

On the Vegetation of the Western and Southern shores of the Dead Sea. By B. T. LOWNE, M.R.C.S. Eng. Communicated by Dr. HOOKER, F.R.S.

[Read April 6, 1865.]

THE least-known flora of Palestine is that of the Ghor or Jordan valley; and, as far as I am aware, the flora of the south of the Dead Sea valley was almost if not entirely unknown before my visit in January 1864, in company with the Rev. H. B. Tristram and his party. With the assistance of the Royal Society, and under the guidance of that distinguished traveller, I was enabled to stay several days in the least frequented and most dangerous part of the Dead Sea valley, and I propose with your leave to present to you this evening the results of my researches in that region.

General Character of the Vegetation near the Dead Sea.—The greater part of the western and southern shores of the Dead Sea, between Ain Terabeh and the oasis Es Saffieh, is quite destitute of vegetation, except occasional patches of *Lycium europæum*, *Salvia ægyptiaca*, *Lagurus ovatus*, and one or two composite plants which I have not been able to determine, owing to the state they were in at the time of our visit. At Ain Terabeh there is a dense thicket of reeds (*Arundo donax*) with a marsh of Salsolas, *Atriplex halimus*, and here and there a clump of Tamarisks, probably *T. Pallasii* or a species very near it. Ain Terabeh was the only place where I found *Æluropus lævis*; but Dr. Hooker found this remarkable grass nearer the northern end of the sea. Beyond Ain Terabeh, travelling south, except at Engedi, Saffieh, and on the flat plain between the Zuweirah and Mahauwat Wadies, all the vegetation I observed, except that already mentioned, were a few tamarisks, one or two small Acacia trees (*Acacia seyal*), and a single specimen of *Astragalus* with purple flowers (near *A. hypoglottis*, Linn.). Our march was, however, very hurried and fatiguing whilst passing over these desert regions, and I speak from memory and not from notes.

The banks of the streams at Engedi are in many places covered with luxuriant vegetation, dense thickets of reeds (*Arundo donax*), *Salix octandra*, and *Salvadora persica* overhanging them, with here and there a patch of *Typha latifolia*, and an apparently new species of *Pennisetum*; whilst immense fronds of Maiden's Hair Fern (*Adiantum capillus Veneris*) hang from the damp shady parts of the rocks. The general appearance of the oasis, however, is exceedingly desolate: the Arabs cultivate but little corn; and the

most conspicuous botanical objects in the landscape are groups of *Tamarix Pallasii*, *Moringa aptera*, *Acacia seyal*, *Zizyphus vulgaris*, and the curious and grotesque Asclepiad *Calotropis procera*, Br. *Retama monosperma*, Boiss., is also a common bush; but it flowers later, and was not a very conspicuous object in the vegetation at the time of our visit.

The oasis of Es Saffieh differs from that at Engedi in being better watered and therefore more fertile, and in being inhabited by settled and not by wandering tribes of Arabs. Unfortunately the curious Arab village had been sacked and burned the day before we arrived, by a lawless gang of Arabs from Petraea; and all its unhappy inhabitants had flown, leaving their corn-crops, and indigo, and the dead bodies of those who had fallen in fight behind them. As the enemy were apparently still lurking about, our survey of the district was necessarily hasty and imperfect. *Zizyphus vulgaris* and *Salvadora persica* are both most abundant at Saffieh, much more abundant than at Engedi, whilst *Calotropis*, although common, is much less common than at the latter place; with the exception of *Acacia seyal* and *Moringa aptera*, I saw no other trees and bushes at Saffieh, although I kept a sharp look-out, knowing at the time that Irby and Mangles had described the oasis as abounding in an almost infinite variety of shrubs and bushes.

The most curious and interesting locality in the south of the Ghor, however, is the delta-like flat which extends from the embouchures of the Zuweirah and Mahauwat Wadies to the shore of the Dead Sea, where I found 82 species of flowering plants, with few exceptions, quite peculiar to this limited region, as regards the Dead Sea valley and the rest of Palestine.

The Zuweirah and Mahauwat Wadies are two very deep gorges formed by the drainage of the eastern portion of the plateau of Beersheba and the hills between it and the Dead Sea, and which enter the Ghor just north of, and on the west side of, Jebel Usdum, about two miles from the Salt Lake. These two miles consist of a flat delta formed of tertiary deposits washed down and deeply channelled by occasional torrents, which, judging from appearances, must be rare and violent. The channels are exceedingly numerous, and vary from a few feet to many yards in breadth, and from two to eighteen feet in depth; and although at the time of our visit they were apparently perfectly dry even a foot or more beneath the surface, they were fringed with *Zizyphus vulgaris*, *Acacia seyal*, *Tamarix*, *Ochradenus*, and *Dæmia cordata*; and the

beds of the channels were dotted over with low scrubby bushes of *Fagonia* and *Gymnocarpum*, and with showy tufts of *Cleome trinervia* and *Salvia controversa*. In fact, the whole of the 82 species which I found were, with few exceptions, confined to the channels or their immediate vicinity, and every plant seemed to be in flower; yet we had to send nearly two miles up the Zuweirah Wady for water, which existed only in deep rock-pools, the remains of former rains. The entire delta has a very desolate aspect. The Rose of Jericho (*Anastatica*) grows in its dryest parts; but it is fringed at the edge of the lake by a bright green marsh of *Salsolas*.

On examining the list of plants which I found in this region, it will be seen that the flora, although very different from the flora of the rest of Palestine, is essentially Mediterranean in type. Its affinities, however, are all with the floras of northern Africa, especially with the desert-floras of Upper Egypt and Nubia. It will also be found to be closely related with that of Aden in the south, and the Canaries in the west. The flora of this delta appears, moreover, to be precisely similar to that of Arabia Petraea; at least I am led to this belief by a comparison of it with the collection made there by Major M'Donald, now in the Herbarium at Kew.

It will be seen, on examining the lists I have appended to this paper, that, of the 94 species collected by myself in the south of the Dead Sea valley, 29 or 30 only are European plants; and these are chiefly weeds of a very wide distribution: why such plants as *Tribulus terrestris*, *Emex spinosus*, *Solanum nigrum*, and *Capsella bursa pastoris* should form so large a part of the European element in this flora, I am unable to form any idea. With the exception of one or two, all these 29 or 30 species extend into northern India; many have a much wider distribution.

On the other hand over 50 species are decidedly African, not extending into Europe; and many of these are exceedingly local; not more than one-third extend into India; and those which do are chiefly natives of Sind and Affghanistan, affecting arid regions: and none of these African species seem to have a very wide distribution, with the exception of *Azraa javanica*.

Although two of the most remarkable forms of the southern Ghor, *Calotropis procera* and *Salvadora persica*, are Indian plants, yet these are equally common in Upper Egypt and Nubia; so that I do not think there is anything to warrant the ordinary belief that the flora of the south of the Ghor has an Indian type.

Excluding the exceedingly widely distributed European plants

between 30 and 40 of the species of the southern Ghor extend into Sind, and about 13 are found in the Canary Isles: this appears to me a fact worthy of note, since these countries are upon the eastern and western limits of the North-African desert-flora.

The relation which the southern Ghor bears to that of the peninsula of Aden, seeing how little is known of the botany of central Arabia, seems to me a subject of special interest. Eleven of the most characteristic plants of the southern extremity of the Dead Sea valley are common to it and to the peninsula of Aden; and, considering how very limited the floras of the two localities are, this is not an unimportant number. In both places *Reseda amblyocarpa* seems to be by far the most common plant.

In both places the number of species and genera is small compared with the number of natural orders to which they belong. My 94 species belong to 33 orders, giving an average of rather more than three species to each.

The most numerous orders in the flora of the Dead Sea are—

Cruciferæ,	containing	13	species;
Compositæ	„	11	„
Leguminosæ	„	6	„
Chenopodiaceæ	„	6	„
Zygophyllaceæ	„	5	„

whilst at Aden, according to Griffith's *Floracula*, published in your 'Transactions,' there are

11	species of	Leguminosæ,
9	„	Capparidæ,
7	„	Euphorbiaceæ,
5	„	Compositæ,

showing the much more decided tropical character of the latter flora.

None of the plants peculiar to Aden were found by me in the Dead Sea valley; and I know of only one well-marked species peculiar to this region and to the north of Arabia and the adjacent deserts of Suez and Persia, the *Cleome trinervia*, Fresen., which is the most characteristic plant of northern Arabia.

Lastly, I may mention that I found two most distinct varieties of *Pagonia* common about the Zuweirah and Mahauwat Wadies—one, the *P. sinaitica* of Boissier, a creeping plant, and the other the common Levant species; these plants, growing side by side in abundance without any intermediate forms, seem to me to point to two distinct species of *Pagonia*, however wide their distribution and variation may be.

I. *The Desert-Flora of Zuweirah and Mahawat Wadies.*

CRUCIFERÆ.

1. *Mathiola oxyceras*, DC.
2. *Mathiola sinuata*.
3. *Zilla myagroides*, Forsk.
4. *Notoceras canariense*, R. Br.
5. *Farsetia ægyptiaca*, Turcz.
6. *Nasturtium coronopifolium*, DC.
7. *Anastatica hierochuntina*, L.
8. *Neslia paniculata*.
9. *Brassica Aucheri*, Boiss.
10. *Enarthrocarpus strangulatus*,
Boiss.
11. *Hesperis*, sp.
12. *Erucaria*, sp.
13. *Carrichteria vella*, DC.

CAPPARIDÆÆ.

14. *Cleome droserifolia*, Dehile.
Probably the same as *quin-*
quenervia, DC.
15. *Cleome trinervia*, Fresen.

RESEDACEÆ.

16. *Reseda crystallina*, Webb. Pro-
bably a var. of *odorata*.
17. — *amblyocarpa*, Fresen.
18. *Oligomeris glaucescens*, Camb.
19. *Ochradenus baccatus*, DC.

TAMARICINÆÆ.

20. *Tamarix tenuifolia*, DC.? } affines
21. — *Pallasii*, Desv.? } sp.
22. *Reaumuria palestina*, Boiss.
Probably the same as *vermi-*
cularis, L.

ZYGOPHYLLACEÆ.

23. *Fagonia cretica*, L.
24. — *sinaitica*, Boiss.
25. *Nitraria tridentata*, Desf.
26. *Gymnocarpum fruticosum*, Pers.
27. *Tribulus terrestris*, L.

RUTACEÆ.

28. *Ruta tuberculata*, L.

AZOIDEÆ.

29. *Azoon canariense*, L.

RHAMNACEÆ.

30. *Zizyphus vulgaris*, L.

LEGUMINOSÆ.

31. *Retama retam*, Webb.
32. *Astragalus*, sp. resembling *gum-*
mifer.
33. *Lotononis Leobordea*, Boiss.
34. *Trigonella hamosa*, L.
35. *Acacia seyal*, L.
36. *Vicia narbonensis*, L.

COMPOSITÆ.

37. *Anvillea Garcini*, DC.
38. *Asteriscus pygmæus*, Cass.
39. — *graveolens*, DC.
40. *Pulicaria undulata*, DC.
41. *Pyrethrum auriculatum*, Boiss.
42. *Zollikoferia chondrilloides*, DC.
43. *Picridium tingitanum*, Desf.
44. *Microrhynchus nudicaulis*, Less.
45. *Trichogyne cauliflora*, DC.
46. *Senecio Decaisnei*, DC.
47. *Leyssera capillifolium*, DC.

CUSCUTACEÆ.

48. *Cuscuta*, sp.

SOLANACEÆ.

49. *Solanum nigrum*, L.

BORAGINÆÆ.

50. *Heliotropium luteum*, Pers.
51. — *hispidum*, Forsk.
52. *Trichodesma*, sp.
53. *Onosma syriaca*, Labill.? A
small variety.

ASCLEPIADEÆ.

54. *Dæmia cordata*, R. Br.
55. *Lycium europæum*, L.

LABIATÆ.

56. *Salvia ægyptiaca*, L.
57. — *controversa*, Fen.
58. *Lavandula multifida*, L.

SCROPHULARINÆÆ.

59. *Verbascum undulatum*, Lam.
60. *Scrophularia variegata*, Bieb.
probably a var. of *canina*.
61. *Antirrhinum orontium*.
62. *Linaria floribunda*, Boiss.
63. — sp.

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| PLANTAGINEÆ. | 72. <i>Atriplex halimus</i> , L. |
| 64. <i>Plantago</i> , sp. | 73. <i>Salsola</i> , sp. |
| PLUMBAGINEÆ. | JUNCACEÆ. |
| 65. <i>Statice pruinosa</i> , Delil. | 74. <i>Juncus maritimus</i> , L. |
| AMARANTHACEÆ. | GRAMINEÆ. |
| 66. <i>Ærua javanica</i> , Juss. | 75. <i>Aristida plumosa</i> , L. |
| POLYGONEÆ. | 76. — Adscensionis, L. |
| 67. <i>Rumex vesicarius</i> , L. | 77. <i>Andropogon</i> , sp. |
| CHENOPODIACEÆ. | 78. <i>Schismus minutus</i> , R. S. |
| 68. <i>Echinopsilon muricatus</i> , Moq. | 79. <i>Æluropus lævis</i> , Trin. |
| 69. —, sp. | 80. <i>Panicum Teneriffæ</i> , R. Br. |
| 70. <i>Salicornia fruticosa</i> , L. | 81. — <i>turgidum</i> , Forsk. |
| 71. <i>Sueda</i> , sp. | 82. <i>Pennisetum cenchroides</i> , Reich. |

At Engedi I also found

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| 1. <i>Moringa aptera</i> , DC. | 7. <i>Zizyphus lotus</i> , DC. |
| 2. <i>Calotropis procera</i> , Br. | 8. <i>Loranthus acaciæ</i> , DC. |
| 3. <i>Salix octandra</i> , DC. | 9. <i>Pennisetum</i> , sp. |
| 4. <i>Arundo donax</i> , L. | 10. <i>Typha latifolia</i> , L. |
| 5. <i>Salvadora persica</i> , L. | 11. <i>Abutilon muticum</i> , DC. |
| 6. <i>Forskahlea</i> , sp. | 12. — <i>denticulatum</i> , DC. |

And these plants, except *Forskahlea* and *Moringa* and the three *Malvaceæ*, were observed by me at Es Saffich. Except *Moringa aptera* and *Loranthus acaciæ*, these are all Indian species. *Salix octandra* extends into Affghanistan. They are all also Egyptian, including both *Moringa* and *Loranthus*.

II. List of Plants found in the Wadies at the south of the Dead Sea, which occur in

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| 1. The CANARY ISLANDS. | 2. The FLORA OF ADEN. |
| 1. <i>Fagonia cretica</i> *. | 1. <i>Fagonia cretica</i> . |
| 2. <i>Notoceras canariense</i> . | 2. <i>Abutilon denticulatum</i> . |
| 3. <i>Gymnocarpum fruticosum</i> . | 3. <i>Reseda amblyocarpa</i> . |
| 4. <i>Azoon canariense</i> . | 4. <i>Cleome droserifolia</i> . |
| 5. <i>Trichogyne cauliflora</i> . | 5. <i>Zizyphus lotus</i> . |
| 6. <i>Senecio Decaisnei</i> . | 6. <i>Moringa aptera</i> . |
| 7. <i>Salvia ægyptiaca</i> . | 7. <i>Salvadora persica</i> . |
| 8. <i>Pennisetum cenchroides</i> . | 8. <i>Ærua javanica</i> . |
| 9. <i>Reseda crystallina</i> . | 9. <i>Pennisetum cenchroides</i> . |
| 10. <i>Atriplex halimus</i> . | 10. <i>Aristida Adscensionis</i> . |
| 11. <i>Statice pruinosa</i> . | 11. — <i>plumosa</i> . |
| 12. <i>Panicum Teneriffæ</i> . | |

* The species in Italics are found in Europe.

3. EUROPE.

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| *1. <i>Notoceras canariense</i> . | *15. <i>Salvia controversa</i> . |
| 2. <i>Mathiola sinuata</i> . | *16. <i>Lavandula multifida</i> . |
| *3. <i>Fagonia cretica</i> . | *17. <i>Scrophularia canina</i> . |
| *4. <i>Neslia paniculata</i> . | *18. <i>Antirrhinum orontium</i> . |
| *5. <i>Capsella bursa pastoris</i> . | *19. <i>Verbascum undulatum</i> . |
| *6. <i>Zizyphus lotus</i> . | *20. <i>Rumex vesicarius</i> . |
| *7. <i>Tribulus terrestris</i> . | *21. <i>Emex spinosus</i> . |
| 8. <i>Retama retam</i> . | 22. <i>Balanophora coccinea</i> . |
| *9. <i>Vicia narbonensis</i> . | *23. <i>Typha latifolia</i> . |
| *10. <i>Zollikoferia chondrilloides</i> . | *24. <i>Juncus maritimus</i> . |
| *11. <i>Trichogyne cauliflora</i> . | *25. <i>Arundo donax</i> . |
| *12. <i>Inula crithmoides</i> . | *26. <i>Pennisetum cenchroides</i> . |
| *13. <i>Solanum nigrum</i> . | 27. <i>Panicum Teneriffæ</i> . |
| *14. <i>Lycium europæum</i> . | |

4. AFRICA, but not in Europe.

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| †1. <i>Mathiola oxyceras</i> . | 27. <i>Asteriscus graveolens</i> . |
| 2. <i>Zilla myagroides</i> . | 28. <i>Pulicaria undulata</i> . |
| 3. <i>Anastatica hierochuntina</i> . | 29. <i>Pyrethrum auriculatum</i> . |
| †4. <i>Farsetia ægyptiaca</i> . | 30. <i>Senecio Decaisnei</i> . |
| 5. <i>Brassica Aucheri</i> . | †31. <i>Microrhynchus nudicaulis</i> . |
| 6. <i>Enarthrocarpus strangulatus</i> . | ‡32. <i>Picridium tingitanum</i> . |
| 7. <i>Nasturtium coronopifolium</i> . | 33. <i>Leyssera capillifolium</i> . |
| †8. <i>Cleome droserifolia</i> . | 34. <i>Heliotropium luteum</i> . |
| 9. <i>Reseda amblyocarpa</i> . | 35. — hispidum. |
| 10. <i>Oligomeris glaucescens</i> . | †36. <i>Trichodesma</i> , sp. |
| †11. <i>Ochradenus baccatus</i> . | †37. <i>Calotropis procera</i> . |
| 12. <i>Tamarix tenuifolia</i> . | 38. <i>Dæmia cordata</i> . |
| 13. — Pallasii? | †39. <i>Salvia ægyptiaca</i> . |
| 14. <i>Fagonia sinaitica</i> . | 40. <i>Linaria floribunda</i> . |
| 15. <i>Nitraria tridentata</i> . | †41. <i>Ærua javanica</i> . |
| 16. <i>Ruta tuberculata</i> . | 42. <i>Forskahlea</i> , sp.? |
| †17. <i>Abutilon denticulatum</i> . | †43. <i>Salvadora persica</i> . |
| †18. — muticum. | 44. <i>Echinopsilon muricatus</i> . |
| †19. <i>Sida asiatica</i> . | 45. <i>Salix octandra</i> . |
| ‡20. <i>Gymnocarpum fruticosum</i> . | 46. <i>Statice pruinosa</i> . |
| 21. <i>Reaumuria palestina</i> . | †47. <i>Aristida Adscensionis</i> . |
| 22. <i>Azoon canariense</i> . | †48. — plumosa. |
| 23. <i>Moringa aptera</i> . | †49. <i>Schismus minutus</i> . |
| 24. <i>Lotononis Leobordea</i> . | 50. <i>Æluropus lævis</i> . |
| 25. <i>Trigonella hamosa</i> . | 51. <i>Panicum turgidum</i> . |
| 26. <i>Acacia seyal</i> . | |

* These species have all a very wide distribution, especially the *Capsella*, *Tribulus*, *Solanum*, *Emex*, and *Juncus*, which are worldwide.

† These species extend into Northern India.

‡ *Gymnocarpum fruticosum*, and *Picridium tingitanum*, extend into Sicily.

List of Orders and Number of Species in each.

13 Cruciferae.	2 Asclepiadeae.
11 Compositae.	1 Moringeae.
10 Gramineae.	1 Rhamnaceae.
6 Leguminosae.	1 Salvadoraceae.
6 Chenopodiaceae.	1 Loranthaceae.
5 Zygophyllaceae.	1 Plantagineae.
5 Scrophularineae.	1 Plumbagineae.
6 Resedaceae.	1 Amaranthaceae.
4 Boragineae.	1 Urticaceae.
3 Tamariscineae.	1 Polygonae.
3 Labiatae.	1 Amentaceae.
2 Capparidaceae.	1 Typhaceae.
2 Solanaceae.	1 Juncaceae.

Notes on the Flora of the Desert of Sinai. By RICHARD MILNE
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[Read April 6, 1865.]

I HAVE written the following notes on the flora of the Desert, more especially the Sinaitic part of it, from memoranda made, and specimens collected, during a tour in the East in the months of February, March, and April 1864, in the hope that, slight as is the information contained in them, it may be of use to those who (as I did), before leaving England, search almost in vain for information on this subject.

I reached Alexandria on the 11th of February, too early to see its flora to advantage; but what I saw did not give promise of much variety. The only trees outside the enclosed gardens of the merchants are *Phœnix dactylifera*, of which there are extensive groves within the fortifications; and which grow luxuriantly in the saline soil, *Tamarix orientalis*, and *Acacia lebbekh*, both planted in avenues along the roads by Mehemet Ali,—the former dusty and stunted in growth, the latter with large yellow pods hanging from its almost leafless branches.

The waste ground, now being gradually built upon as the modern city expands over the deserted site of its ancient predecessor, is thinly covered with vegetation, the most noticeable plants being a small yellow-flowered *Eruca* (*E. sativa*), a white-flowered *Erucaria* (*E. aleppica*), and the bright-orange *Calendula officinalis* all very dwarf: great quantities of a *Mesembryanthemum* (apparently *M. crystallinum*) were springing from seed. On the banks of the Mahmoudieh canal I remarked a kind of *Cyperus*