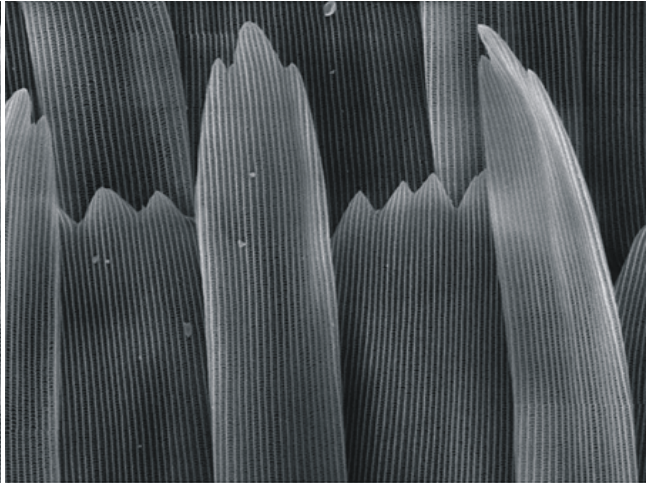
Vega ©Tescan
TNIT



SEM MAG: 3.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.6450 mm

20 um

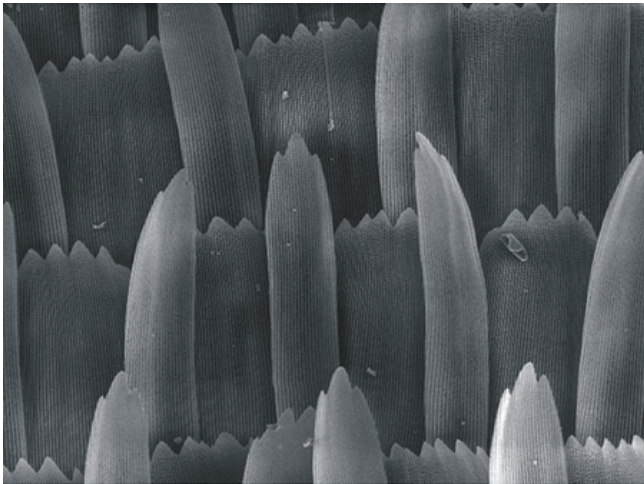
Vega ©Tescan
TNIT



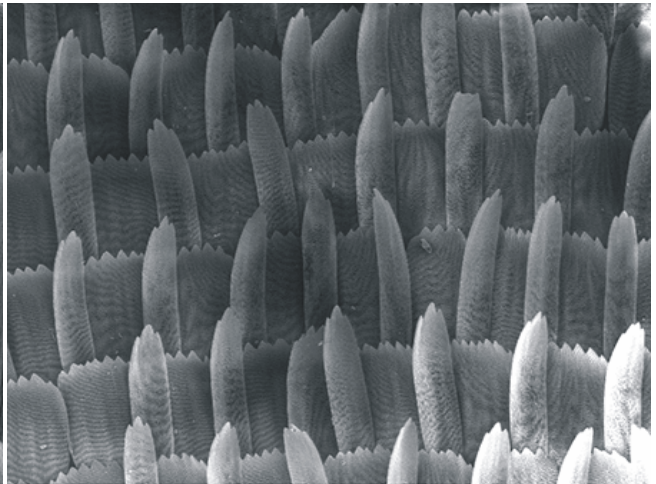
SEM MAG: 2.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.6450 mm

50 um

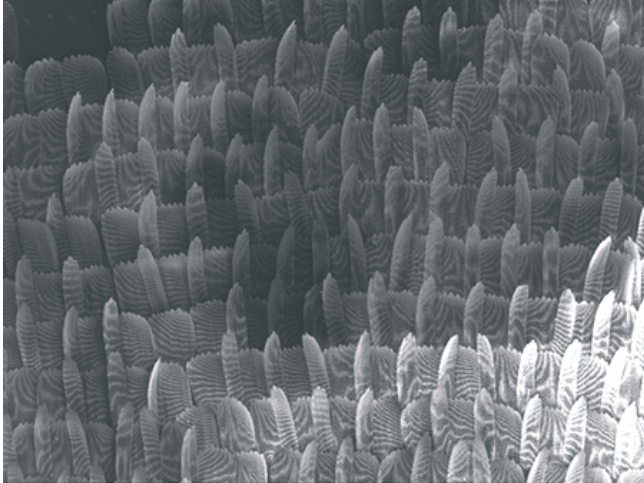
Vega ©Tescan
TNIT



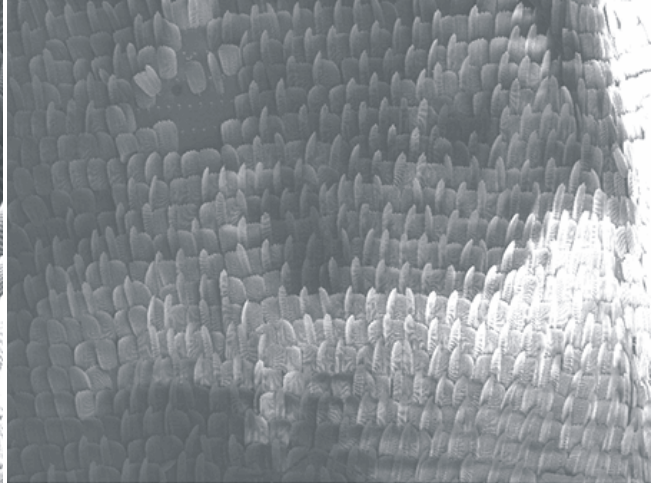
SEM MAG: 1,00 kx
 HV: 10.00 kV
 VAC: HiVac
 DET: SE Detector administrator
 WD: 16.6450 mm
 100 um
 Vega ©Tescan TNIT



SEM MAG: 500 x
 HV: 10.00 kV
 VAC: HiVac
 DET: SE Detector administrator
 WD: 16.6450 mm
 200 um
 Vega ©Tescan TNIT



SEM MAG: 250 x
 HV: 10.00 kV
 VAC: HiVac
 DET: SE Detector administrator
 WD: 16.6450 mm
 500 um
 Vega ©Tescan TNIT



SEM MAG: 125 x
 HV: 10.00 kV
 VAC: HiVac
 DET: SE Detector administrator
 WD: 16.6450 mm
 1 mm
 Vega ©Tescan TNIT

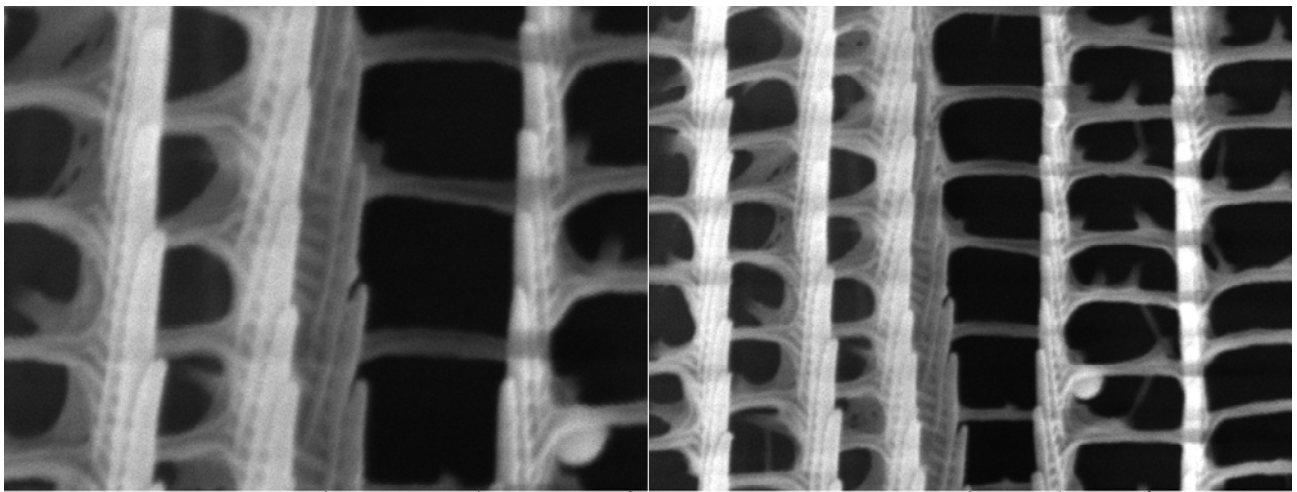


SEM MAG: 74 x
 HV: 10.00 kV
 VAC: HiVac
 DET: SE Detector administrator
 WD: 16.6450 mm
 1 mm
 Vega ©Tescan TNIT



小紫斑蝶 #5-1

5-1



SEM MAG: 68.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.2450 mm

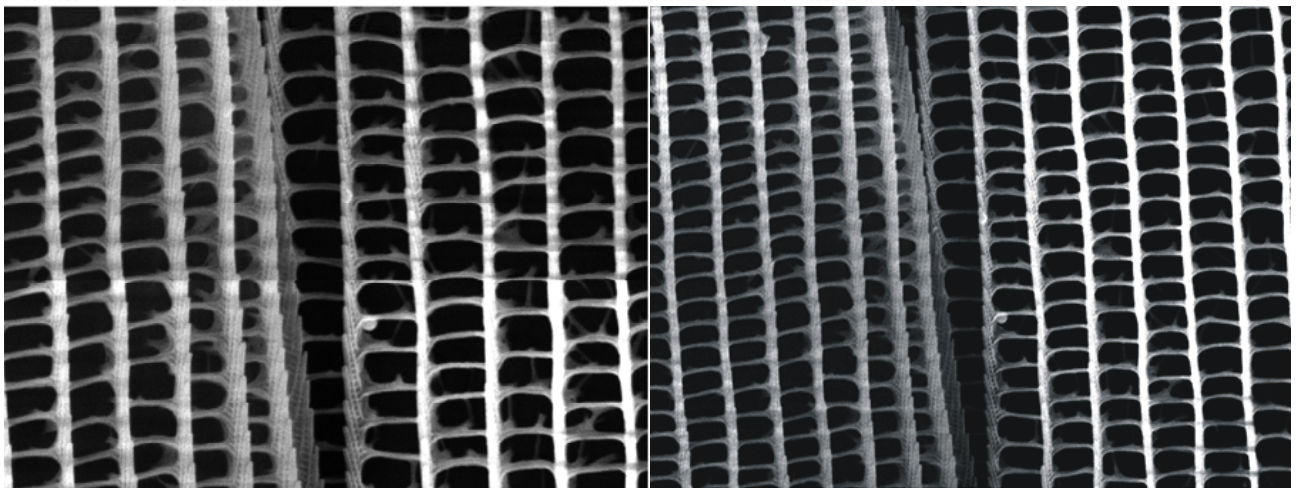
2 μm

Vega ©Tescan
TNIT

SEM MAG: 40.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.2450 mm

2 μm

Vega ©Tescan
TNIT



SEM MAG: 20.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.2450 mm

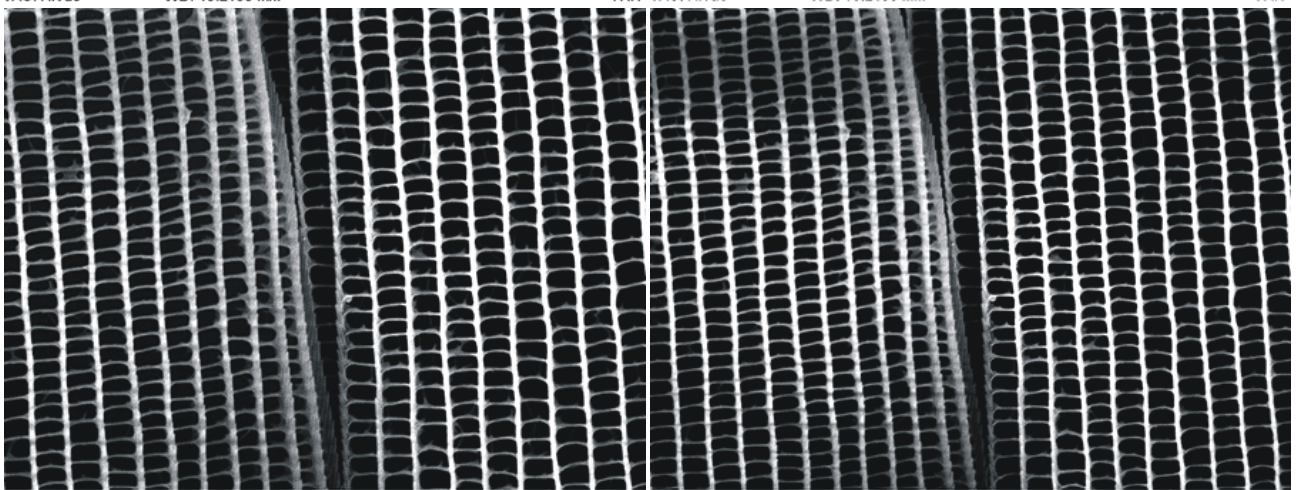
5 μm

Vega ©Tescan
TNIT

SEM MAG: 15.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.2450 mm

5 μm

Vega ©Tescan
TNIT



SEM MAG: 10.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.2450 mm

10 μm

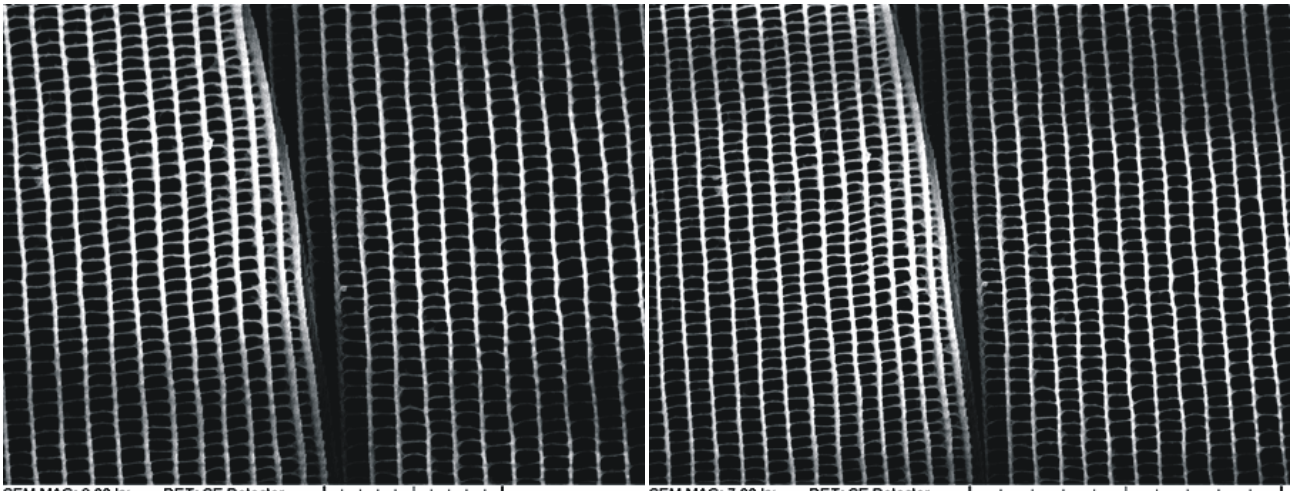
Vega ©Tescan
TNIT

SEM MAG: 9.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.2450 mm

10 μm

Vega ©Tescan
TNIT

5-1



SEM MAG: 8.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.2450 mm

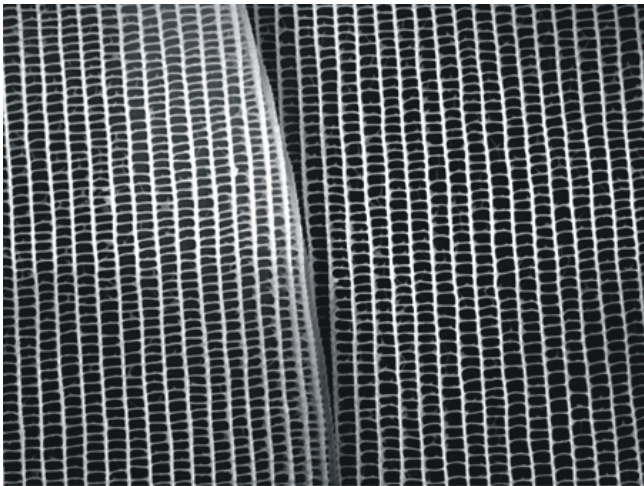
10 um

Vega ©Tescan
TNIT

SEM MAG: 7.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.2450 mm

20 um

Vega ©Tescan
TNIT



SEM MAG: 6.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.2450 mm

20 um

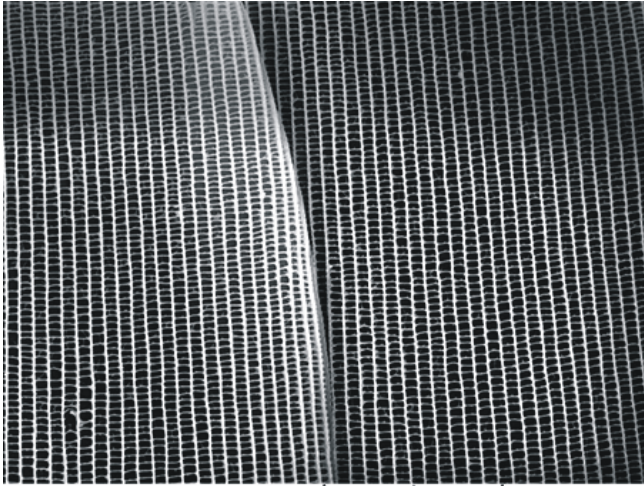
Vega ©Tescan
TNIT



SEM MAG: 5.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.2450 mm

20 um

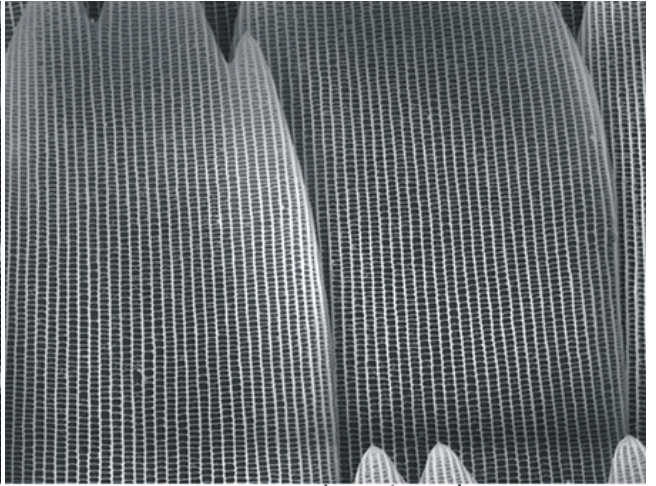
Vega ©Tescan
TNIT



SEM MAG: 4.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.2450 mm

20 um

Vega ©Tescan
TNIT

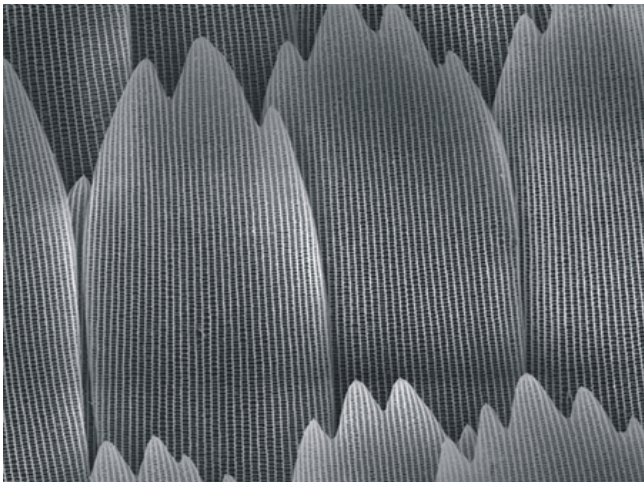


SEM MAG: 3.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.2450 mm

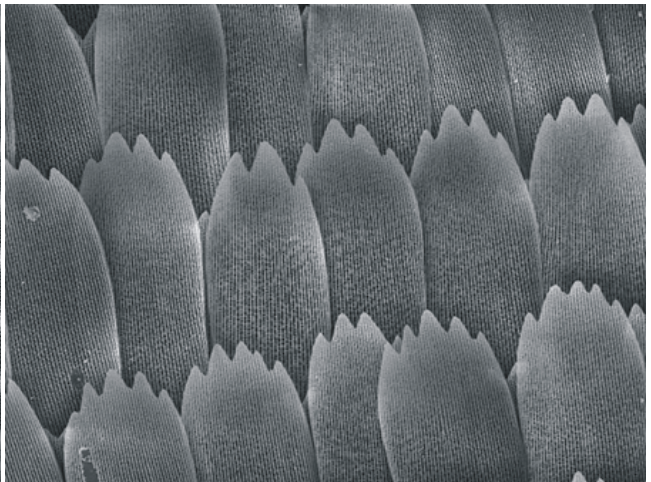
20 um

Vega ©Tescan
TNIT

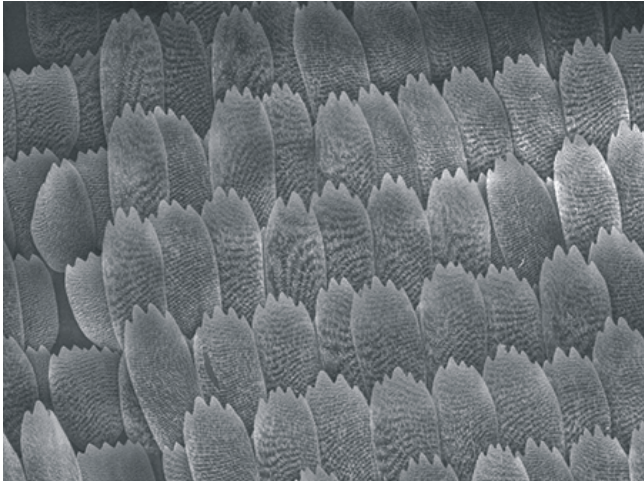
5-1



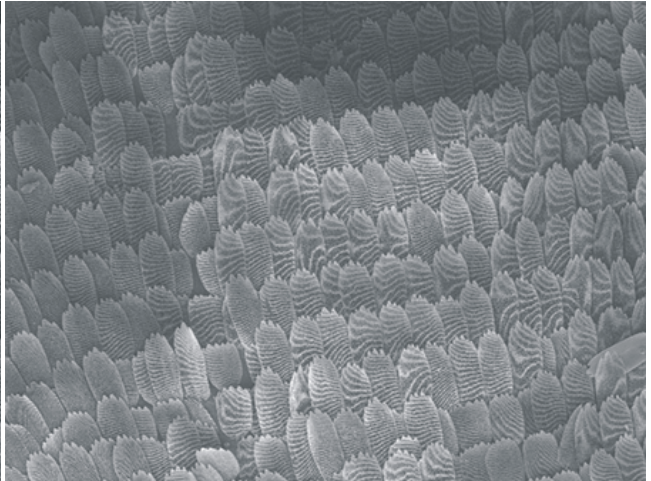
SEM MAG: 2.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector administrator
WD: 16.2450 mm
50 um
Vega ©Tescan TNIT



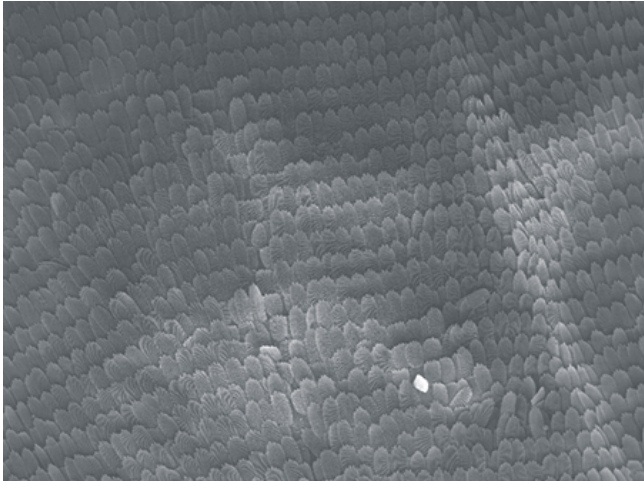
SEM MAG: 1.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector administrator
WD: 16.2450 mm
100 um
Vega ©Tescan TNIT



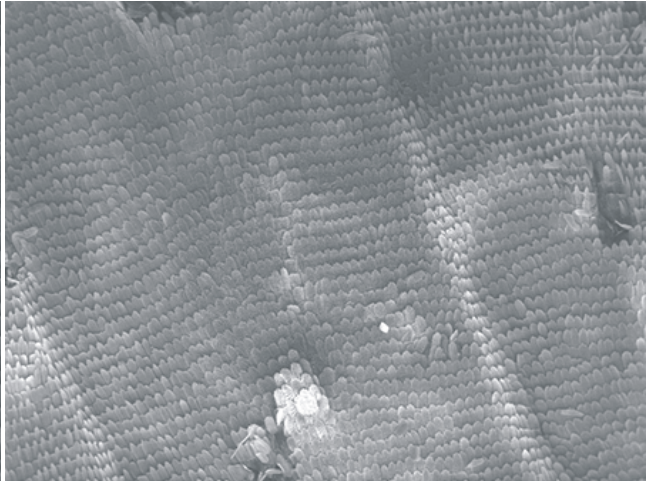
SEM MAG: 500 x
HV: 10.00 kV
VAC: HiVac
DET: SE Detector administrator
WD: 16.2450 mm
200 um
Vega ©Tescan TNIT



SEM MAG: 250 x
HV: 10.00 kV
VAC: HiVac
DET: SE Detector administrator
WD: 16.2450 mm
500 um
Vega ©Tescan TNIT



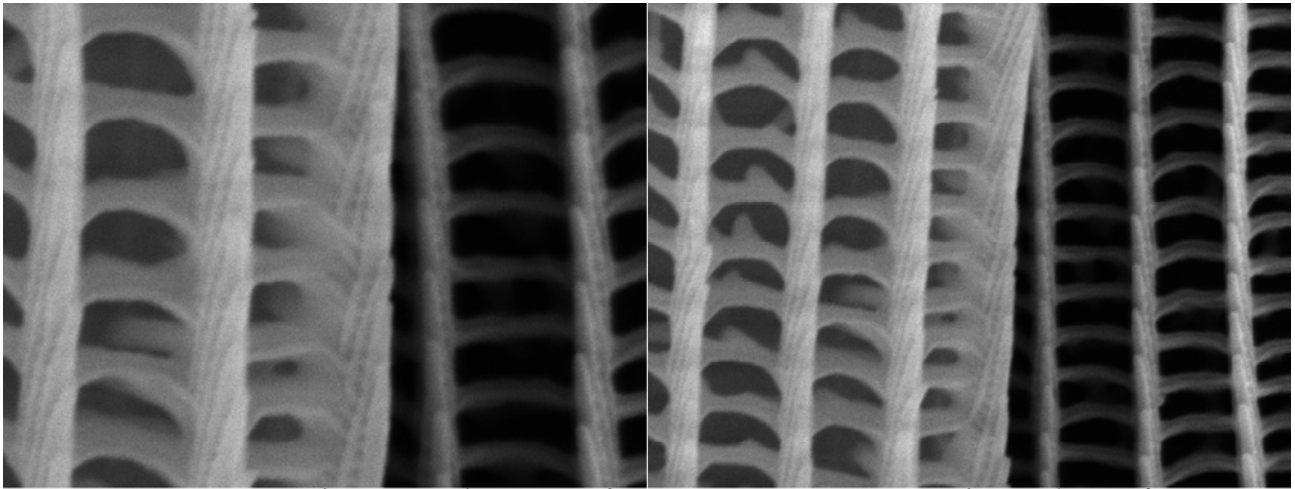
SEM MAG: 125 x
HV: 10.00 kV
VAC: HiVac
DET: SE Detector administrator
WD: 16.2450 mm
1 mm
Vega ©Tescan TNIT



SEM MAG: 75 x
HV: 10.00 kV
VAC: HiVac
DET: SE Detector administrator
WD: 16.2450 mm
1 mm
Vega ©Tescan TNIT

小紫斑蝶 #5-2

5-2



SEM MAG: 63.67 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.7850 mm

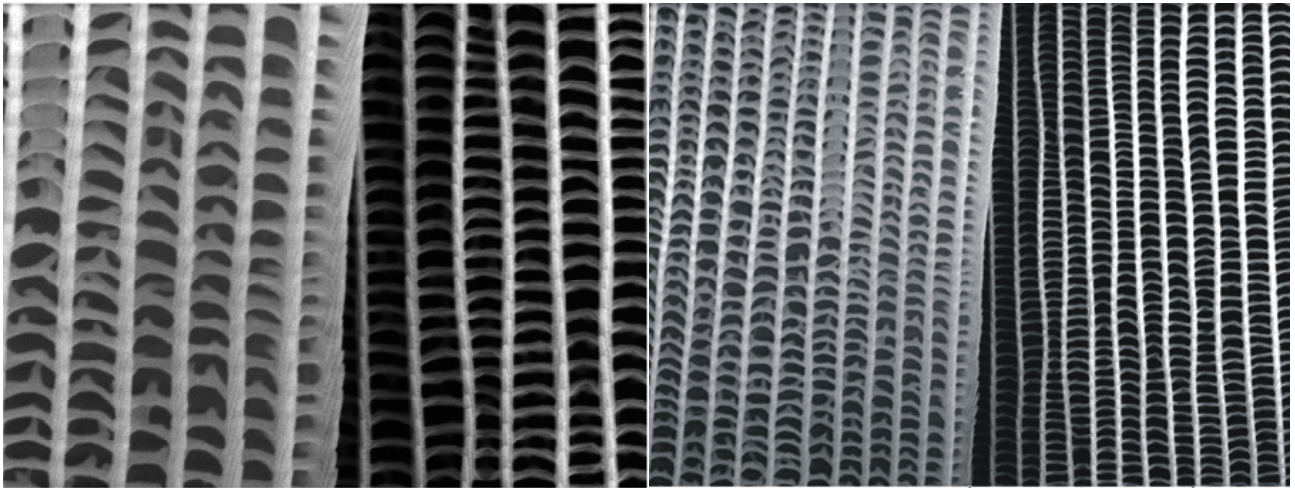
2 um

Vega ©Tescan
TNIT

SEM MAG: 40.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.7850 mm

2 um

Vega ©Tescan
TNIT



SEM MAG: 20.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.7850 mm

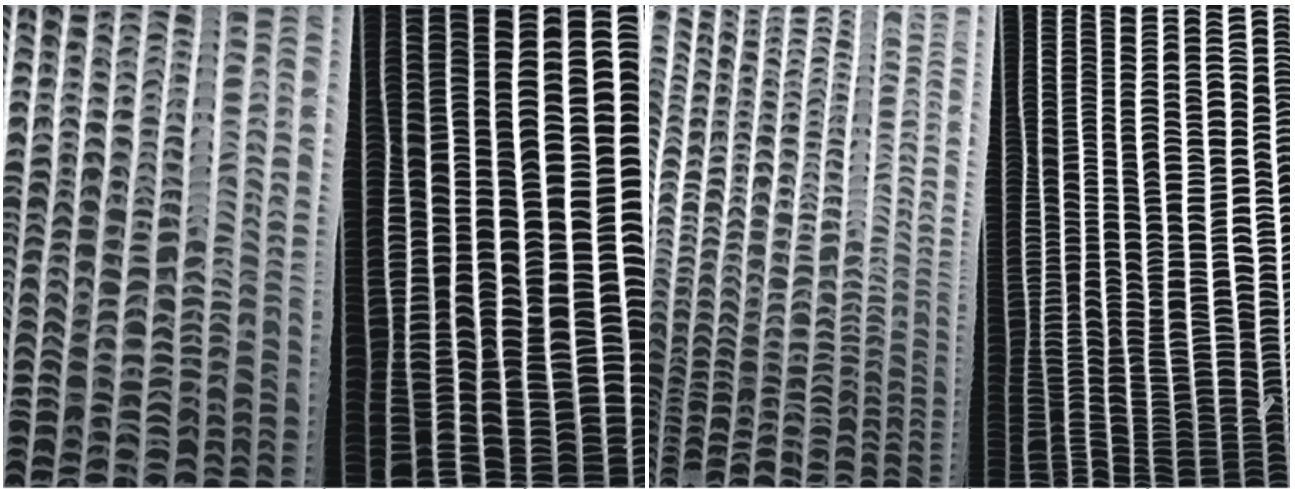
5 um

Vega ©Tescan
TNIT

SEM MAG: 10.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.7850 mm

10 um

Vega ©Tescan
TNIT



SEM MAG: 9.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.7850 mm

10 um

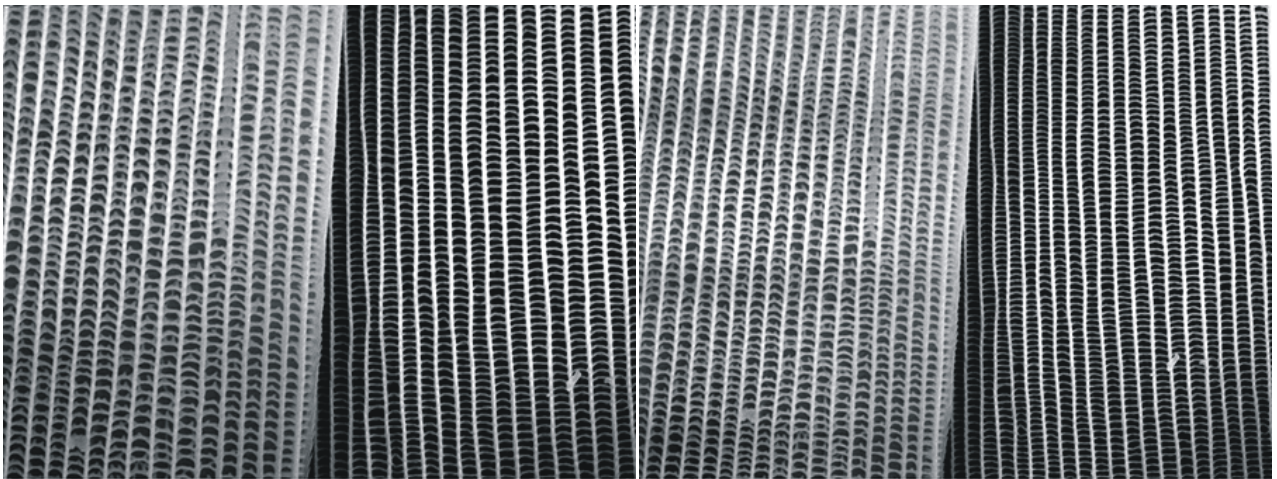
Vega ©Tescan
TNIT

SEM MAG: 8.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.7850 mm

10 um

Vega ©Tescan
TNIT

5-2



SEM MAG: 7.00 kx
HV: 10.00 kV
VAC: HiVac

DET: SE Detector
administrator
WD: 16.7850 mm

20 um

Vega ©Tescan
TNIT

SEM MAG: 6.00 kx
HV: 10.00 kV
VAC: HiVac

DET: SE Detector
administrator
WD: 16.7850 mm

20 um

Vega ©Tescan
TNIT

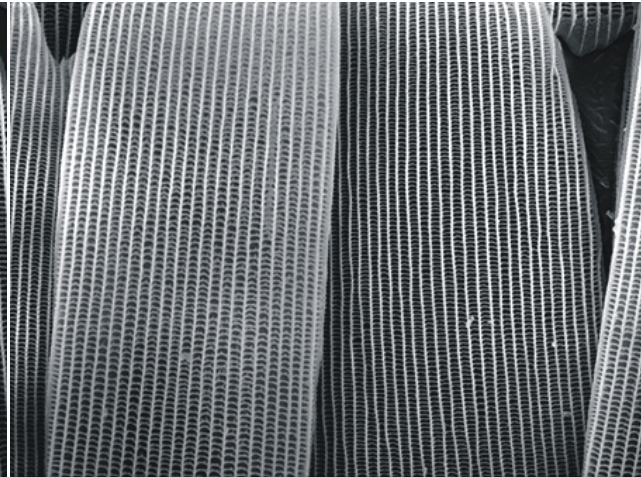


SEM MAG: 5.00 kx
HV: 10.00 kV
VAC: HiVac

DET: SE Detector
administrator
WD: 16.7850 mm

20 um

Vega ©Tescan
TNIT

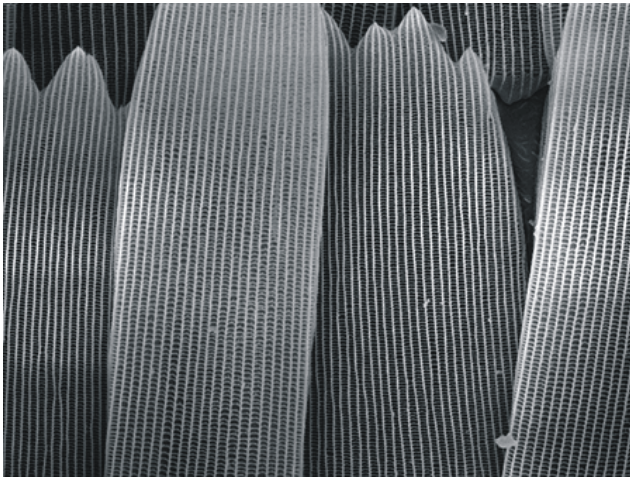


SEM MAG: 4.00 kx
HV: 10.00 kV
VAC: HiVac

DET: SE Detector
administrator
WD: 16.7850 mm

20 um

Vega ©Tescan
TNIT

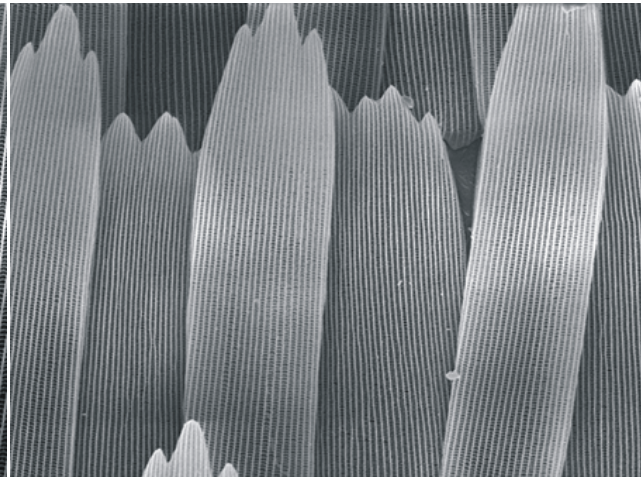


SEM MAG: 3.00 kx
HV: 10.00 kV
VAC: HiVac

DET: SE Detector
administrator
WD: 16.7850 mm

20 um

Vega ©Tescan
TNIT



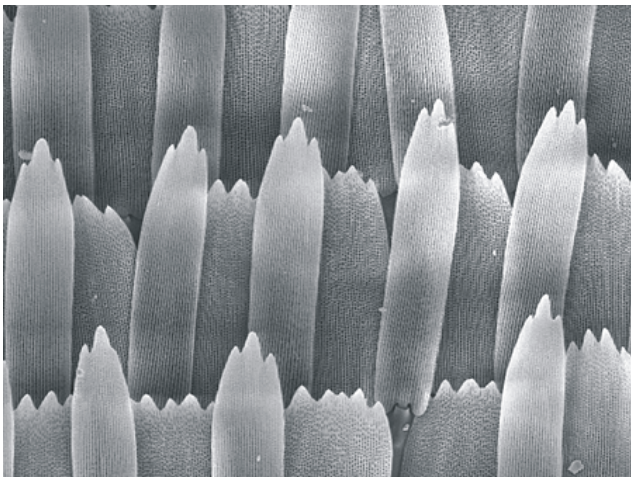
SEM MAG: 2.01 kx
HV: 10.00 kV
VAC: HiVac

DET: SE Detector
administrator
WD: 16.7850 mm

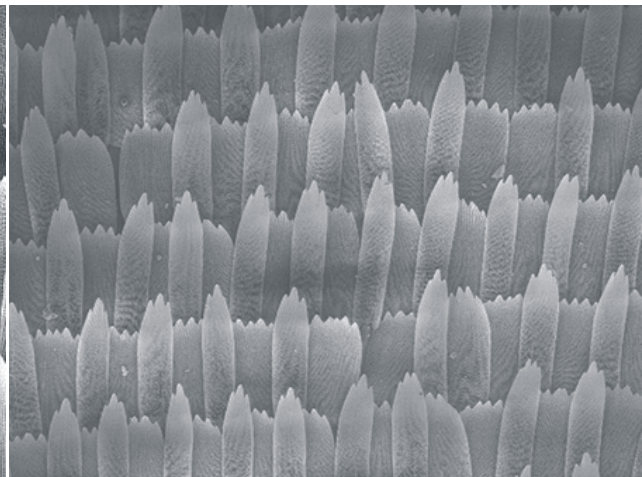
50 um

Vega ©Tescan
TNIT

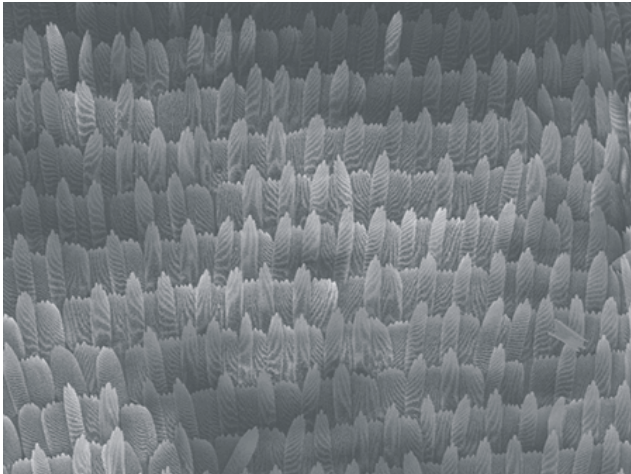
5-2



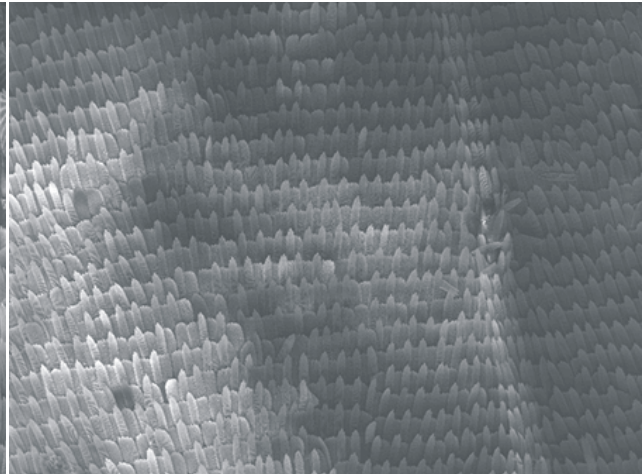
SEM MAG: 1.00 kx
 HV: 10.00 kV
 VAC: HiVac
 DET: SE Detector administrator
 WD: 16.7850 mm
 100 um
 Vega ©Tescan TNIT



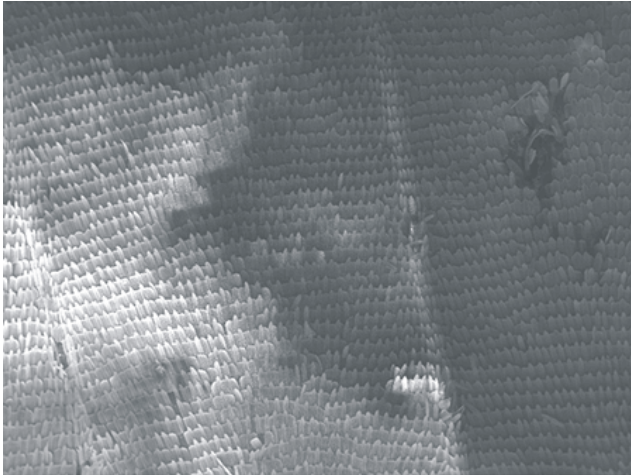
SEM MAG: 500 x
 HV: 10.00 kV
 VAC: HiVac
 DET: SE Detector administrator
 WD: 16.7850 mm
 200 um
 Vega ©Tescan TNIT



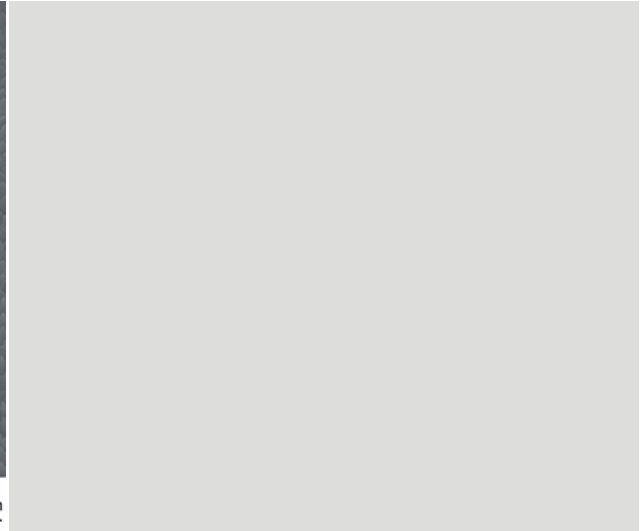
SEM MAG: 250 x
 HV: 10.00 kV
 VAC: HiVac
 DET: SE Detector administrator
 WD: 16.7850 mm
 500 um
 Vega ©Tescan TNIT



SEM MAG: 125 x
 HV: 10.00 kV
 VAC: HiVac
 DET: SE Detector administrator
 WD: 16.7850 mm
 1 mm
 Vega ©Tescan TNIT

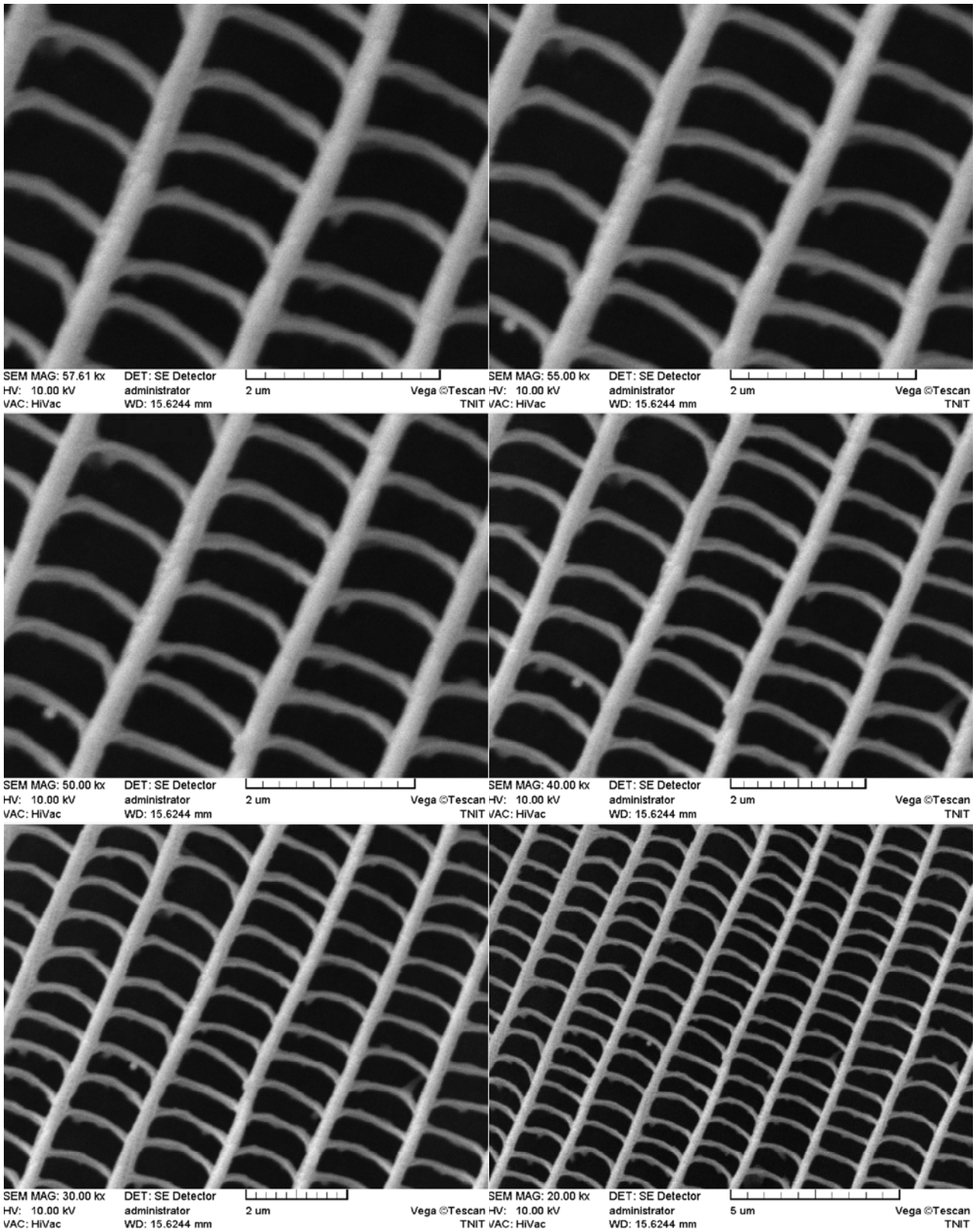


SEM MAG: 73 x
 HV: 10.00 kV
 VAC: HiVac
 DET: SE Detector administrator
 WD: 16.7850 mm
 1 mm
 Vega ©Tescan TNIT

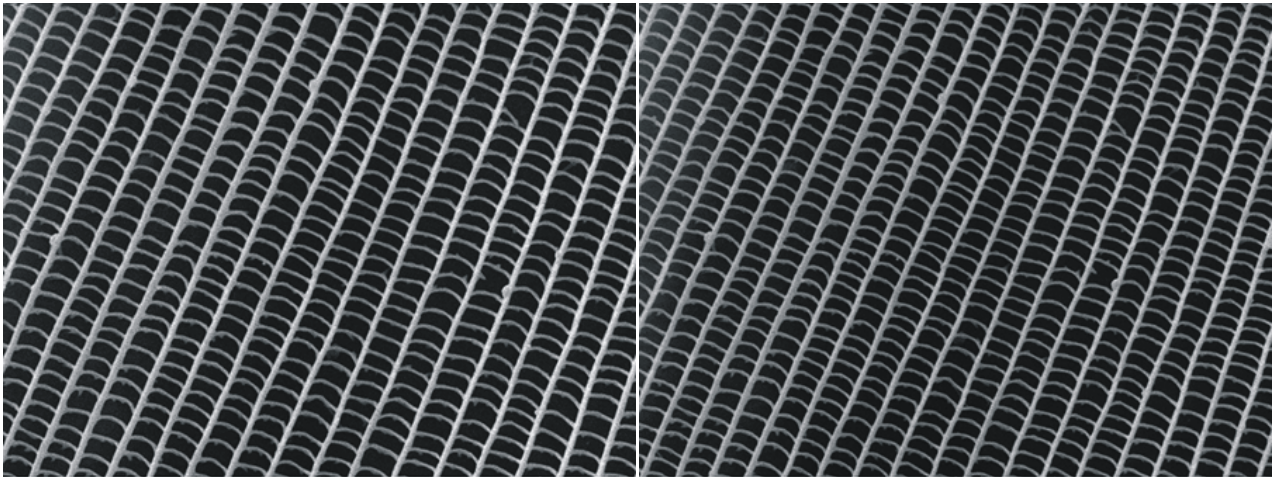


端紫斑蝶 #6-1

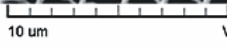
6-1



6-1

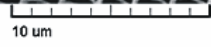


SEM MAG: 10.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 15.6244 mm

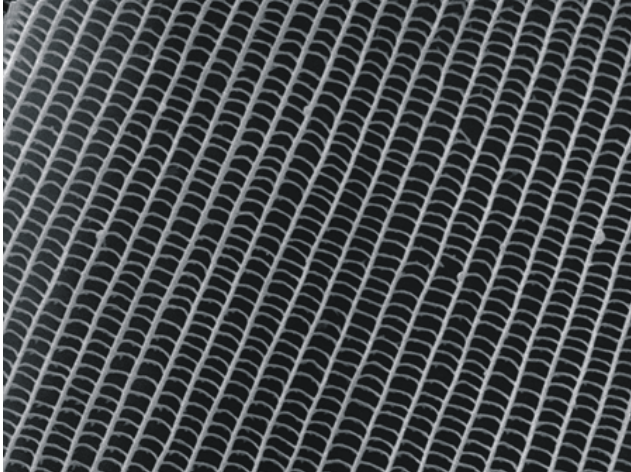


Vega ©Tescan
TNIT

SEM MAG: 9.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 15.6244 mm



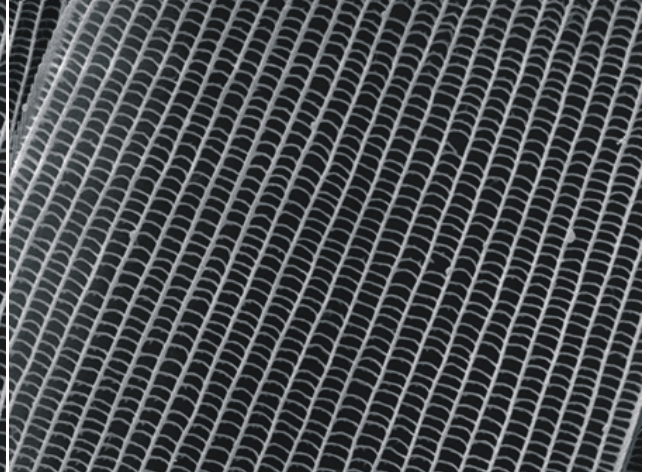
Vega ©Tescan
TNIT



SEM MAG: 8.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 15.6244 mm



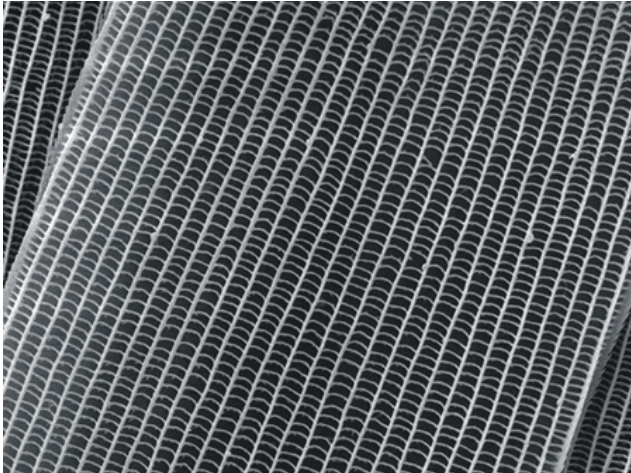
Vega ©Tescan
TNIT



SEM MAG: 7.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 15.6244 mm



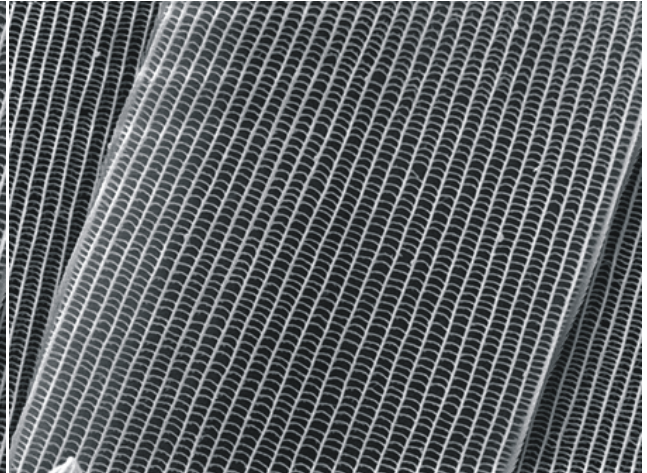
Vega ©Tescan
TNIT



SEM MAG: 6.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 15.6244 mm



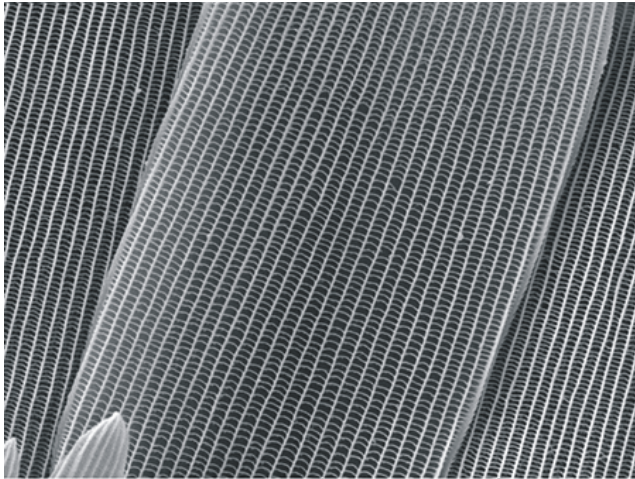
Vega ©Tescan
TNIT



SEM MAG: 5.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 15.6244 mm



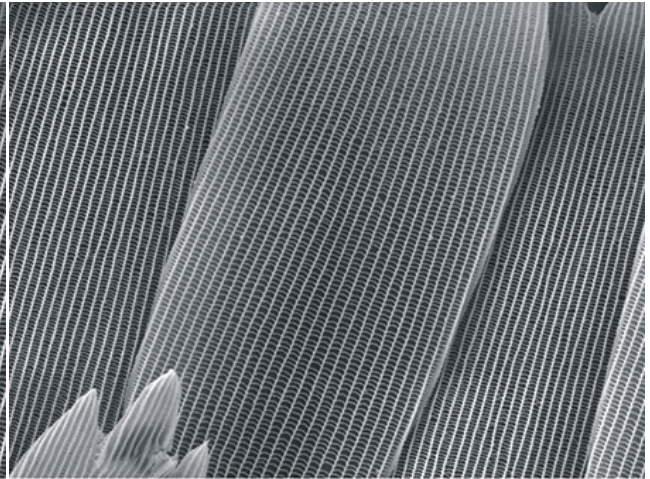
Vega ©Tescan
TNIT



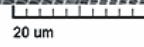
SEM MAG: 4.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 15.6244 mm



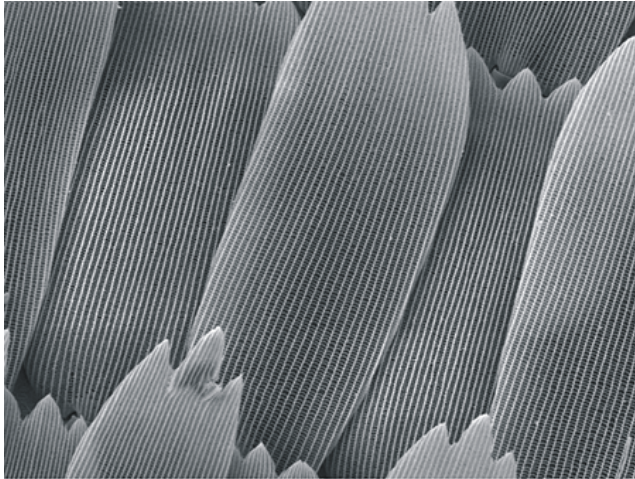
Vega ©Tescan
TNIT



SEM MAG: 3.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 15.6244 mm



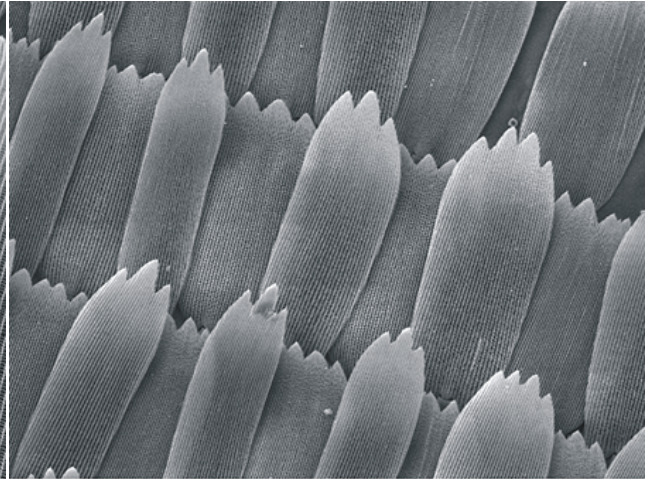
Vega ©Tescan
TNIT



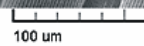
SEM MAG: 2.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 15.6244 mm



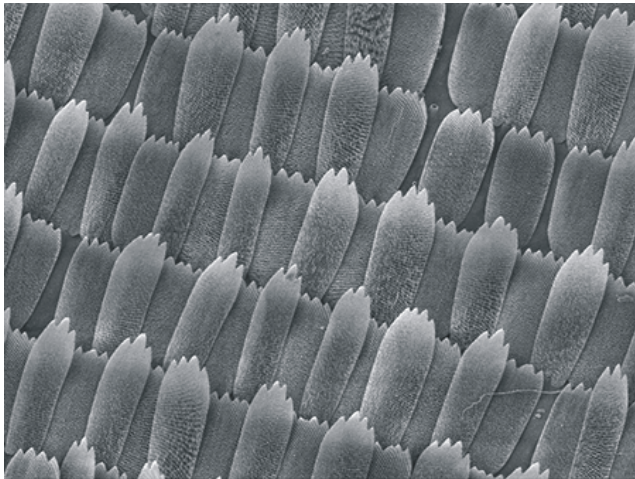
Vega ©Tescan
TNIT



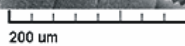
SEM MAG: 1.00 kx
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 15.6244 mm



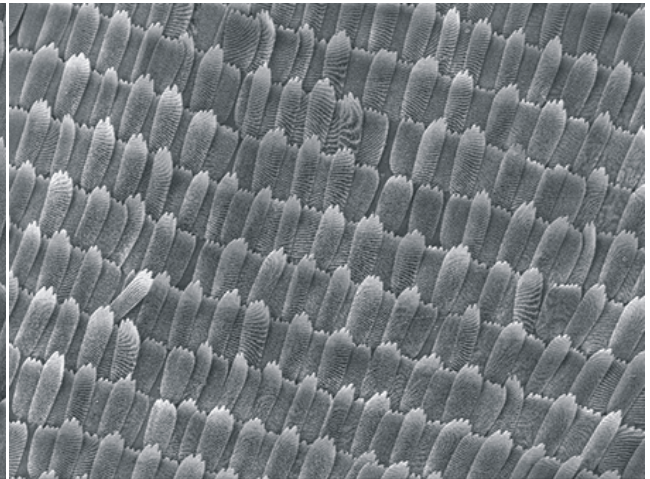
Vega ©Tescan
TNIT



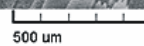
SEM MAG: 500 x
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 15.6244 mm



Vega ©Tescan
TNIT

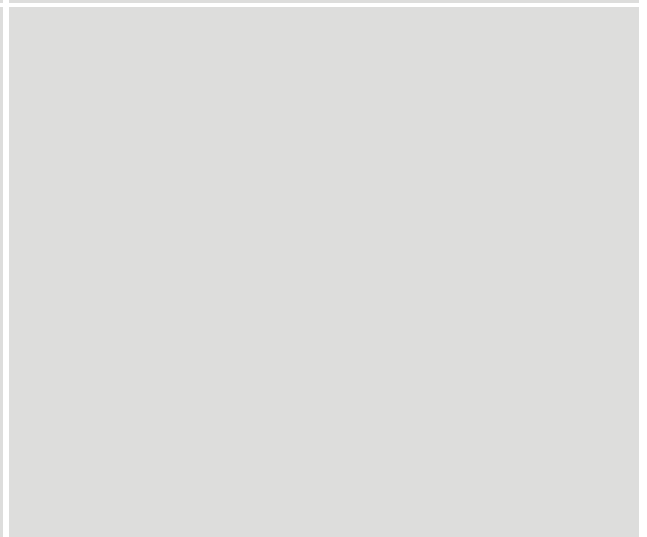
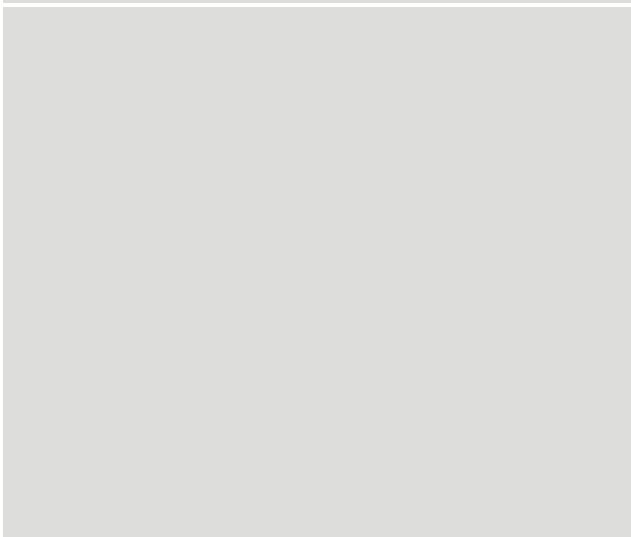
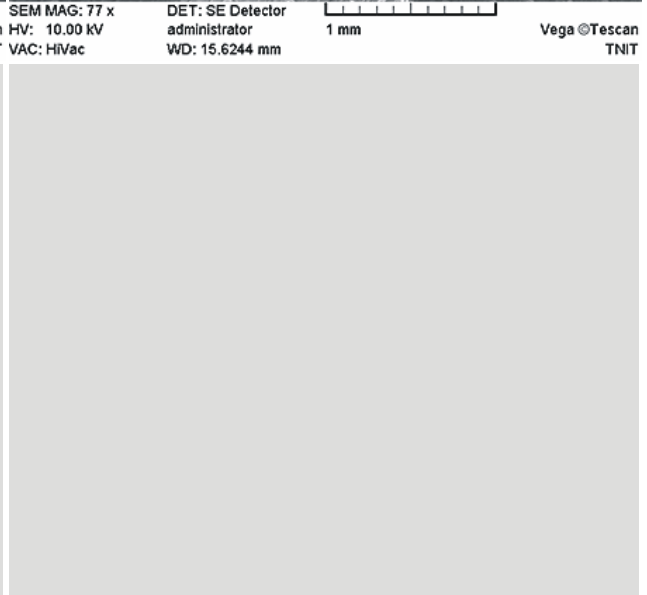
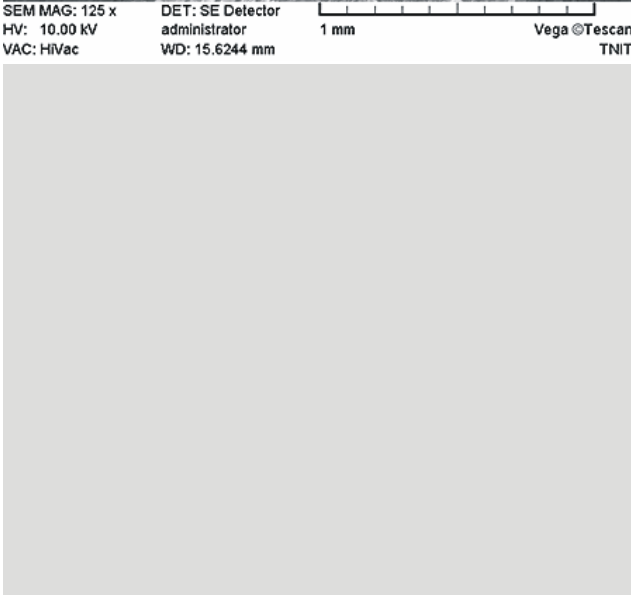
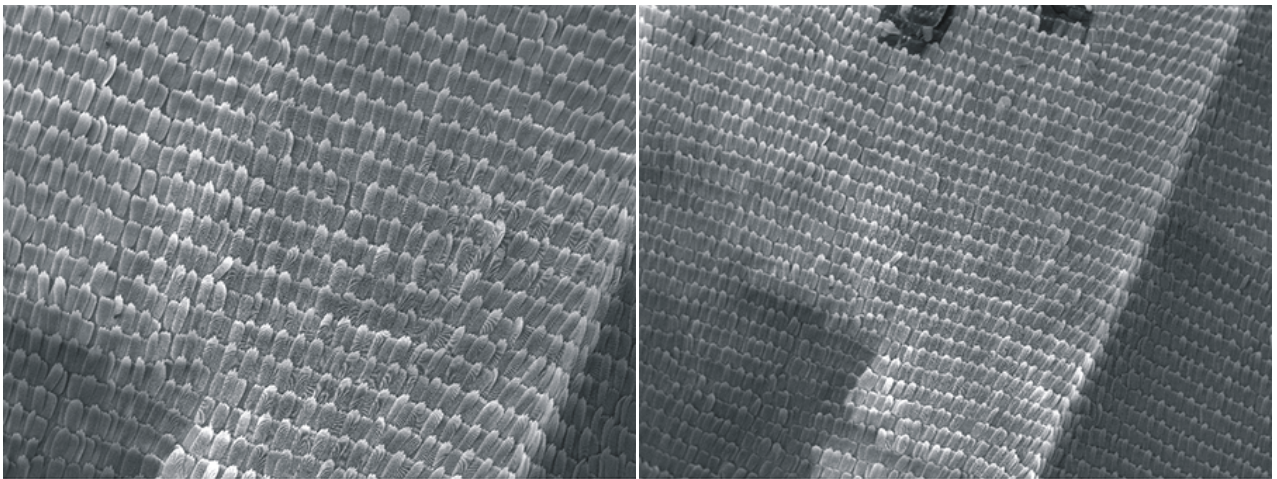


SEM MAG: 250 x
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 15.6244 mm



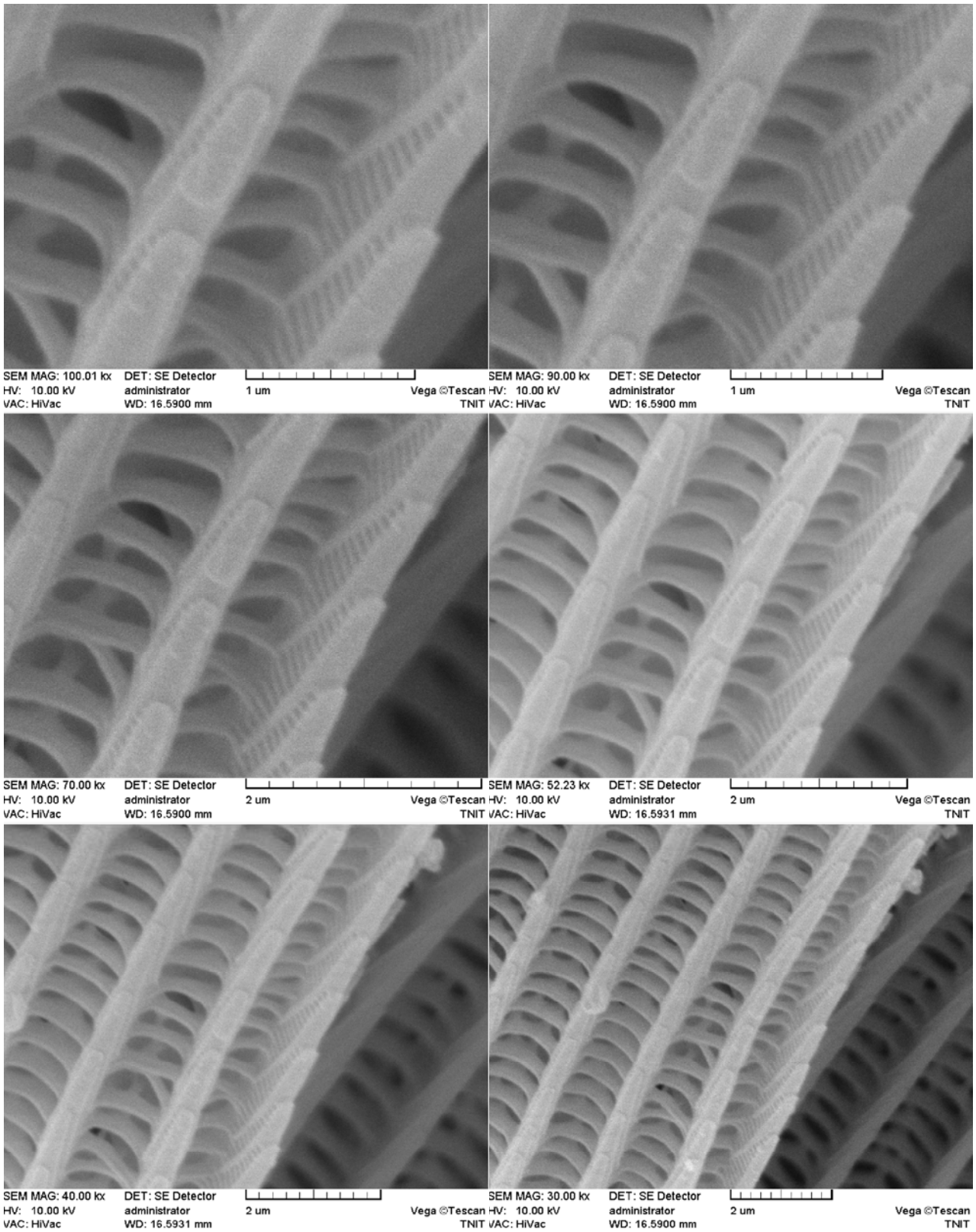
Vega ©Tescan
TNIT

6-1

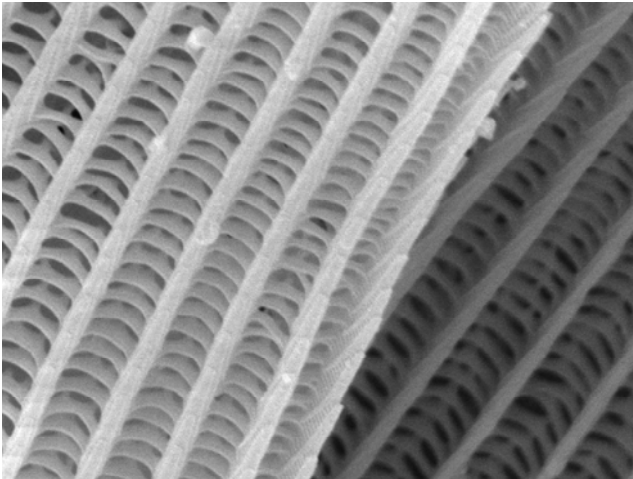


端紫斑蝶 #6-2

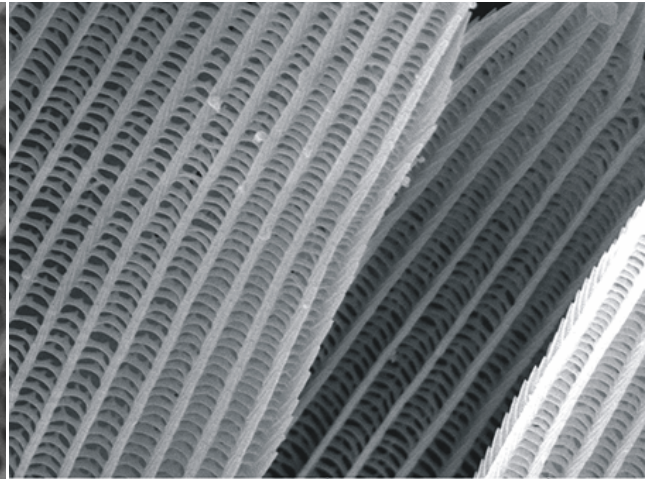
6-2



6-2



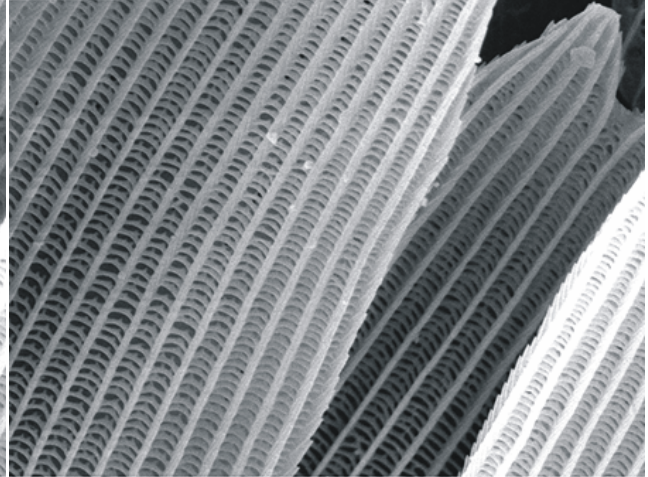
SEM MAG: 20.00 kx DET: SE Detector administrator
HV: 10.00 kV WD: 16.5900 mm
VAC: HiVac Vega ©Tescan TNIT



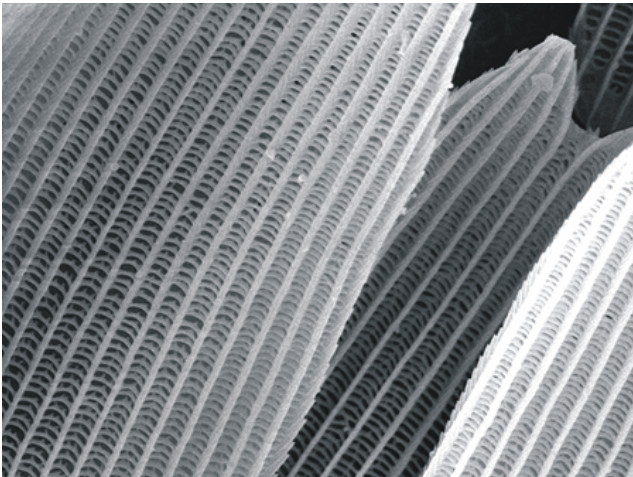
SEM MAG: 10.00 kx DET: SE Detector administrator
HV: 10.00 kV WD: 16.5900 mm
VAC: HiVac Vega ©Tescan TNIT



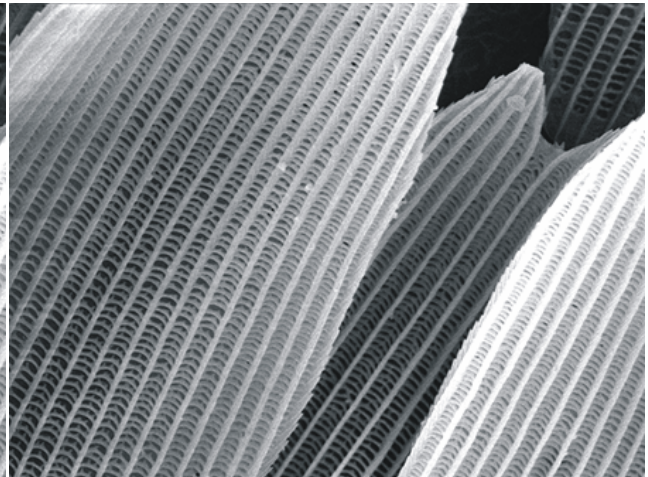
SEM MAG: 9.00 kx DET: SE Detector administrator
HV: 10.00 kV WD: 16.5900 mm
VAC: HiVac Vega ©Tescan TNIT



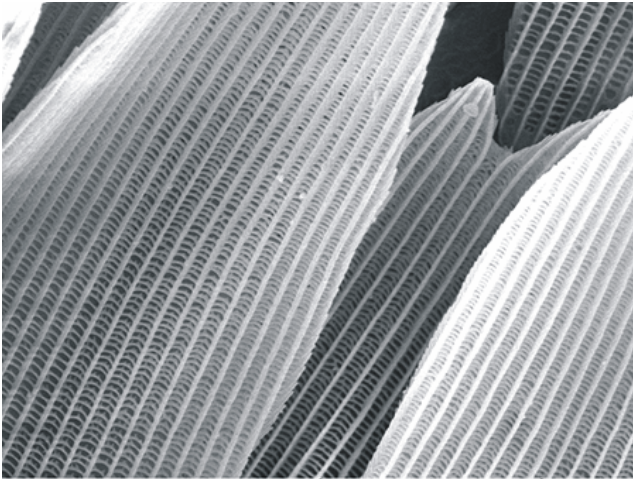
SEM MAG: 8.00 kx DET: SE Detector administrator
HV: 10.00 kV WD: 16.5900 mm
VAC: HiVac Vega ©Tescan TNIT



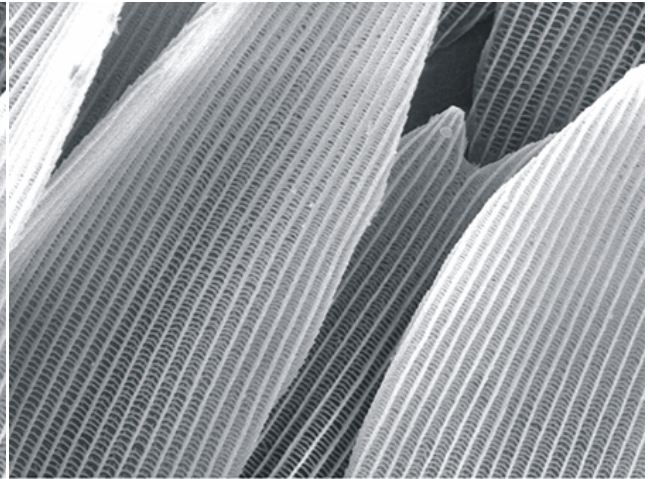
SEM MAG: 7.00 kx DET: SE Detector administrator
HV: 10.00 kV WD: 16.5900 mm
VAC: HiVac Vega ©Tescan TNIT



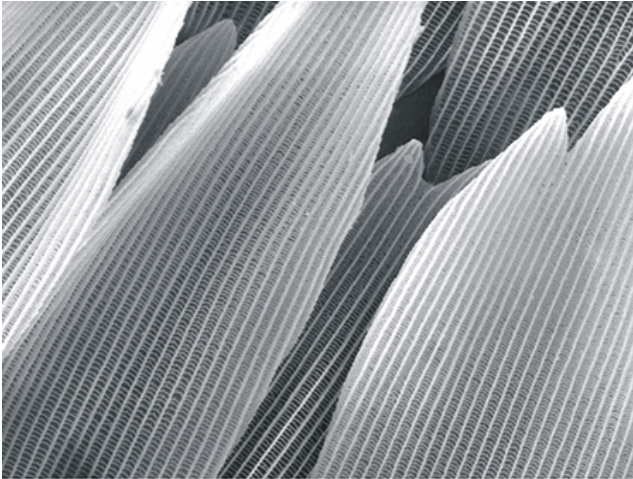
SEM MAG: 6.00 kx DET: SE Detector administrator
HV: 10.00 kV WD: 16.5900 mm
VAC: HiVac Vega ©Tescan TNIT



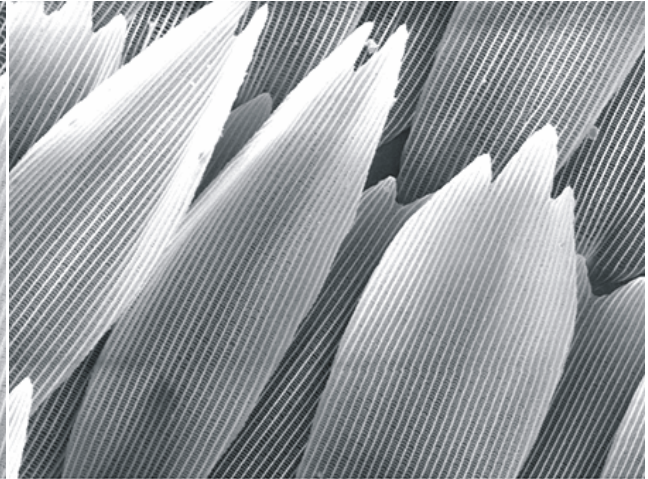
SEM MAG: 5.00 kx
 HV: 10.00 kV
 VAC: HiVac
 DET: SE Detector administrator
 WD: 16.5900 mm
 20 um
 Vega ©Tescan TNIT



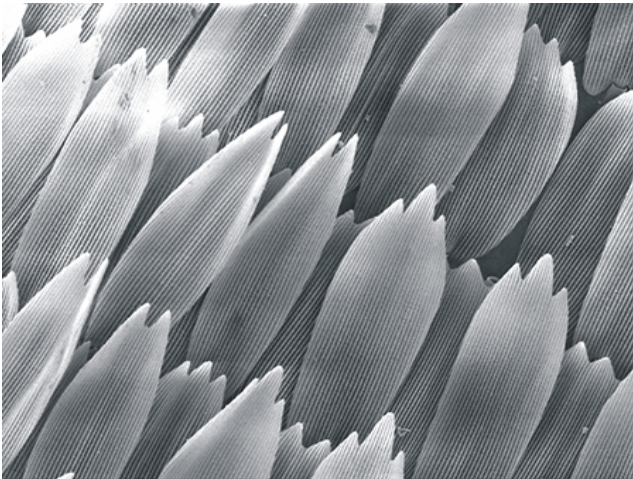
SEM MAG: 4.00 kx
 HV: 10.00 kV
 VAC: HiVac
 DET: SE Detector administrator
 WD: 16.5900 mm
 20 um
 Vega ©Tescan TNIT



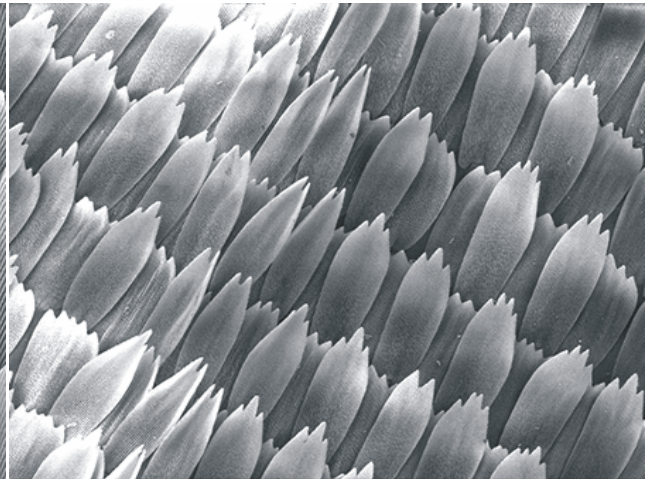
SEM MAG: 3.00 kx
 HV: 10.00 kV
 VAC: HiVac
 DET: SE Detector administrator
 WD: 16.5900 mm
 20 um
 Vega ©Tescan TNIT



SEM MAG: 2.00 kx
 HV: 10.00 kV
 VAC: HiVac
 DET: SE Detector administrator
 WD: 16.5900 mm
 50 um
 Vega ©Tescan TNIT

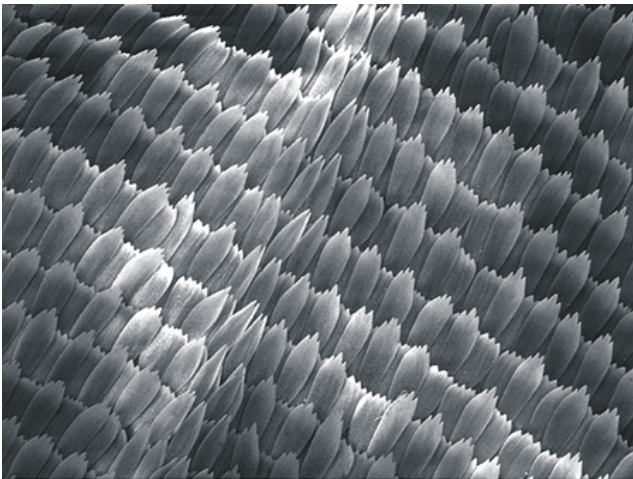


SEM MAG: 1.00 kx
 HV: 10.00 kV
 VAC: HiVac
 DET: SE Detector administrator
 WD: 16.5900 mm
 100 um
 Vega ©Tescan TNIT

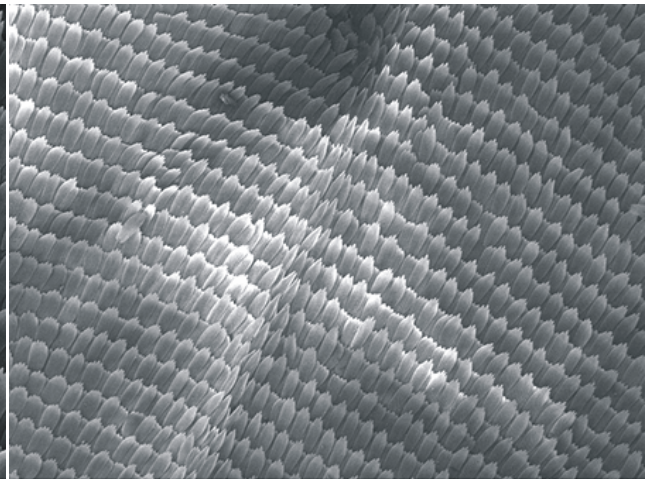


SEM MAG: 500 x
 HV: 10.00 kV
 VAC: HiVac
 DET: SE Detector administrator
 WD: 16.5900 mm
 200 um
 Vega ©Tescan TNIT

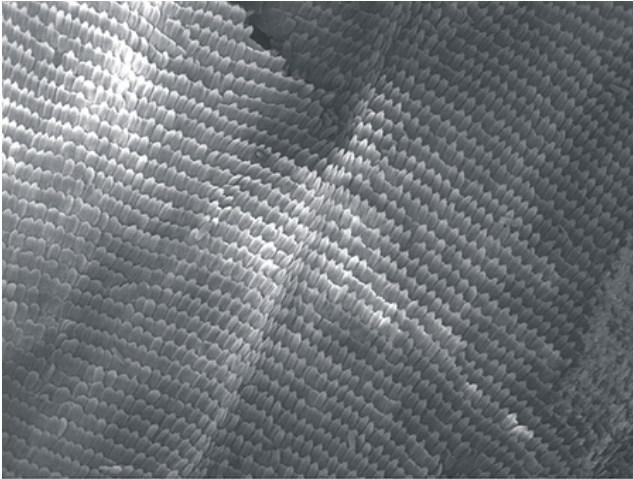
6-2



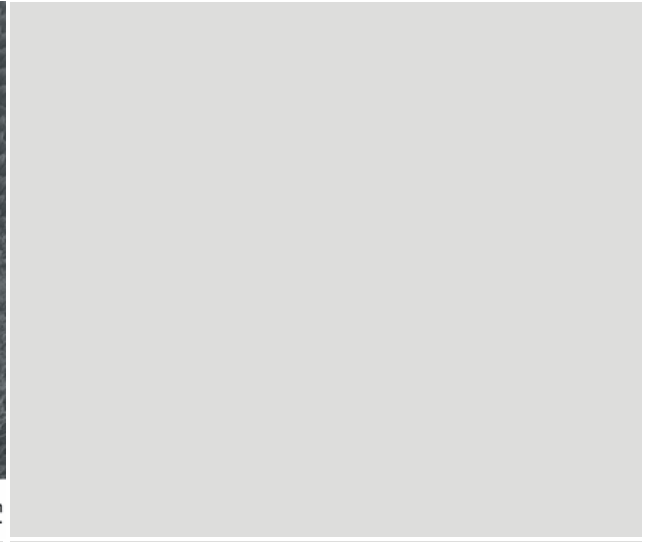
SEM MAG: 250 x
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.5900 mm
500 um
Vega ©Tescan
TNIT



SEM MAG: 125 x
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.5900 mm
1 mm
Vega ©Tescan
TNIT

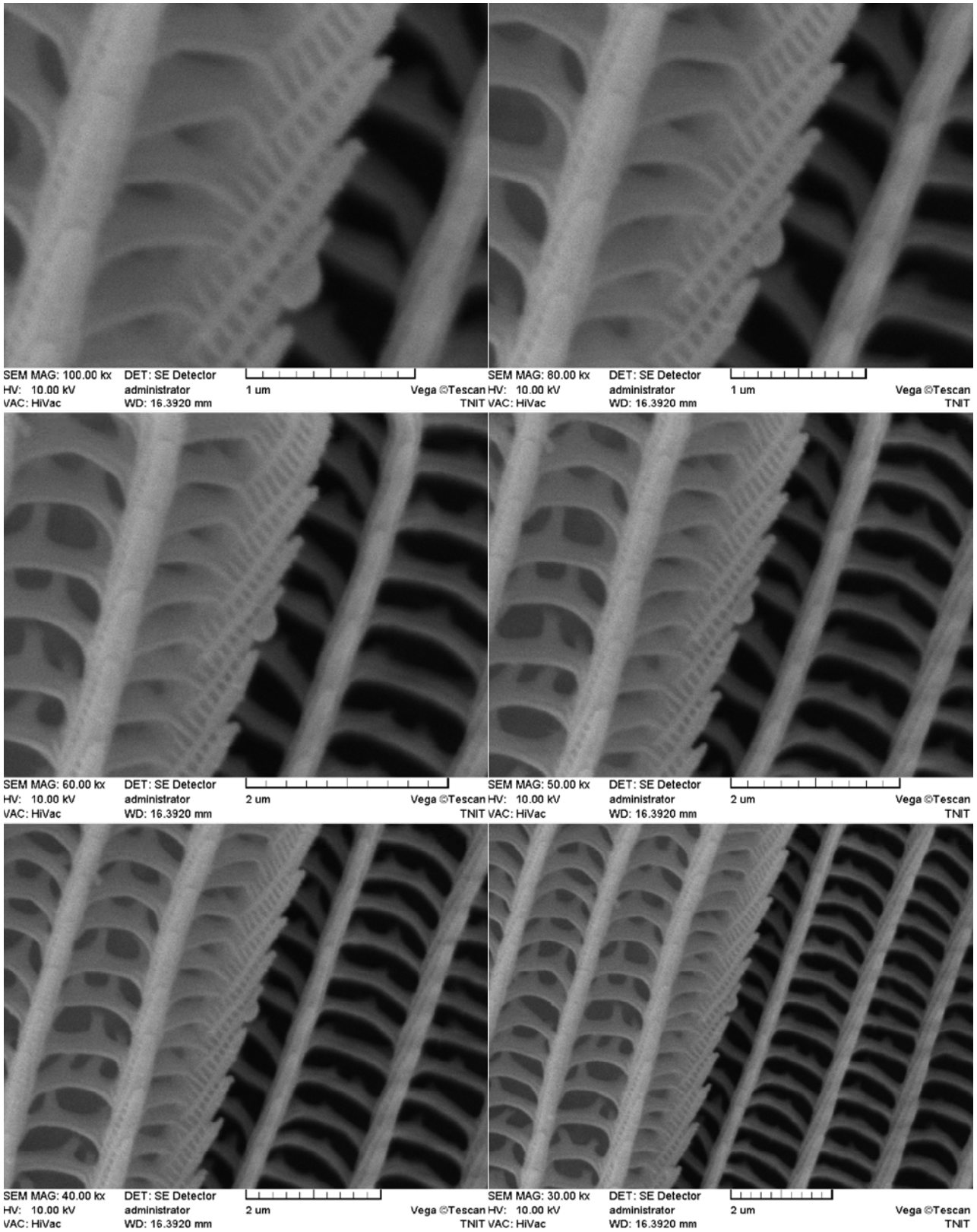


SEM MAG: 74 x
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.5900 mm
1 mm
Vega ©Tescan
TNIT

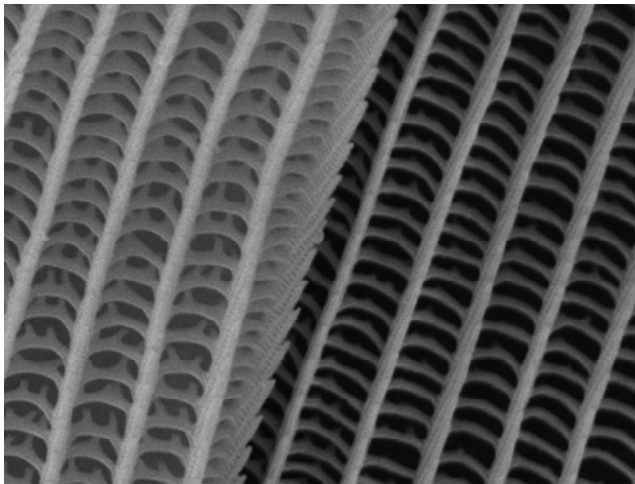


端紫斑蝶 #6-3

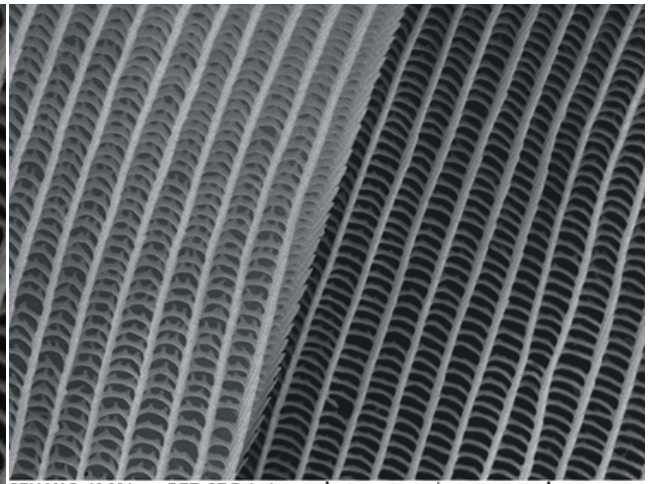
6-3



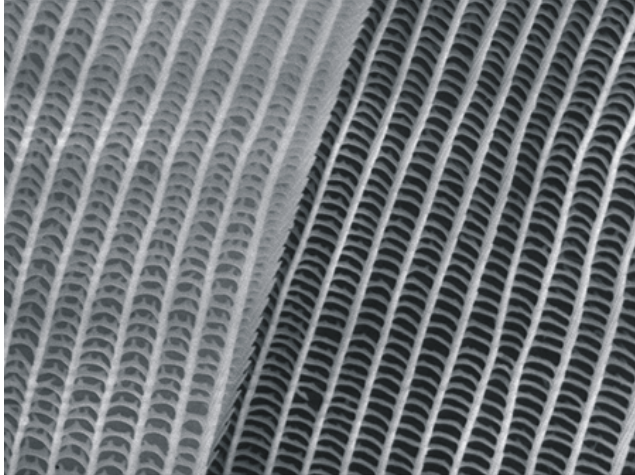
6-3



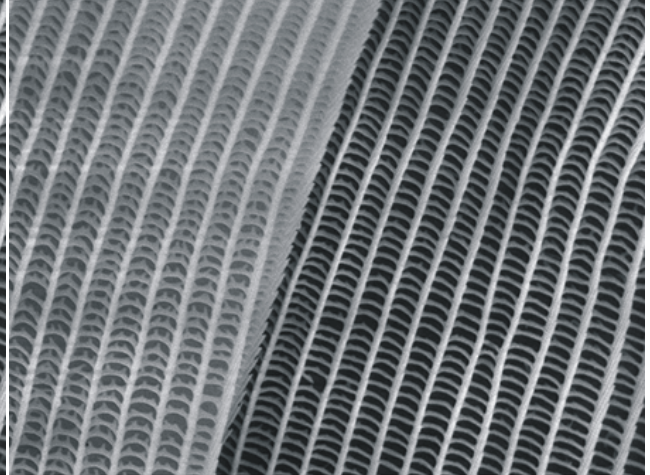
SEM MAG: 20.00 kx DET: SE Detector
HV: 10.00 kV administrator
VAC: HiVac WD: 16.3920 mm
Vega ©Tescan
TNIT



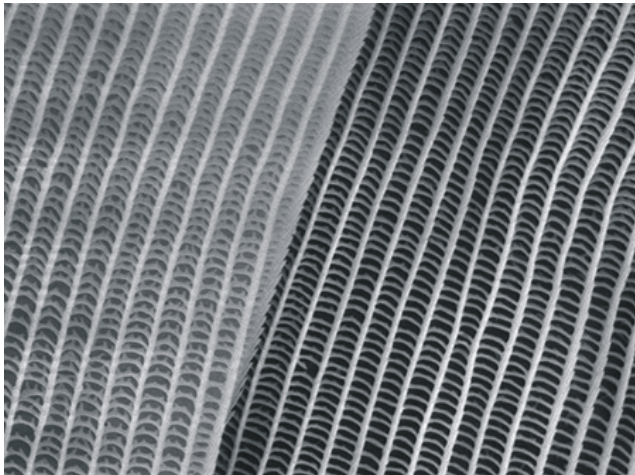
SEM MAG: 10.00 kx DET: SE Detector
HV: 10.00 kV administrator
VAC: HiVac WD: 16.3920 mm
Vega ©Tescan
TNIT



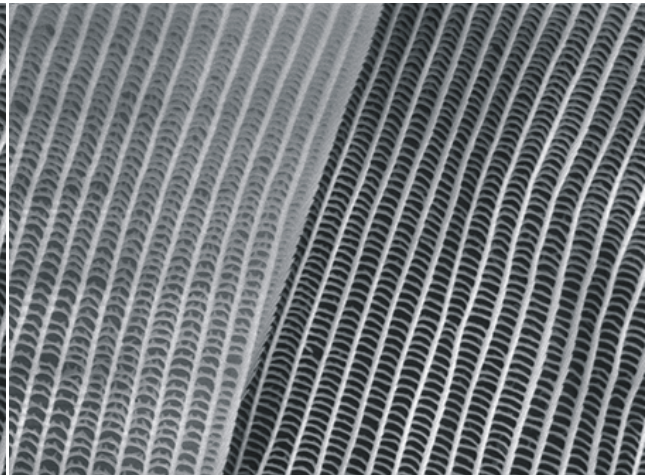
SEM MAG: 10.00 kx DET: SE Detector
HV: 10.00 kV administrator
VAC: HiVac WD: 16.3920 mm
Vega ©Tescan
TNIT



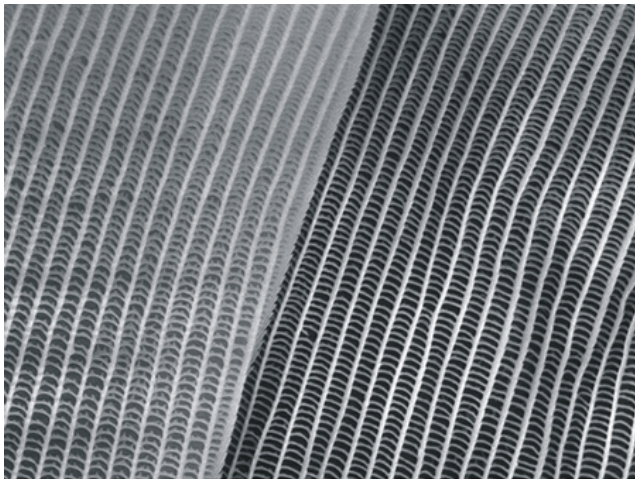
SEM MAG: 9.00 kx DET: SE Detector
HV: 10.00 kV administrator
VAC: HiVac WD: 16.3920 mm
Vega ©Tescan
TNIT



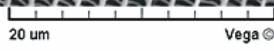
SEM MAG: 8.00 kx DET: SE Detector
HV: 10.00 kV administrator
VAC: HiVac WD: 16.3920 mm
Vega ©Tescan
TNIT



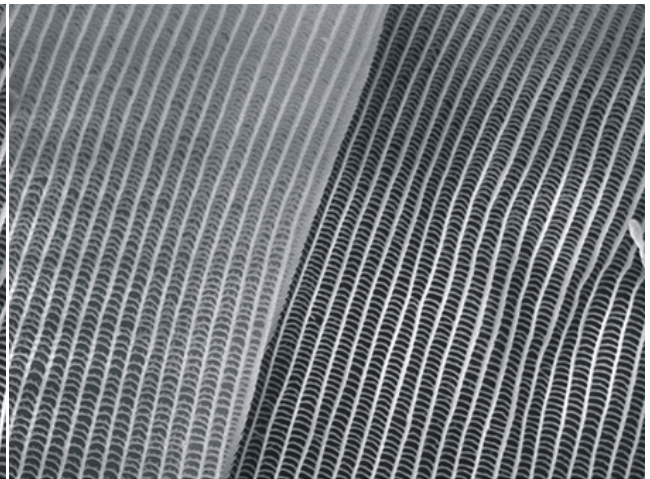
SEM MAG: 7.00 kx DET: SE Detector
HV: 10.00 kV administrator
VAC: HiVac WD: 16.3920 mm
Vega ©Tescan
TNIT



SEM MAG: 6.00 kx
 HV: 10.00 kV
 VAC: HiVac
 DET: SE Detector
 administrator
 WD: 16.3920 mm



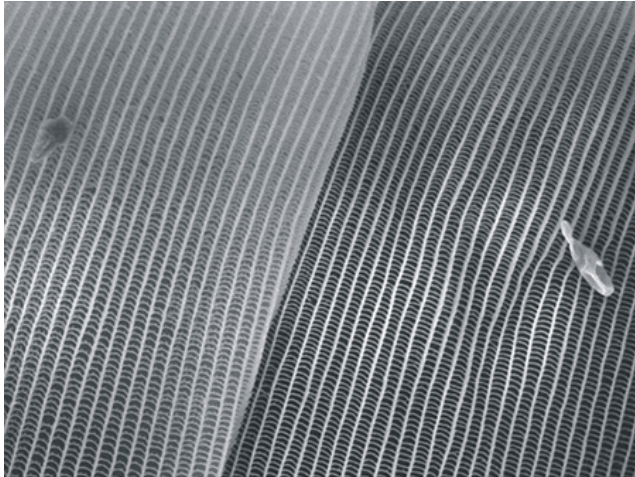
Vega ©Tescan
 TNIT



SEM MAG: 5.00 kx
 HV: 10.00 kV
 VAC: HiVac
 DET: SE Detector
 administrator
 WD: 16.3920 mm



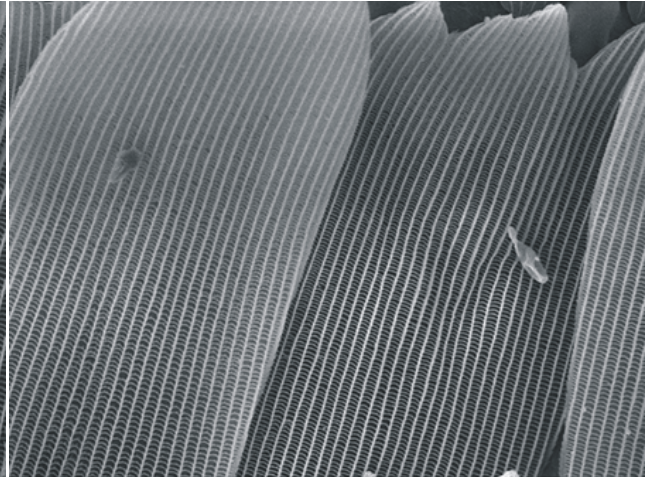
Vega ©Tescan
 TNIT



SEM MAG: 4.00 kx
 HV: 10.00 kV
 VAC: HiVac
 DET: SE Detector
 administrator
 WD: 16.3920 mm



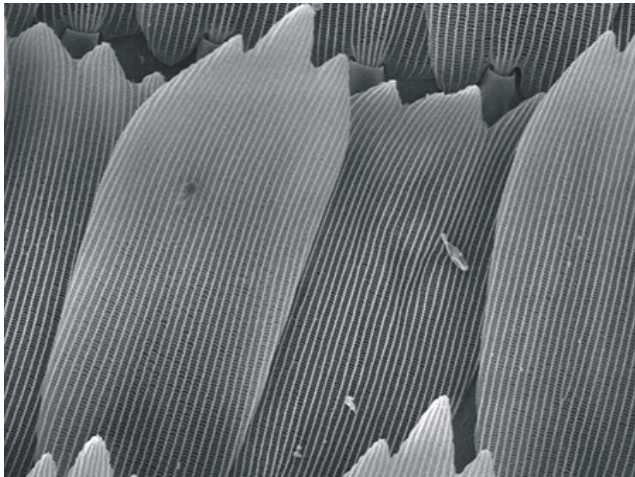
Vega ©Tescan
 TNIT



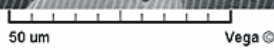
SEM MAG: 3.00 kx
 HV: 10.00 kV
 VAC: HiVac
 DET: SE Detector
 administrator
 WD: 16.3920 mm



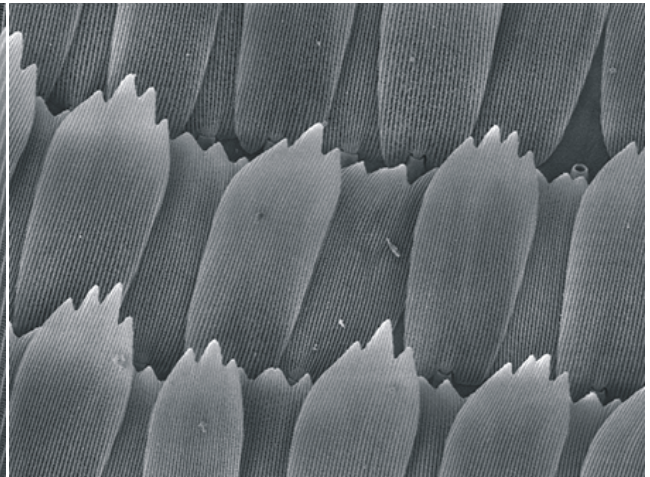
Vega ©Tescan
 TNIT



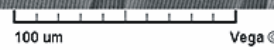
SEM MAG: 2.00 kx
 HV: 10.00 kV
 VAC: HiVac
 DET: SE Detector
 administrator
 WD: 16.3920 mm



Vega ©Tescan
 TNIT

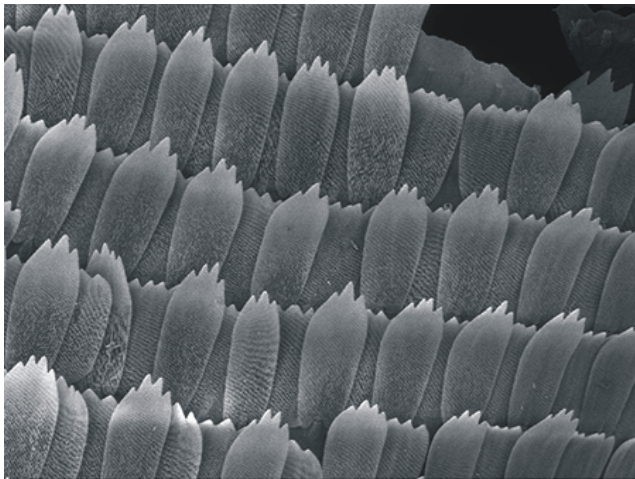


SEM MAG: 1.00 kx
 HV: 10.00 kV
 VAC: HiVac
 DET: SE Detector
 administrator
 WD: 16.3920 mm

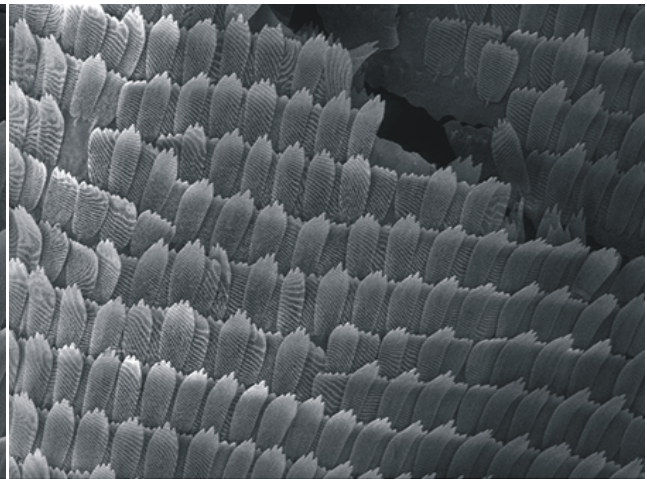


Vega ©Tescan
 TNIT

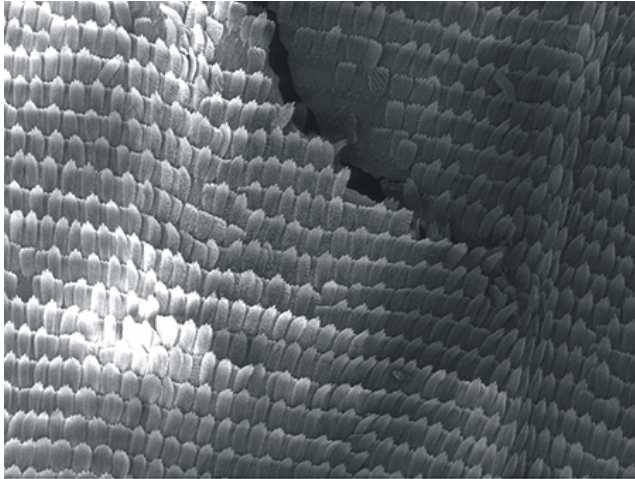
6-3



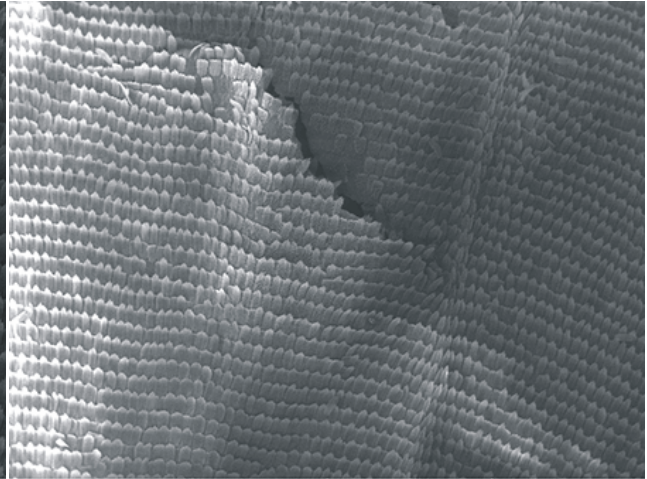
SEM MAG: 500 x
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.3920 mm
200 um
Vega ©Tescan
TNIT



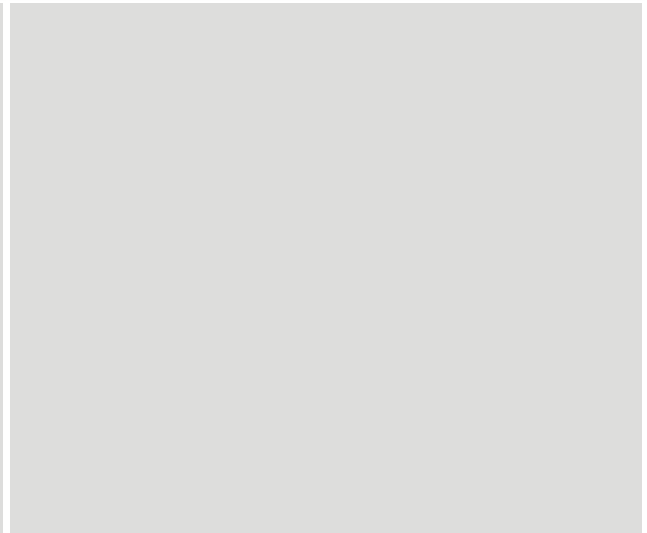
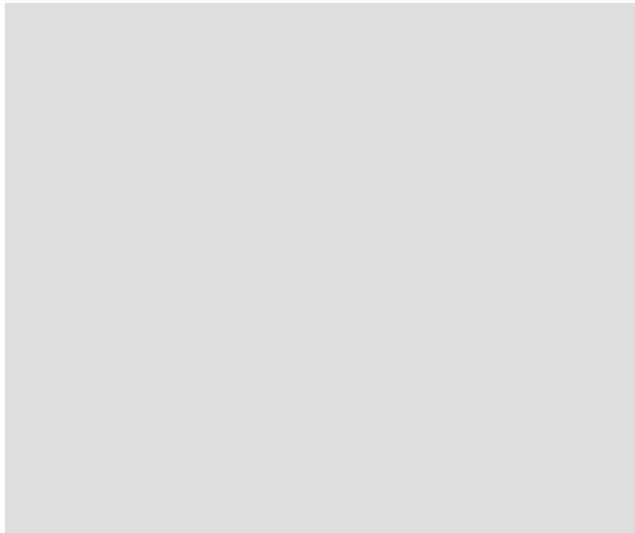
SEM MAG: 250 x
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.3920 mm
500 um
Vega ©Tescan
TNIT



SEM MAG: 125 x
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.3920 mm
1 mm
Vega ©Tescan
TNIT

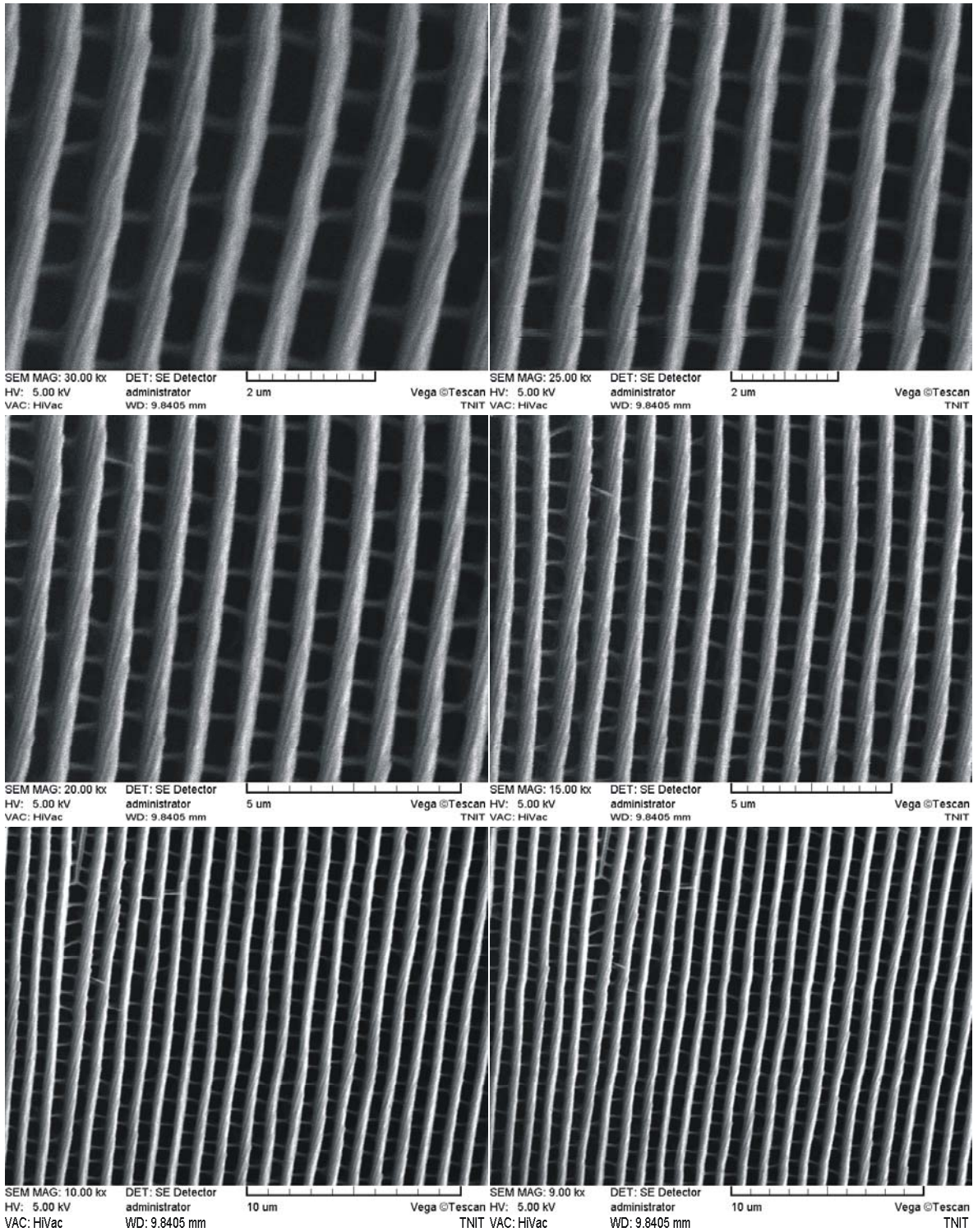


SEM MAG: 75 x
HV: 10.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 16.3920 mm
1 mm
Vega ©Tescan
TNIT

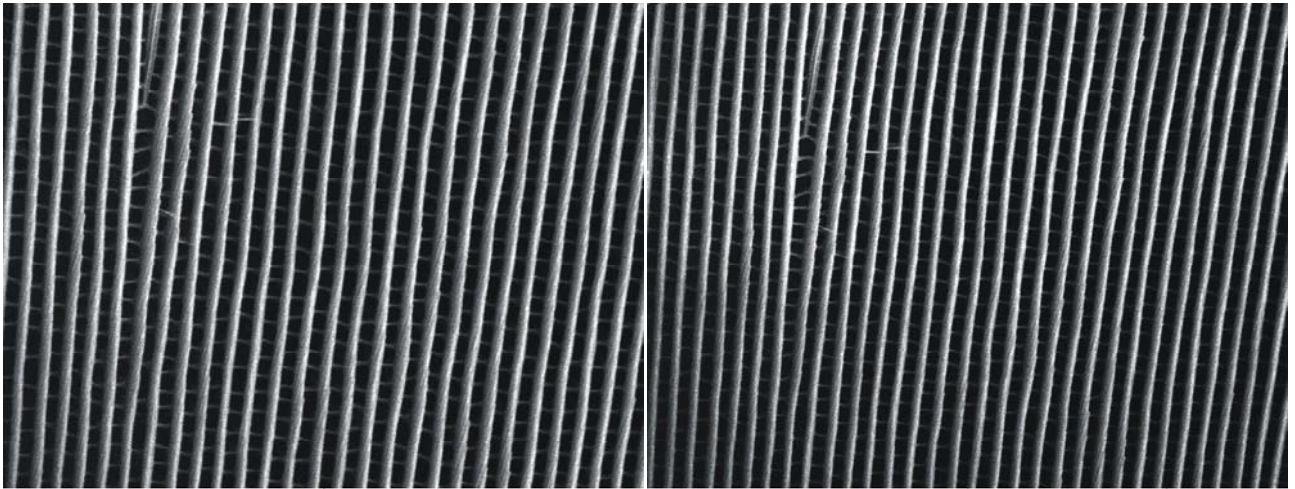


紫蛇目蝶#幻色區

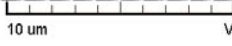
紫蛇目蝶-1



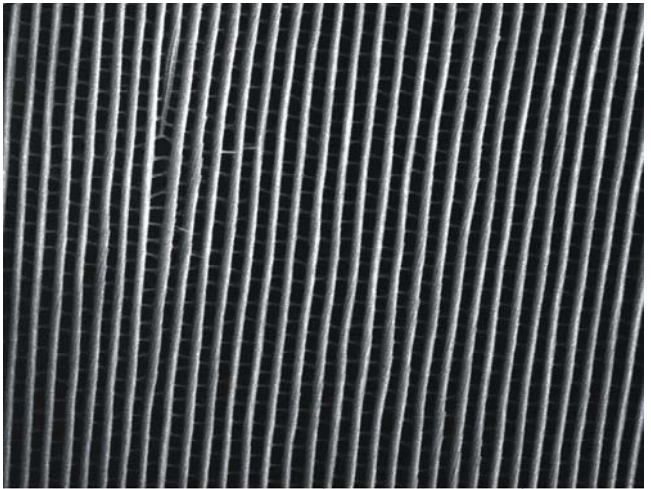
紫蛇目蝶-1



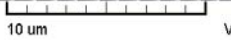
SEM MAG: 8.00 kx
HV: 5.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 9.8405 mm



Vega ©Tescan



SEM MAG: 7.00 kx
HV: 5.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 9.8405 mm



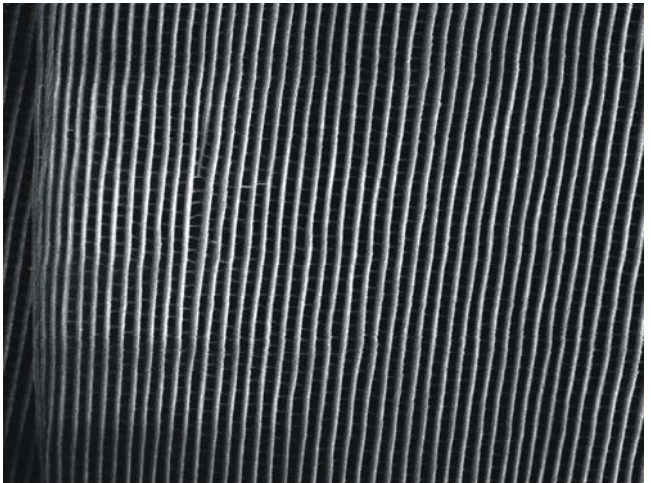
Vega ©Tescan



SEM MAG: 6.00 kx
HV: 5.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 9.8405 mm



Vega ©Tescan



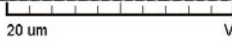
SEM MAG: 5.00 kx
HV: 5.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 9.8405 mm



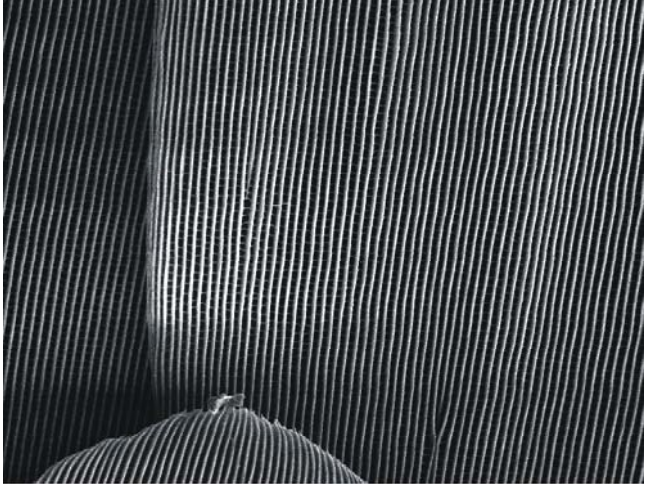
Vega ©Tescan



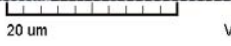
SEM MAG: 4.00 kx
HV: 5.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 9.8405 mm



Vega ©Tescan

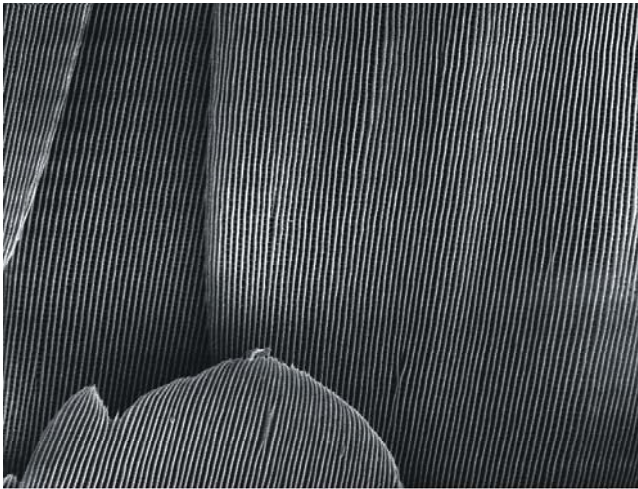


SEM MAG: 3.00 kx
HV: 5.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 9.8405 mm



Vega ©Tescan

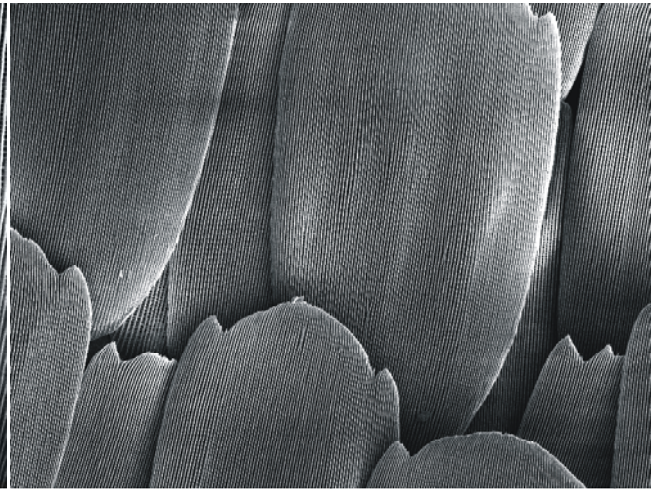
紫蛇目蝶-1



SEM MAG: 2.00 kx
HV: 5.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 9.8405 mm

50 um

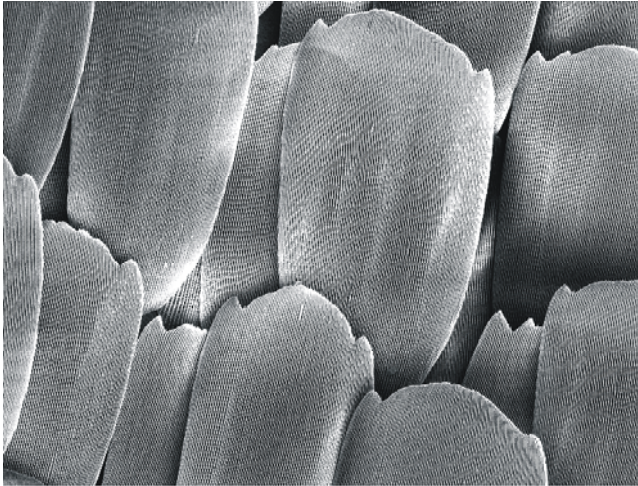
Vega ©Tescan
TNIT



SEM MAG: 1.00 kx
HV: 5.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 9.8405 mm

100 um

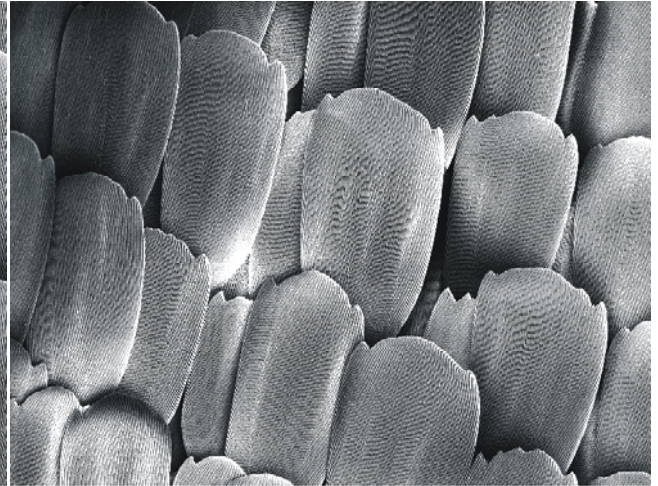
Vega ©Tescan
TNIT



SEM MAG: 750 x
HV: 5.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 9.8405 mm

100 um

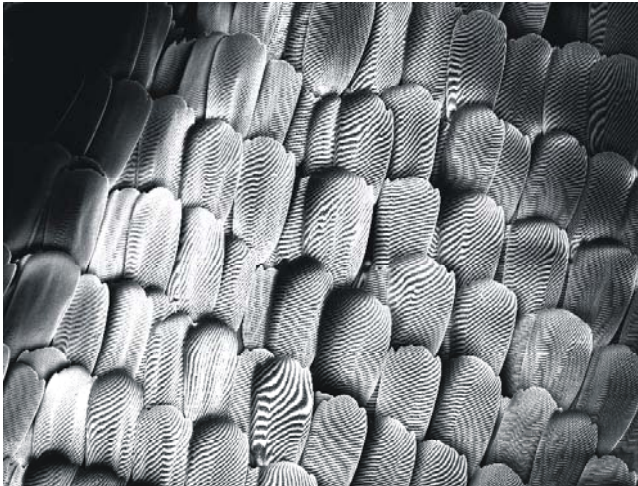
Vega ©Tescan
TNIT



SEM MAG: 500 x
HV: 5.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 9.8405 mm

200 um

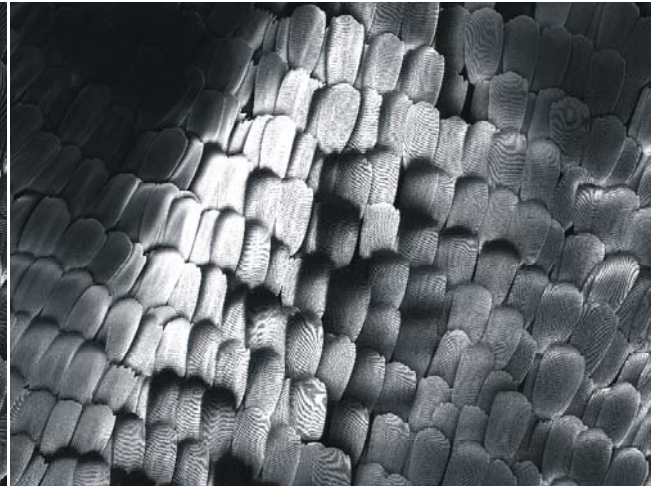
Vega ©Tescan
TNIT



SEM MAG: 250 x
HV: 5.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 9.8405 mm

200 um

Vega ©Tescan
TNIT

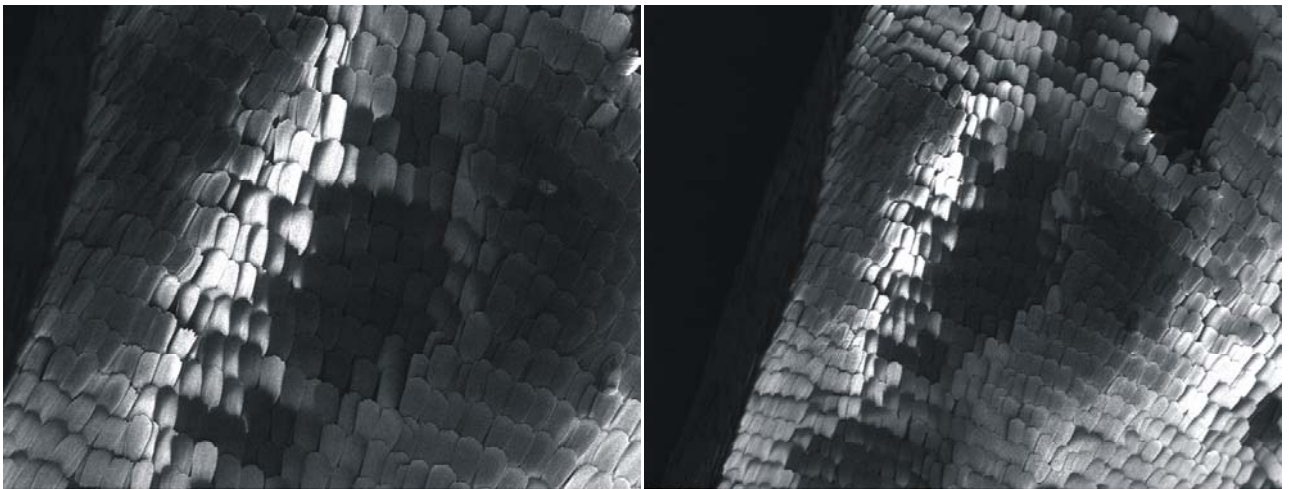


SEM MAG: 150 x
HV: 5.00 kV
VAC: HiVac
DET: SE Detector
administrator
WD: 9.8405 mm

500 um

Vega ©Tescan
TNIT

紫蛇目蝶-1



SEM MAG: 100 x
HV: 5.00 kV
VAC: HiVac

DET: SE Detector
administrator
WD: 9.8405 mm

1 mm

Vega ©Tescan

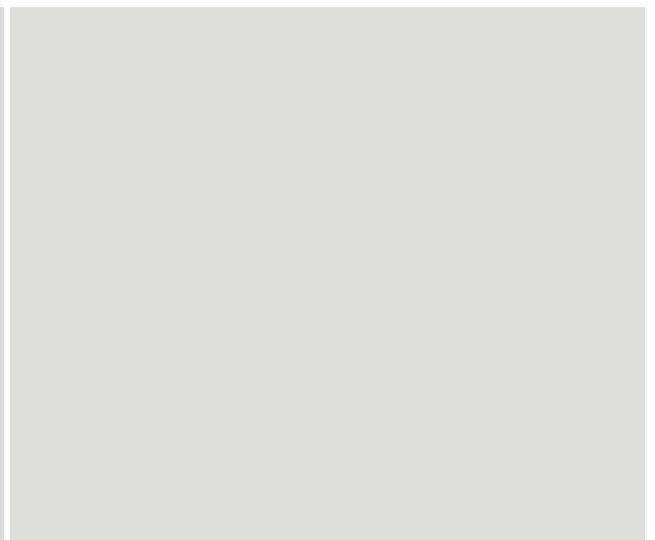
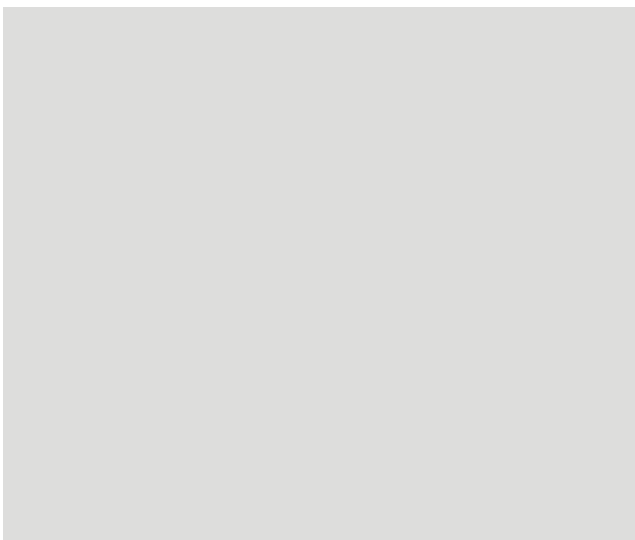
SEM MAG: 60 x
HV: 5.00 kV
VAC: HiVac

DET: SE Detector
administrator
WD: 9.8405 mm

1 mm

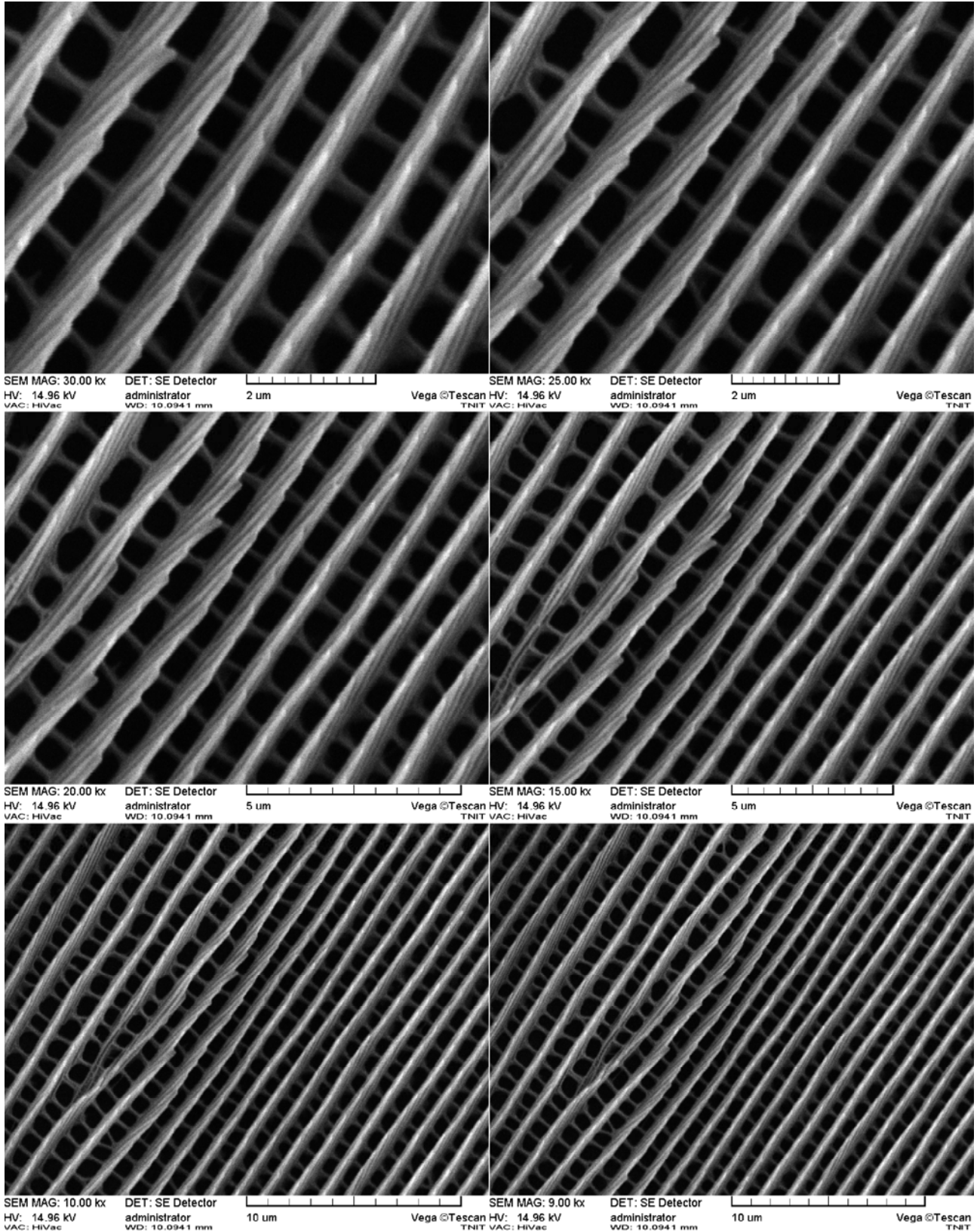
Vega ©Tescan

TNIT

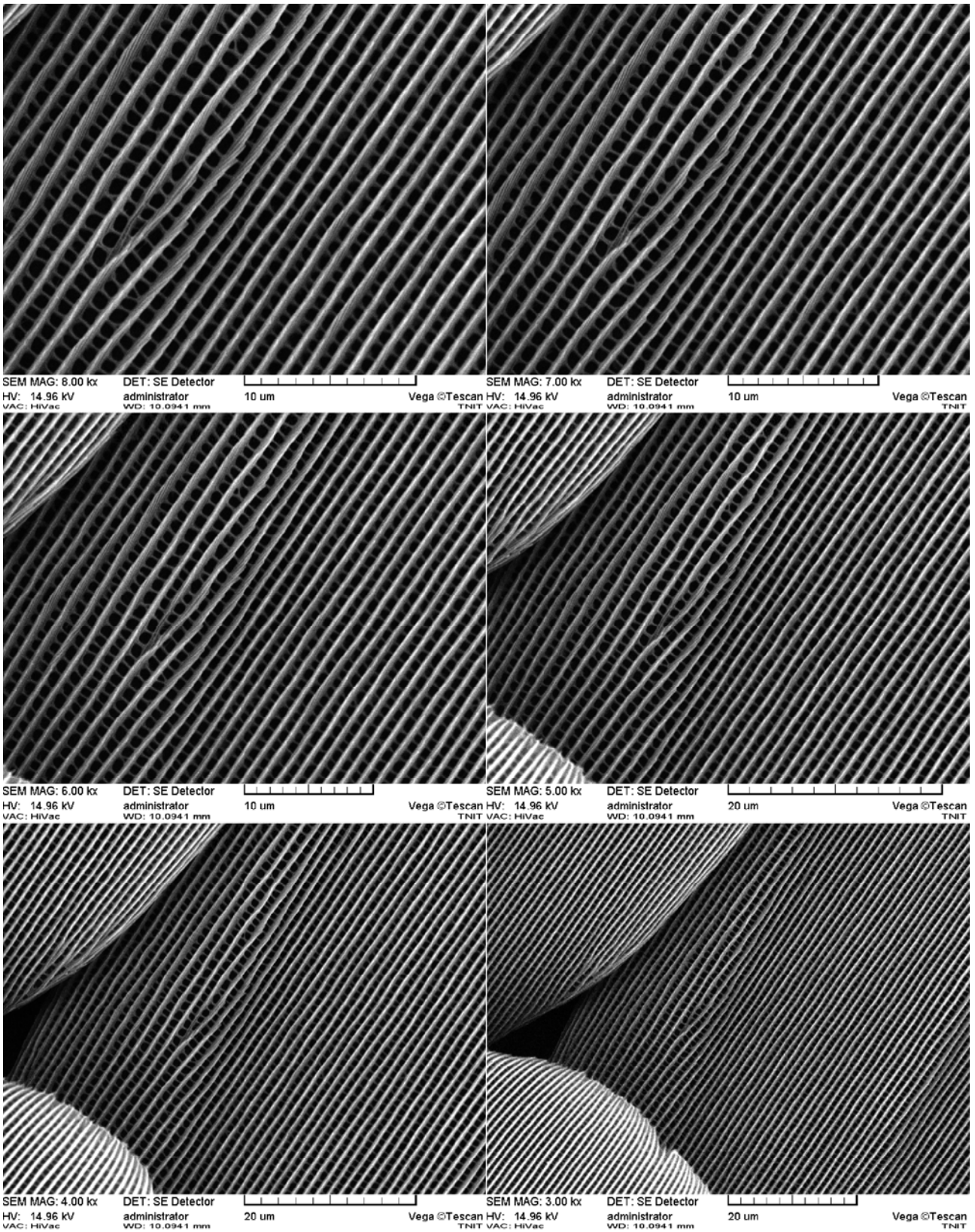


紫蛇目蝶#介於幻色區與非幻色區

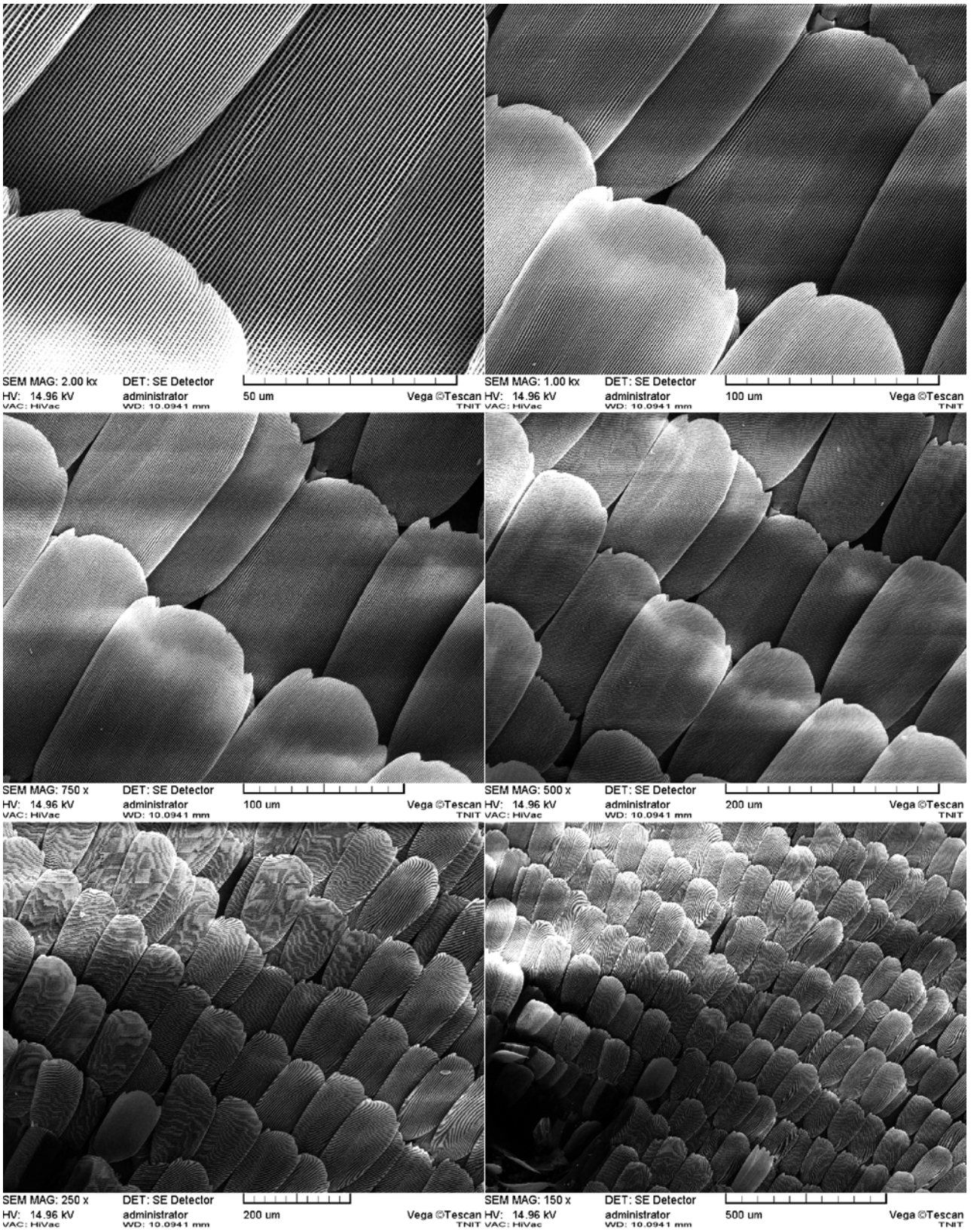
紫蛇目蝶-2



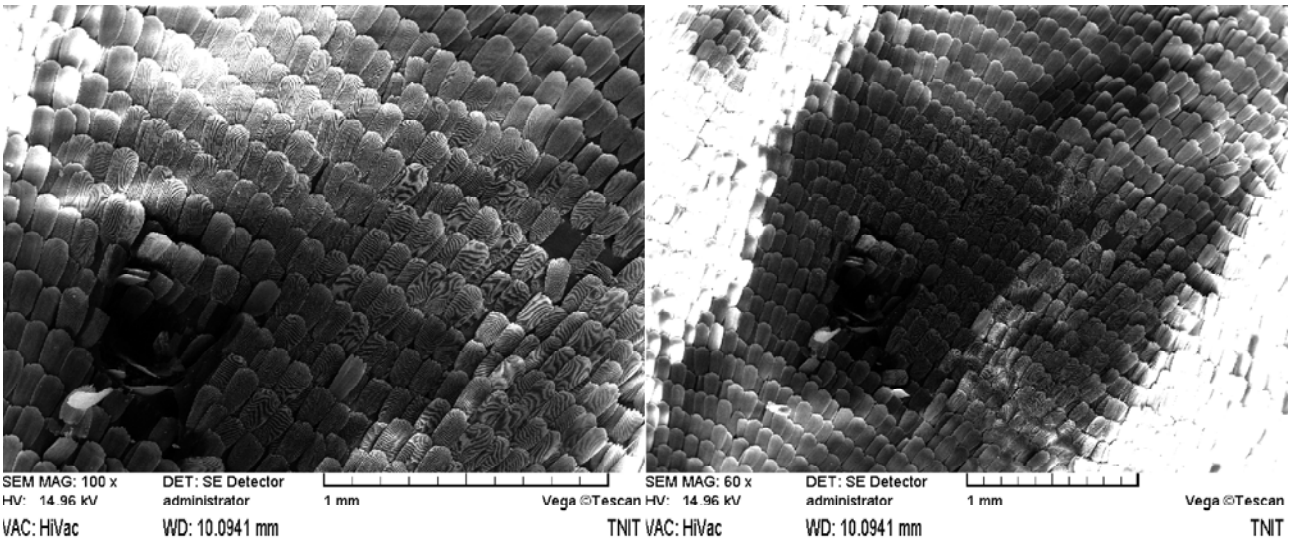
紫蛇目蝶-2



紫蛇目蝶-2

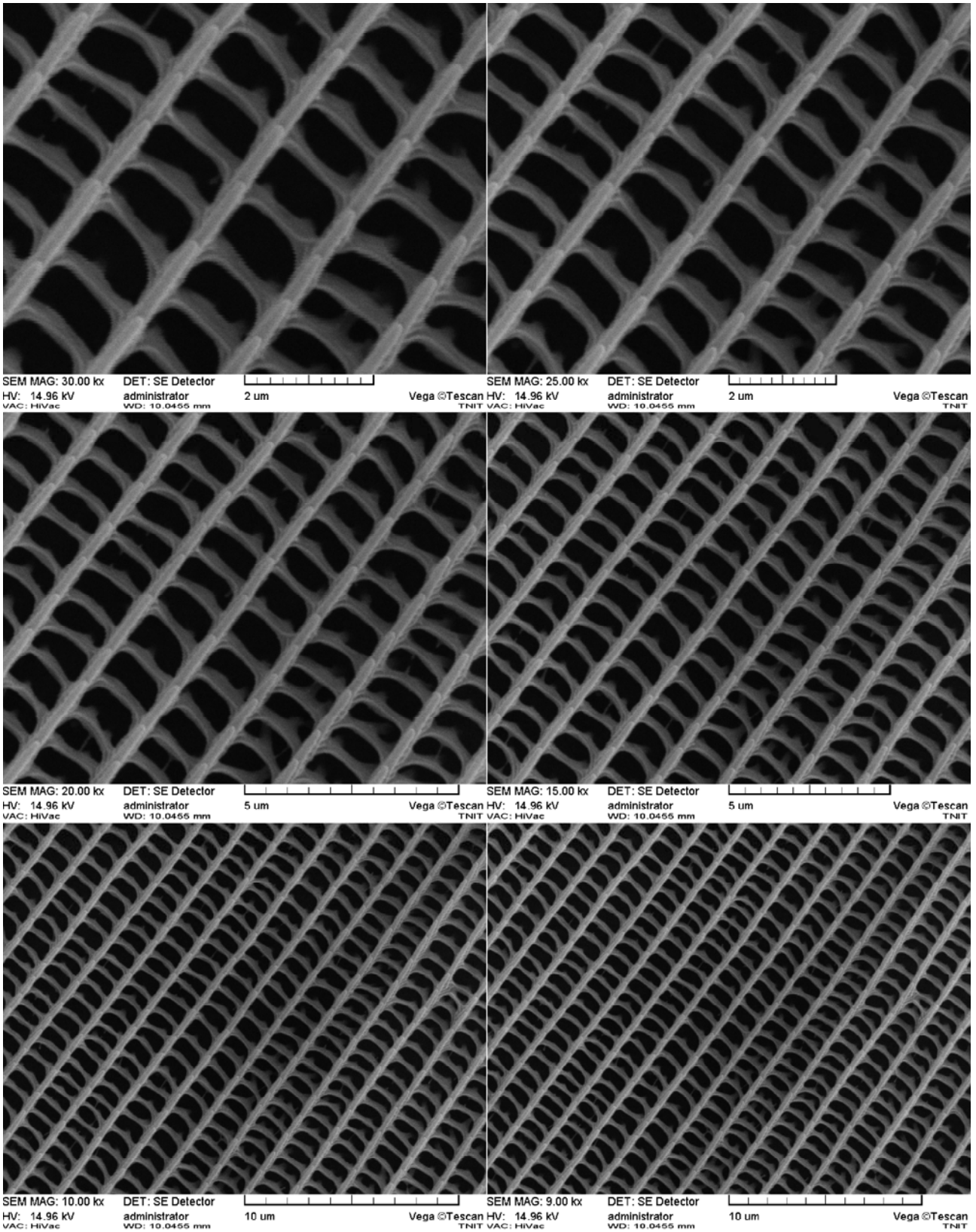


紫蛇目蝶-2

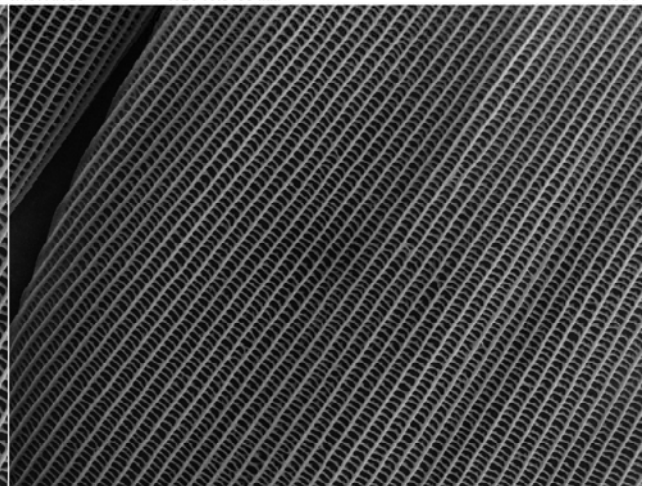
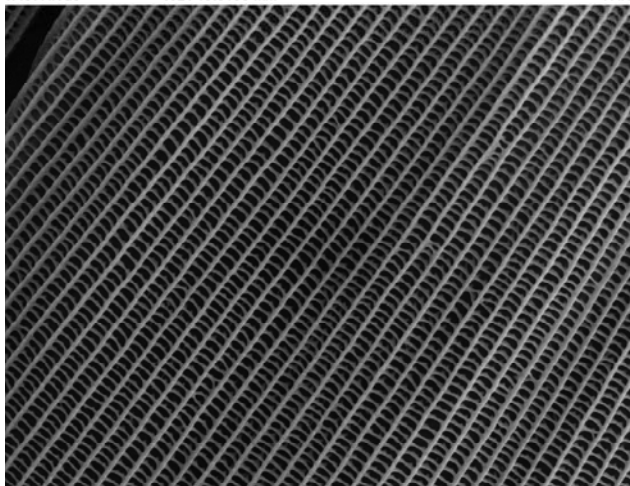
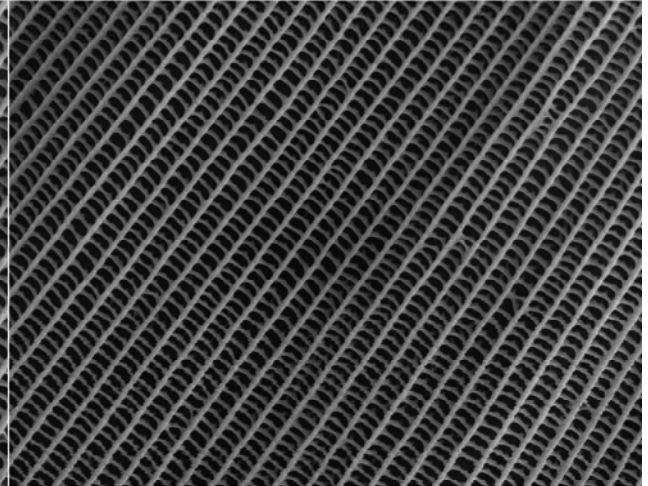
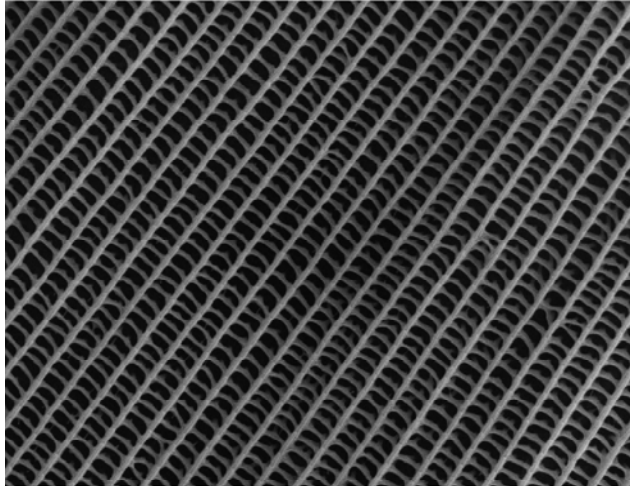
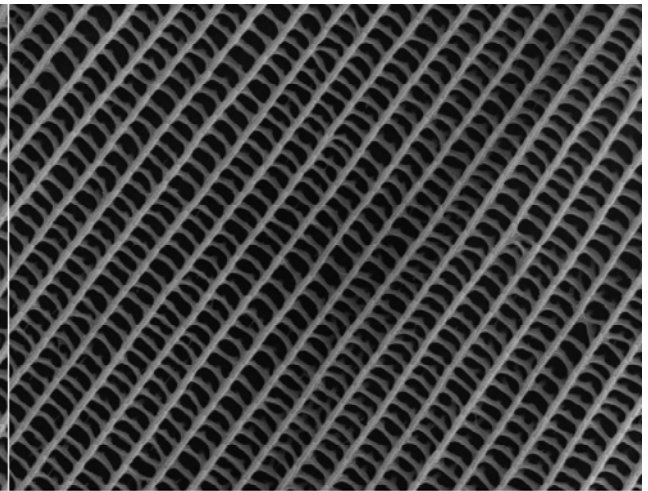
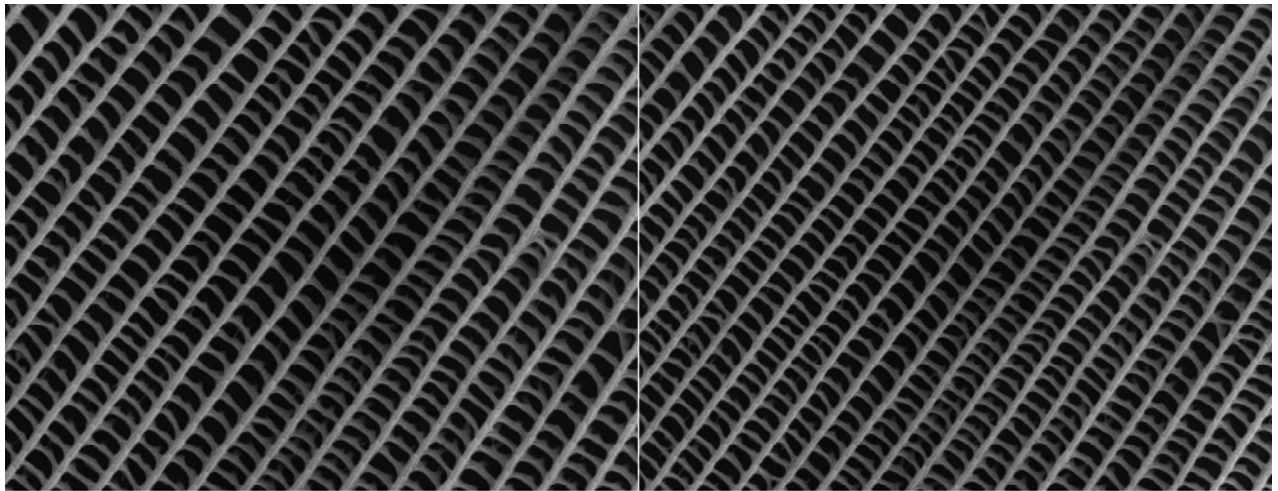


紫蛇目蝶#非幻色區

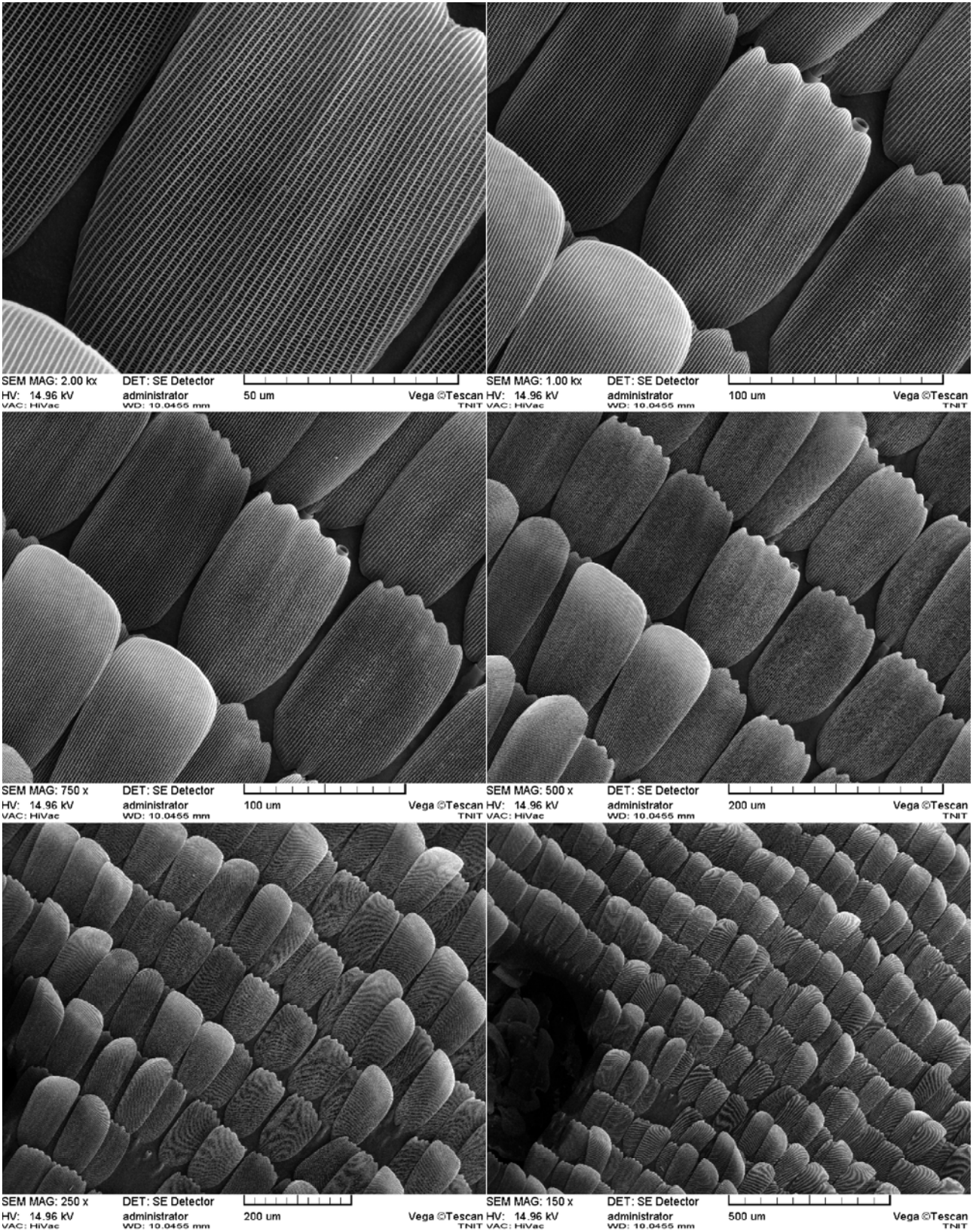
紫蛇目蝶-3



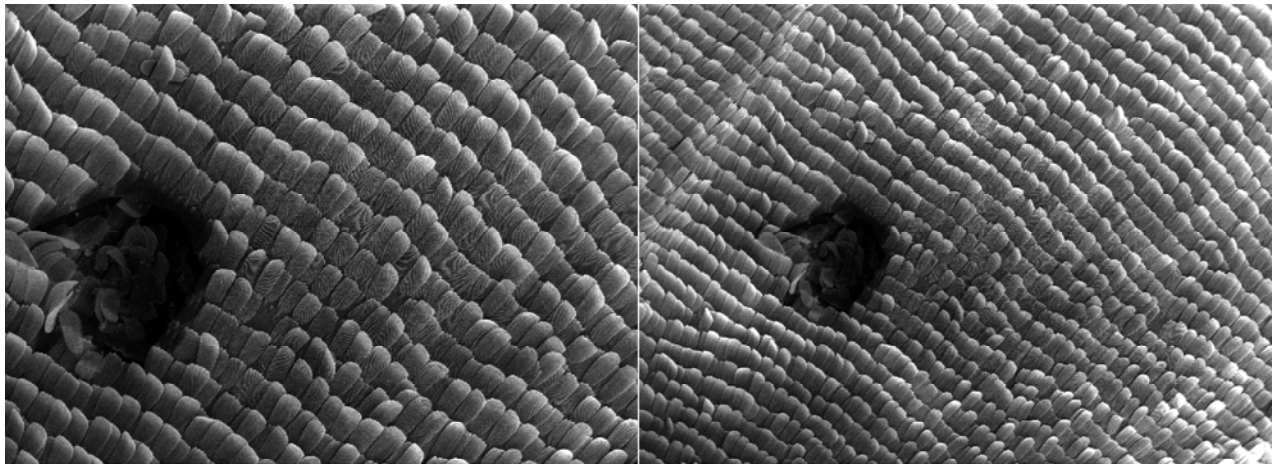
紫蛇目蝶-3



紫蛇目蝶-3



紫蛇目蝶-3



SEM MAG: 100 x
HV: 14.96 kV
VAC: HiVac

DET: SE Detector
administrator
WD: 10.0455 mm

1 mm

Vega ©Tescan

TNIT

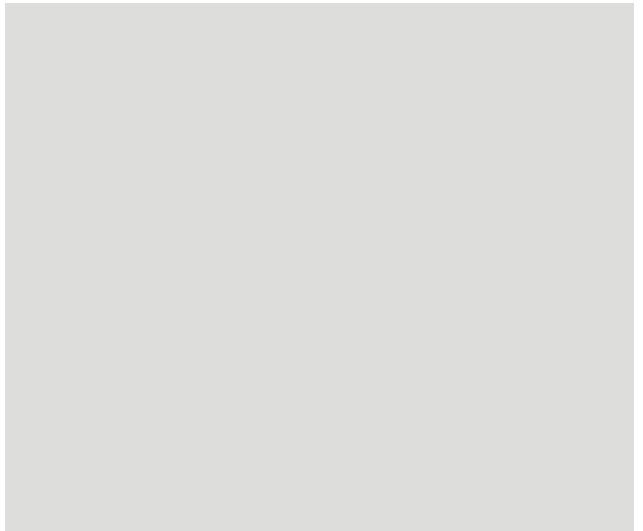
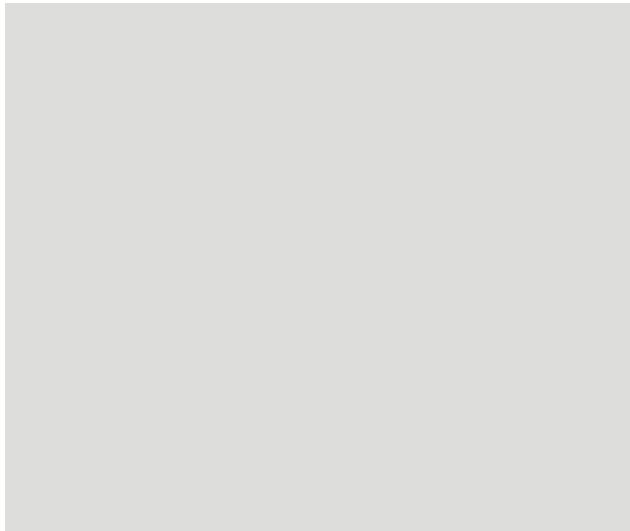
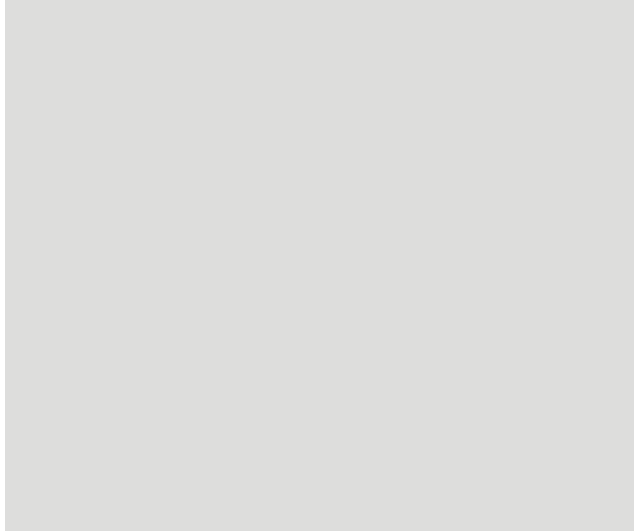
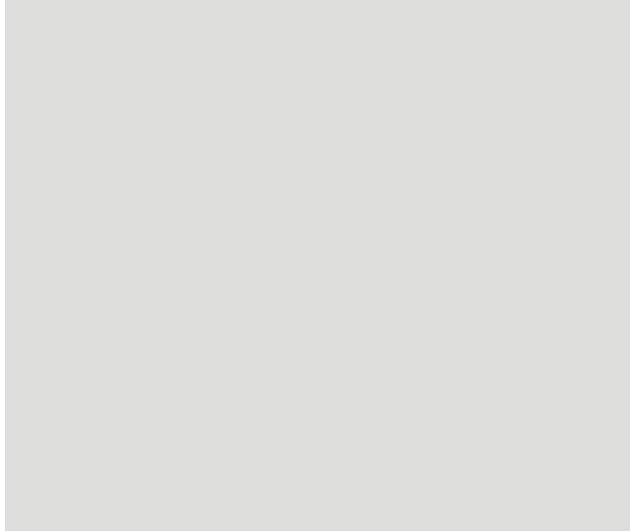
SEM MAG: 60 x
HV: 14.96 kV

DET: SE Detector
administrator
WD: 10.0455 mm

1 mm

Vega ©Tescan

TNIT



評語

此作品相當有趣，一方面觀察紫蝶翅膀的影像，一方面用掃描式電子顯微鏡觀察翅膀的鱗片。但可惜的是未能將兩項觀察連結在一起。若能請物理或資訊工程的協助，會使此作品更具價值。