

SUPPLEMENT
TO
HARVESTING ANTS
AND
TRAP-DOOR SPIDERS.

SUPPLEMENT
TO
HARVESTING ANTS
AND
TRAP-DOOR SPIDERS.

BY
J. TRAHERNE MOGGRIDGE, F.L.S., F.Z.S.

WITH SPECIFIC DESCRIPTIONS OF THE SPIDERS,

BY THE
REV. O. PICKARD-CAMBRIDGE.



LONDON :
L. REEVE & CO., 5, HENRIETTA STREET, COVENT GARDEN.
1874.

LONDON:
SAVILL, EDWARDS AND CO., PRINTERS, CHANDOS STREET,
COVENT GARDEN.

CONTENTS.

	PAGE
SUPPLEMENT TO HARVESTING ANTS	157
SUPPLEMENT TO TRAP-DOOR SPIDERS.	180
SPECIFIC DESCRIPTIONS OF SPIDERS	254

EXPLANATION OF PLATES.

PLATE XIII., p. 183, fig. A.—Silk lining of tube of *Atypus piceus* (Sulz.), taken at Troyes in Champagne, and communicated to me by M. E. Simon; B, drawing of portion of nest of *Cyrttauchenius elongatus* (Sim.) made after the description of the discoverer, and subject to his (M. E. Simon's) corrections. This is the only illustration in the present work not taken from an actual specimen. These figures are of the natural size.

PLATE XIV., p. 193.—Diagrams of the known types of trap-door nest. Fig. A, nest of *Atypus piceus* (Sulz.); B, nest of cork type; B 1, the layers of silk with earth rims of which a cork door is composed; C, single-door unbranched wafer type; D, single-door branched wafer type; E double-door unbranched wafer type; E 1, lower door of the same, of the natural size; F, Hyères double-door branched wafer type; F 1, lower door of the same, of the natural size; G, and G 1, double-door branched cavity wafer type. At G 1 the perfect type is seen, while at G, the descending cavity, the outlines of which are indicated by dotted lines, has been filled up; G 2, lower door of the same of the natural size. (Figs. A, B, C, D, E, F, G and G 1, diagrammatic representations of nest on a reduced scale, Figs. B 1, E 1, F 1 and G 2, of the natural size).

PLATE XV., p. 198, fig. A.—Nest of *Cteniza Californica* (Camb.) nearly entire, enclosed in the clayey earth of the bank from which the specimen was taken, the door being artificially represented as being partly open; A 1, door of the same as seen when closed; B, *Cteniza Californica* (Camb.) from a living specimen; B 1, the same seen in spirits, the legs not represented; B 2, the same seen sideways; (figs. A, A 1, B, B 1 and B 2, are of the natural size); B 3, the eyes, greatly magnified; B 4, the three claws terminating the tarsal joint of the hindmost left leg; B 5, line representing the measured length of the spider excluding the falces and spinners, the uppermost division gives the length of the caput terminating at the half-moon-shaped fovea, the middle division that of the thorax, and the lowest that of the abdomen, while the transverse line gives the breadth of the cephalothorax; B 6, eggs laid by the spider in captivity on the under side of the gauze which covered the box (the position is reversed here) of the natural size; B 7, the same magnified; B 8, another group of eggs, magnified; B 9, a portion of the same still more highly magnified; B 10, lines

showing measured lengths of legs of the 1st, 2nd, 3rd, and 4th pairs, and of palpus, with those of the several joints.

PLATE XVI., p. 211, fig. A.—Part of the nest of *Nemesia Simoni* (Camb.) taken at Bordeaux; A 1, *N. Simoni* (Camb.) from life, of the natural size; A 2, the same seen in spirits, the legs not represented; A 3, the same seen sideways and magnified; A 4, the eyes, magnified; A 5, the thoracic fovea, magnified; A 6, line showing measured length of spider, (see above explanation of fig. B 5, plate XV.); A 7, lines showing measured lengths of legs of the 1st, 2nd, 3rd, and 4th pairs, and palpus of spider, with those of the several joints. B, cephalothorax and abdomen of another specimen of *N. Simoni*, in which the proportions are different, taken from life, of the natural size.

PLATE XVII., p. 215, fig. A.—Part of the nest of *N. suffusa* (Camb.) taken at Montpellier; A 1, *N. suffusa* (Camb.) from life, of the natural size; A 2, the same in spirits, seen sideways and magnified, the legs not represented; A 3, another view of the same; A 4, the eyes, magnified; A 5, length of spider (see above, fig. B 5, plate XV.); A 6, measurements of legs and palpus; B, *N. meridionalis* (Costa and Sim.), male, from a specimen in spirits, of the natural size, legs not represented; B 1, the same magnified; B 2, the eyes, magnified; B 3, radial and digital joints of the left palpus with bulb, magnified; B 4, another view of the same, magnified; B 5, back view of the same, magnified, but less highly; B 6, length of spider (see above, fig. B 5, plate XV.); C, *N. meridionalis* (Costa and Sim.) female, from a specimen in spirit of wine, of the natural size, legs not represented; C 1, eyes of the same, magnified; C 2, length of spider. These two specimens (male and female) were collected in Corsica, and named by M. E. Simon, who kindly presented them to me; they are now in the possession of the Rev. O. Pickard-Cambridge.

PLATE XVIII., p. 225, fig. A.—Part of nest of *N. eongener* (Camb.) taken at Hyères; A 1, lower door of this nest viewed from above, of the natural size; A 2, side view of the same; A 3, *N. eongener* (Camb.) taken from life, of the natural size; A 4, side view of the same, enlarged to twice the natural size, the legs not represented; A 5, cephalothorax and falces from specimen in spirits, magnified; * A 6, the eyes, magnified; A 7, femur, patella (or genual joint) and tibia of leg of third pair, showing the three spines on the outer side of the patella, magnified. B, lower door from a smaller and younger nest, viewed from above, of the natural size; B 1, the same viewed sideways.

* While these pages were passing through the press (Hyères, Oct. '74), I have had an opportunity of examining 17 additional specimens of *N. eongener*. I learn from this that the pattern represented on the caput in fig. A 5, does not accord with that in the majority of adult specimens, being usually less defined and composed of three converging bands. Mr. Pickard-Cambridge's description (p. 293 below) is, however, quite correct. I may mention that three spines were present on the patella (genual joint) of legs III in 16 specimens, the 17th specimen having but a single spine.

PLATE XIX., p. 229, fig. A.—Nest of a young specimen of *N. Manderstjerneæ* (Ausserer = *N. meridionalis* Camb., in "Ants and Spiders," p. 101) from Mentone, showing the descending cavity, with the lower door pushed across, so as to close the main tube and join the cavity; A 1, upper portion of the same, showing the lower door closing the branch. B, *N. cœmentaria* (Latr.) from a living specimen taken at Montpellier; B 1, the same seen in spirits of wine, legs not represented; B 2, the eyes, magnified; B 3, one of the two larger claws; and B 4, the small claw of the tarsus of one of the hindmost legs; B 5, length of spider; B 6, measurements of legs and palpus. C, the eyes of *N. Moggridii* (Camb.) (*N. = cœmentaria*, Camb., in "Ants and Spiders," p. 92), magnified. D, *N. incerta* (Camb.), male, from a specimen preserved in spirits, collected at Digne in the Basses Alpes, by M. E. Simon, who kindly lent me the specimen for examination, represented of twice the natural size, and without the legs; D 1, another view of the same; D 2, radial and digital joints of the palpus and palpal bulb, magnified; D 3, back view of the same; D 4, the eyes magnified. E, eyes of *N. dubia* (Camb.), male (= *N. cœmentaria*, Sim.), from a specimen in spirits, collected in the Pyrénées Orientales, communicated by M. Simon, magnified; E 1, radial and digital joints of the palpus with palpal bulb of the same, magnified; E 2, another view of the same.

PLATE XX., p. 254, fig. A, *Cteniza Moggridii* (Camb.), male (= *Ct. fodiens*, Camb., in "Ants and Spiders," p. 89), from a living specimen taken at Mentone, of the natural size; A 1, the same seen sideways, the legs not represented; A 2, cephalothorax and falces of the same; A 3, the eyes; A 4, radial and digital joints and the palpal bulb; A 5, another view of the same; A 6, one of the two large claws, and A 7, the small claw of the tarsus of one of the legs of the hindmost pair; A 8, length of the spider and breadth of the cephalothorax; A 9, measurements of legs and palpus. (Figs. A 1, A 2, A 3, A 4, A 5, A 6, and A 7, are all magnified.) B, *N. Manderstjerneæ* (Ausserer), male (= *N. meridionalis*, Camb., in "Ants and Spiders," p. 101), from a living specimen taken at Mentone, of the natural size; B 1, the same seen in spirits and magnified to twice the natural size; B 2, the same viewed sideways; B 3, the eyes; B 4, tibia, metatarsus and tarsus of the right leg of the first pair showing the spine and process on the under and inner side of the enlarged tibia; B 5, right leg of the third pair showing the three short spines on the patella; B 6, one of the two large claws, and B 7, the small claw of the tarsus of one of the legs of the hindmost pair; B 8, radial and digital joints of palpus with palpal bulb; B 9, another view of the same; B 10, back view of the same (figs. B 1 to B 10, all magnified); B 11, measurements of legs and palpus. C, tibia, metatarsus and tarsus of right leg of *N. Manderstjerneæ* (Ausserer), male, viewed from the under side and magnified, drawn from the original specimen belonging to Dr. L. Koch, collected at Nice, and described as *N. Manderstjerneæ* by Professor Ausserer. My best thanks are due to Dr. L. Koch for having enabled me to examine this valuable specimen. [In fig. C, the curved spine should bend towards, and not away from, the process on its right and inner side.]

LIST OF SPIDERS DESCRIBED.

Cteniza Moggridgii, sp. n.	♂	p. 254, pl. XX.	fig. A.
„ Californica, sp. n.	♀	p. 260, pl. XV.	fig. B.
Nemesia cæmentaria (Latr.)	♀	p. 264, pl. XIX.	fig. B.
„ Eleanora (Cambr.)		p. 272.	
„ Moggridgii, sp. n.	♀	p. 273, pl. XIX.	fig. C.
„ incerta, sp. n.	♂	p. 276, pl. XIX.	fig. D.
„ dubia, sp. n.	♂	p. 280, pl. XIX.	fig. E.
„ Manderstjernæ (Auss.)	♂ and ♀	p. 283, pl. XX.	fig. B.
„ meridionalis (Costa)	♂ and ♀	p. 289, pl. XVII.	fig. B.
„ congener, sp. n.	♀	p. 292, pl. XVIII.	fig. A 3.
„ suffusa, sp. n.	♀	p. 295, pl. XVII.	fig. A 1.
„ Simoni, sp. n.	♀	p. 297, pl. XVI.	fig. A 1.

SUPPLEMENT
TO
HARVESTING ANTS.

DURING the short time which has elapsed since *Harvesting Ants and Trap-door Spiders* left the printer's hands, fresh material has rapidly accumulated, and an assiduous search after these creatures, and the continued study of their works and ways, has met with ample reward and encouragement.

It was my wish, when originally publishing these observations, many of which were due to the active co-operation of friends, to invite my readers to take part with me in my pleasure and pursuits, so that we should from that time work together, and, by communicating our discoveries to each other, increase our knowledge, and at the same time enlarge the field of our research. My intention was that we should leave to others the necessary work of collection, preservation, and arrangement, and that, while our fellow naturalists pin specimens into classified cabinets, and devote long hours to the description of peculiarities of form and colour, we should undertake the lighter task of complementing their labours by observing and recording the habits and conditions of existence of the creatures themselves.

Looked at in this light, the present pages and

those of the preceding work may be regarded as so many drawers in our *Cabinet of Habits*, and though, as we open drawer after drawer, many gaps and blank spaces remind us how much remains to be done in order to complete the collection, yet the interest and suggestiveness of the specimen-facts already secured, should encourage and direct us onwards. There have not been wanting instances in which my readers have associated themselves with me in the way indicated, and it is with pleasure, when reviewing the entire work, that I recall how many of its most interesting features are due to the researches and assistance of friends,* and commemorate at once their discoveries and unfailing kindness. I had certainly expected that before this time some new species of harvesting ants would have been discovered, either on the Riviera, where attention has been especially called to the subject, or in other parts of Europe, where dissimilar conditions might have been expected to be associated with a different fauna; but this has hitherto not been the case.

One might naturally suppose that if harvesting ants were discovered in localities very widely distant from each other, they would prove to belong to different species, but thus far, both in Europe and Northern Africa, it is the same two well-known species of *Atta barbara* and *A. structor* that constantly reappear.

For instance, I have recently learned that harvesting ants are found at Cadenabbia on the lake of

* To all who have rendered me this valuable help I tender my cordial thanks. I am under very special obligations to Mr. Pickard-Cambridge, for descriptions of spiders, and to Mr. F. Smith for the names of the Ants; assistance which I should have found it almost impossible to dispense with or to replace.

Como, and at Montpellier in Southern France ; but on examination, the ants from the former place are clearly seen to belong to the species *structor*, and those from Montpellier to the two species *structor* and *barbara*.

I was greatly interested to receive specimens of ants, and of the seeds which they were carrying and storing beneath the stones of a paved road at Cadenabbia, for this is the northernmost point* at which the habit of harvesting has as yet been noted. This discovery suggests the possibility of the occurrence of the habit in the warmer and more sheltered of the Swiss valleys. When at Montpellier in May last I frequently observed long trains of ants bringing seeds and small dry fruits to their nests, but these harvesters also turned out on close inspection to be *Atta structor* and *A. barbara*, with its red-headed

* I have related in a note at the foot of p. 4 in *Ants and Spiders* how *Formica nigra* in England, though paying no attention to seeds generally, will sometimes collect the fresh seeds of the sweet violet (*Viola odorata*).

When I published this account I was quite unaware that the fact that certain English ants collect sweet violet seeds had been observed by Mr. R. Wakefield forty years before.

This was communicated by Mr. Wakefield in a letter to Mr. John Curtis, the substance of which was read before the Linnean Society in 1854, and published in their Proceedings (see Proceedings of the Linnean Society, ii. 293), where we read: "He (Mr. Wakefield) states that he has seen the black species (*Formica nigra*, L.) for days and nights together industriously occupied in dragging to its cells the seeds of the common violet (*Viola odorata*, L.)

"He first noticed this fact on the 3rd of July, 1832; and he regards it as a curious subject of inquiry for what purpose, if not for their own future provision, they could accumulate these stores?" Mr. Wakefield appears to accept this as evidence that these ants possess the habit of storing seeds; but this is not so, as will be seen by reference to my note alluded to above, and I am inclined to believe that they collect these particular seeds either under the mistaken belief that they are larvae, to which when fresh they bear some resemblance, or for the sake of some juices which they may obtain from the fleshy appendage attached to the seed.

variety. These, it will be remembered, are the only species of European ants which have as yet been proved to be harvesters and seed-storers in the fullest sense of the term, that is to say, which not only gather and carry seeds, but also store them in large quantities below the surface of the ground.*

In the case of *Pheidole megacephala* (the only other European ant which I have detected collecting seeds in large numbers), I have never been able to find granaries or subterranean stores of any kind, though I have frequently made extensive search for them, and explored, to all appearance, the whole nest.

When we remember the great variety of ants which inhabit Europe alone (a recent list† enumerating no fewer than 104 distinct species), it certainly may seem strange at first that only two of their number should possess this habit. Perhaps, however, we may yet discover that some other of these species are true harvesters; but at present the chances seem rather against it, since the harvesters found at such distant points as Algiers, Cadenabbia, and Montpellier have all turned out to belong to one or other of the two species, *structor* or *barbara*.

Indeed it may very well be that the numerical superiority and wide distribution of these two species have served to secure to them a more or less exclusive

* Six other species belonging to the genus *Atta* are found in Europe, but they are all unknown to me.

It seems likely that, if other harvesting ants do exist in Europe they may belong to one of these six species; for we have seen (*Ants and Spiders*, p. 59) that all the ants which are known to possess this habit are either members of the genus *Atta* or belong to genera closely related to it.

† *Description des Fourmis d'Europe pour servir à l'étude des insectes myrmécophiles*, by Ernest André, in *Rev. et Mag. de Zool.* 3^e ser. tom. ii. (1874), p. 152, &c.

right to the habit of harvesting, for it is clear that a given tract of country can only afford supplies of grain to a limited number of colonies; so that, if these ants have taken up the ground and are strong enough to maintain possession, no others would have a chance. However this may be, I find that the more insight I gain into the distinctive habits and relations of animals, the more the belief impresses itself upon me that wherever we find many closely-allied species inhabiting restricted areas, there we may safely look for important differences among these species in respect of their modes of life, and in the development of their instinct and intelligence. And indeed this may be considered as a corollary of the great law of natural selection, which uniformly tends to secure the greatest possible amount of divergence in this respect, and to prevent the co-existence in close proximity to each other of distinct species having the same requirements and manner of life.

Thus, for example, even *Atta barbara* and *structor*, though most closely related as species, differ in habit; the former leading a much more active life during the winter months at Mentone than the latter, and seeking its home rather in wild than cultivated ground. Then what differences different ants present in respect of strength, speed, powers of offence and defence, numerical strength of colonies, timidity, date and frequency of departure of winged ants from the nest, odour emitted, combativeness, architecture and selection of localities, nature of food, nocturnal and diurnal habits, and in many other properties and conditions! It is doubtless owing to dissimilarity in these and other respects that it becomes possible for

so many species to co-exist within very narrow limits, so that even three or four distinct kinds sometimes form their nests so close to each other that their galleries interlace and almost touch.

There are probably very few conditions of life (except those concerned with the nature and manner of obtaining food) which have a greater influence either in keeping creatures apart or in bringing them into collision, than those which constitute differences in their respective periods of activity and development. Thus, two species of which one has nocturnal and the other diurnal habits, or of which one is dormant while the other is active, may be said to travel different roads and to be complete strangers to one another. Complete separation of this kind is, of course, not the rule, and the greater number of species find themselves in more or less constant rivalry, but possess a sufficient number of points of dissimilarity in habit and requirements to make their co-existence possible.

It is curious to note what little differences, as they seem to us, may determine the fate of an ant. For example, the lizards will lie in wait for and greedily seize and devour the winged males and females of *structor* and *barbara*, though they dare not attack the assembled workers. It is curious to watch the way in which these worker ants will protect the winged ants which are about to leave the nest, by gathering round and swarming over them. When, as often happens, the nest is placed in an old terrace-wall, one may see the lizards creeping along or lying moulded into the inequalities of the stones, all having their eager eyes directed towards the swarm. One may then see the worker ants walk with impunity straight

up to the very noses of the lizards, while the male or female which should chance to straggle in the same direction would infallibly be eaten up. The lizards plainly show their fear of the workers by the way in which, when they make up their mind to try a dash at some outlying part of the ant colony, they leap through the lines in the utmost haste as if traversing a ring of fire.

Now these worker ants are destitute of stings, and I can only suppose that their power of combination, stronger jaws and more horny coats, have gained them this immunity. I remarked that the smaller lizards appeared to have some difficulty in dealing with the males and females which they captured, and would beat and pound them against the stones before devouring them, while the larger ones would often make but one mouthful of them, swallowing wings and all!

If it were not for this body-guard of workers it is difficult to see how the males and females in such situations could ever escape. It is also plain that if the worker harvesting ants were as liable to be seized and devoured as their winged companions, the species would soon become extinct, for they expose themselves more than ants ordinarily do, and their long provision-laden trains would be almost at the mercy of any enemy which could attack them without fear of results.*

* Speaking of the enemies of ants, I may mention having seen a young robin in England picking up and swallowing the workers of *Formica nigra* just as if they were crumbs. I knew that birds would eat the male and female ants, but I had thought the workers were exempt from their attacks, and, indeed, they must be so as a rule, for otherwise they would speedily become extinct.

Remembering this, it is interesting to note how differently the tiger-beetle (*Cicendela*) behaves when hunting the powerful harvesting ants and when preying upon the weak little *Formica* (*Tapinoma*) *erratica*; for, while it seizes the latter without taking any precautions, it is evidently more than half afraid of the former.

I have seen this beetle lying in wait near a train of *structor* or *barbara* ants, watching until some individual separated a little from the main body, when it would rush forward and make a snap at it, retiring again as quickly as it came. If the tiger-beetle fails to seize its prey exactly behind the head it will let it go again, and two or three ants are often thus cruelly mutilated before a single one is carried off.

No doubt the beetle has learned that if once this ant clasps its mandibles upon either antennæ or legs, nothing, not even death itself, will make it release its hold. It therefore tries to pin the ant in such a way that it cannot use its formidable jaws. Perhaps the habit of forming long compact trains may have been acquired by the ants partly with a view to guarding against attacks of this kind.

The colonies of the little *F. erratica*, on the other hand, apparently have to trust to their habit of working under the covered ways which they construct, as well as to their activity and great numbers for their preservation.

I had thought that the very powerful, and, to me, disagreeable, odour of these little ants might have rendered them distasteful to the tiger-beetle, but this is evidently not the case.

I have said above that, as far as our present know-

ledge goes, only two out of the 104 species of European ants are possessed of the habit of collecting and storing seed, and it may be reasonably asked how it can have come about, if this is the case, that the ancient authors were so well acquainted with the fact.

The explanation is that these writers lived on the shores of the Mediterranean, where these two species—*Atta barbara* and *structor*—are extremely common objects, both on account of their abundance and their habits. The long trains of harvesters remain exposed to view for hours together, and *structor* seeks the neighbourhood or even the interior of towns, so that these ants arrest the attention even of the unobservant, and often become familiar as the sparrows.

There can be little doubt that these two ants display the same habits throughout all the warmer districts which they inhabit, but whether they do so in Switzerland, Germany, Northern France, and the other colder portions of their range, remains one of the many interesting questions which still await investigation.

Mr. F. Smith has recorded the presence of *Atta barbara* in Palestine, and I have lately obtained some curious evidence which goes to show that harvesting ants not only carried on their operations in times past in that country, but that their seed-stores were on a much larger scale than any I have observed on the Riviera.

I am indebted to Dr. F. A. Pratt for the information that mention was made of ants and their stores in the Misna, that codification of the traditional and unwritten laws of the Jews, which was commenced after the birth of Christ under the presi-

dency of Hillel, and which has at least the merit of serving as a record of a multitude of very ancient customs and observances which, but for it, would probably have long ago been forgotten.

Now it so happens that the very first section of the Misna is called *Zeraim*, and has to do with seeds and crops, and I was thus enabled, without any very prolonged search, to light upon one of the passages in question.* It occurs in a chapter entitled *De Angulo* in the Latin version, treating of the *corner* of the fields bearing crops which should be set aside for the poor, and of the rights of the gleaners, and may be freely rendered as follows: "The granaries of ants (*Formicarum cavernulæ*), which may be found in the midst of a growing crop of corn, shall belong to the owner of the crop; but, if these granaries are found after the reapers have passed, the upper part (of each heap contained in these granaries) shall go to the poor and the lower to the proprietor." And then is added: "The Rabbi Meir is of opinion that the whole should go to the poor, because whenever any doubt arises about a question of gleaning the doubt is to be given in favour of the gleaner."

The intention of this very quaint bit of legislation, or rather of the ancient custom which gave rise to it, appears to have been the following; it was to settle once and for all a nice point of conscience with refe-

* "Formicarum cavernulæ in media segete proprietarii censentur; pone messorum superiore parte pauperum, inferiore proprietarii. R. Meir totum pauperum esse censet, quia quod dubium est in spicilegio, spicilegium est." And to this the following explanatory note is appended: "Formicarum cavernulæ, Frumentum inibi repertum." Misna, Sect. I. Zeraim. Cap. IV. p. 25. Latine vertit et commentario illustravit Gulielmus Guisius. *Accedit Mosis Maimonidis Prefatio in Misram*, Edo. Pocockio *Interprete*, Oxoniæ A.D. 1690.

rence to the claims of the poor upon these ant stores. If the heaps of grain were found among the standing corn before the reapers reached the spot or while they were still at work, the proprietor might claim them without any hesitation ; but, if they were discovered after the passing of the reapers, then it was conceivable that the ants, which during the whole time had never ceased their labours, might have collected some of the grain from the fallen ears of corn which lay upon the ground, and were the property of the gleaners. These grains would be those which the ants had collected most recently, and would therefore lie on the surface of each granary heap. Thus it was settled that the upper portion of each heap should belong to the poor, and the lower, that collected from the standing crop, to the proprietor.

We may perhaps laugh at the notion of critically discussing and legislating upon such a subject, and think that such a pitiful matter might have been allowed to pass among those *minima* about which even the Jewish law need not care.

Be this as it may, it is interesting for us to learn that a custom of the kind had its place among the recognised traditions of the people, and that the harvesting ants of Syria had earned a place in these records by amassing stores of sufficient size, and so disposed as to make them worth collecting.

This reminds us of what M. Germain de St. Pierre has related (*Ants and Spiders*, p. 29) of the extent of the depredations made among the corn crops at Hyères by these ants ; and doubtless other observers who have opportunities for watching the ants

during the summer months might supply further confirmation.

It would be of interest to learn the extent and manner of concealment of these large stores of grain, but, during the months from October to May, I have never seen corn in any quantity in the granaries, though there was frequent evidence of its late presence in the dense masses of husks of oats and other large grain lying near the nests. In October, 1873, I found near the entrances to a nest of *structor* a circular mound formed of this refuse, twenty-seven inches in diameter, and averaging two inches in thickness, while near other nests I have found the chinks between the stones of the terrace-wall behind which the nest lay, literally stuffed with husks. It was plain that these grains of cereals and the larger grasses had been collected during the summer. The granaries in the winter and spring contain the grains of some few of the autumnal grasses, but are principally filled with seeds of the other more abundant autumn-fruiting plants belonging to the neighbourhood.

I have now collected from the granaries of these ants the seeds or small dry fruits of fifty-four distinct species of wild plants, and on examination I find that during my stay in the south (from October to May) the seeds of the distinctively spring and summer-flowering plants are either entirely absent or are very scarce, while the great bulk of the seeds belong to plants which ripen their fruits in the autumn. Thus the grains of oats, of the large fescue and brome grasses, of quaking grasses (*Melica*), and other kinds common near the nests in May, are conspicuously absent in the winter, as are the fruits of all the sedges

but one, and this one (*Carex distans*) retains its fruits till late in the autumn. Among other spring-flowering plants common near the nests, the seeds of which are also absent, I may mention violets (*Viola odorata*), poppies, (*Papaver*), certain species of *Veronica*, *Helianthemum guttatum*, *Silene quinque-vulnera* and *Plantago Bellardi*.

Here a curious question arises—viz., What becomes of the large stores of seeds which one may still find in the nests in May, when the ants are busy pouring fresh supplies into the nest? The answer probably is, that, as the weather becomes warmer, ever-increasing calls are made by the larvæ upon the food-resources of the nest, and that old and new seeds rapidly disappear together, and all the energy and activity of the colony is needed to meet the increased demand.

Still, it would be interesting, if it were possible, to assure oneself whether this is the case; that is to say, whether the residue of the winter stores is really consumed during the summer, or whether a portion of it remains in the granaries until the following autumn. One might perhaps learn something as to this if one had an opportunity of opening a nest late in July, and before the characteristic autumn-fruiting plants had set their seed. If the granaries were then principally filled with seeds of spring-fruiting plants, and the winter seeds were almost or entirely absent, this would afford tolerably good negative evidence in favour of the latter having been eaten during the summer.

One thing is certain, and that is, that these harvesting ants do not habitually abandon their nests every year. On the contrary, while many swarms leave the nests at different seasons, a portion of the original colony, or

of its descendants, still remains in the old home, and very few out of the many nests which I have watched during the past three years, and of which I have noted and mapped the positions, have been deserted. On my return to Mentone in October, 1873, I hastened to examine the nests between which war had been carried on in the previous year (*Ants and Spiders*, p. 38), and found in one case that the vanquished nest was completely lifeless and abandoned, while the victorious colony was remarkably thriving, and its granaries teemed with seeds. The locality occupied by the other belligerent colonies had unfortunately been built over.

I have often been asked whether I could give an approximate estimate of the quantity of seeds contained in a nest of average size, but I have hitherto felt unable to do this in a satisfactory manner. I am now in possession of more reliable data, and believe that the following calculation may be taken as a near approximation to the truth. During the spring of 1873 I removed with but very little loss the contents of two granaries from a very extensive nest of *Atta structor*, consisting principally of seeds of clover, fumitory, and pellitory. These seeds, when perfectly clean and freed from earth, weighed in the one case 4 sc. 4 grs., and in the other 5 sc. 8 grs. Now there cannot have been less than eighty such granaries in this nest, so that, if we take five scruples as the average weight of the seeds in each granary, and this, allowing for loss in collection, which we may fairly do, we should have a total weight of more than sixteen ounces, or one pound avoirdupois weight of seeds contained in the nest. But, though this mass of seeds

represents the result of infinite labour on the part of the ants, each individual granary contains but an insignificant quantity, and the store-chambers often lie at great distances apart; it is therefore impossible to believe that the stores alluded to in the Misna can have been as small and scattered as these were, and we must, on the contrary, suppose them to have been both larger and more accessible.*

The means employed by the ants to prevent the germination of the seeds contained in their granaries still remain secret, and all the experiments and investigations which I have hitherto been able to make have failed to give me the clue.

The problem to be solved is the following: Given seeds, the readiness of which to germinate has been proved, to place them in damp soil at depths varying from half an inch to twenty inches below the surface in such a manner that they shall remain there dormant, neither germinating nor decaying, for weeks and even months. These very seeds must be capable of germinating after the conclusion of the experiment.

This is what the ants do for millions of seeds, for the instances in which a few seeds appear to have sprouted within the nest in defiance of the ants, are very rare and wholly exceptional; and when after prolonged wet weather germinated seeds are seen outside the nest, it will usually be found that these have the little root cut off, and are eventually carried

* Perhaps these heaps of corn may have been piled up at the entrance to the nest, as is sometimes the case when the workers, in their eagerness to secure as much as possible of a passing harvest, bring in the supplies too fast for their companions within the nest to be able to find room for and accommodate. When this happens the seeds lie outside the nest until fresh chambers are prepared for their reception.

back into the nest and used as food. By a fortunate chance I have been able to prove that the seeds will germinate in an undisturbed granary when the ants are prevented from obtaining access to it; and this goes to show not only that the structure and nature of the granary chamber is not sufficient of itself to prevent germination, but also that the presence of the ants is essential to secure the dormant condition of the seeds.

I discovered in two places portions of distinct nests of *Atta structor* which had been isolated owing to the destruction of the terrace-wall behind which they lay, and there the granaries were filled up and literally choked with growing seeds, though the earth in which they lay completely enclosed and concealed them, until by chance I laid them bare! In one case I knew that the destruction of the wall had only taken place ten days before, so that the seeds had sprouted in this interval.

My experiments also tend to confirm this, and to favour the belief that the non-germination of the seeds is due to some direct influence voluntarily exercised by the ants, and not merely to the conditions found in the nest, or to acid vapours which in certain cases are given off by the ants themselves.

In order to put this latter point to the test of experiment, I confined about a hundred harvesting ants (*A. structor*), with their queen and several larvæ, in a glass test-tube eight inches long and one inch in diameter, closed with a cork and filled up to within about an inch of the cork with damp sandy soil, most of which was taken from the ants' nest.

I added six peas, six cress and six millet, and then

kept the tube tightly corked for nine days, only once removing the cork for a few seconds in order to sprinkle a little water on the ants, which were evidently in need of it. On the ninth day I turned out the contents of the tube and found that all the peas, millet and cress, had germinated and were growing strongly. One of the cress, however, had had its root, which lay across the gallery constructed by the ants, gnawed off; four clover seeds, which had come with the soil taken from the nest, and which had formed part of the ants' stores, had germinated also. Here the small quantity of air contained in the test-tube must certainly have become saturated with any vapour which the ants may be supposed to give off, and we cannot therefore accept this as the cause of the dormant condition of the granary seeds.

I made other experiments in which harvesting ants were imprisoned along with various seeds in small, cylindrical, closed vessels containing a little damp sand. Here the vessels were frequently rolled from side to side or shaken, during the twenty-two hours for which the experiment lasted, so as to excite the ants and make them give off such odours as they possessed, but no trace of injurious influence was produced upon the seeds, which germinated and grew normally afterwards.

At Mr. Darwin's suggestion I made a long series of experiments with formic acid, in which measured quantities, pure or diluted, were placed in a watch-glass on damp sand and surrounded by seeds, the whole being enclosed in a covered tumbler, so that the effects produced on the seeds by the vapour

rising from the acid might be noted. Similar seeds were sown at the same time and in the same way, but without the acid, so as to permit of comparison. These experiments have afforded some interesting results,* but do not supply any positive data which might help us to discover the secret of the ants. They narrow, indeed, the area in which search can profitably be made, indicating as they do that the vapour of formic acid is incapable of rendering the seeds dormant after the manner of the ants, and showing, on the contrary, that its influence is always injurious to the seeds, even when present only in excessively minute quantities.

It appears to me now that the most promising field for experiments made with a view to clearing up this difficulty, is that afforded by the closer investigation of the phenomena of normal germination, and by a study of the conditions under which seeds remain dormant, as they are occasionally known to do, in situations which our general experience would have selected as favourable to germination.

I have good hopes, also, that when we come to know more of the habits of harvesting ants in tropical countries, and when naturalists have excavated and described their subterranean stores—a thing which has not yet been done as far as I know—we may gather fresh indications to guide us in our search.

I am puzzled to account for the fact, which I have seen stated by more than one observer in India, that

* I hope shortly to offer these observations, together with another series of a similar nature in which my friend Mr. J. B. Andrews has taken part, to the Linnean Society.

the ants there have a habit of bringing out large quantities of grain and seed and laying them in heaps outside their nests at the commencement of the wet season. Dr. King, the director of the Royal Botanic Gardens at Calcutta, has told me that when in the Gwalior territory during the beginning of the rainy season, he saw heaps of seeds, principally those of a leguminous plant (*Alysicarpus*), piled up round the entrances to the ants' nests, and that it was precisely at that time that flocks of a rock-grouse (*Pterocles exustus*) first made their appearance. They fed freely upon the seeds, and Dr. King found the crops of some of these birds, which he had shot, filled with them.

It is difficult to imagine why these Indian ants should turn out from their nests the very seeds which it had cost them so much labour to collect, and the more so as we find that these seeds are devoured by birds. It seems just possible, however, that the ants, remaining torpid during the rainy season, do not require the seeds, and know that, under these circumstances, if left in the nest, they would sprout, and choke up the galleries and granaries. Perhaps also they may have learned that a certain number of the ejected seeds will spring up and afford future harvests within easy reach of the nest.

All this, however, and especially the suggestion as to the dormant condition of the ants during the rainy season, might easily be proved or disproved by direct observation; and at present we have nothing but mere speculation to go upon.

It is curious to find that the native population in a certain part of India pay a kind of tribute to the

ants, for Dr. King informs me that the Hindoos in Rajputana, a province in which the old traditions and superstitions retain especial hold, have a custom of scattering dry rice and sugar for the ants, and thus apparently recognise both their love of sweet things and their habit of collecting seeds. It may be that this custom is now little more than a meaningless rite; but in the past it probably had its origin, either in a wish to propitiate the good will and avert the destructive attacks of creatures which are the scourge and dread of entire districts, or in a sentiment of combined fear and admiration—fear of the power, and admiration of the energy, forethought, perseverance, and sense of duty to the community displayed by these marvellous insects.

That the latter feeling may have had some share in prompting this act is suggested by another custom which is stated* to prevail in Arabia, in accordance with which an ant is placed in the hand of a newly-born child, in order that its virtues may pass into and possess the infant.

Among the many curious and obscure features in the economy of ants, one of the most interesting is the occasional presence in their nests of different creatures which live among and often in harmony with them, the nature of the relations between host and guest being for the most part quite unknown.

When examining the contents of some granaries from an extensive nest of *Atta structor* at Mentone last spring (1874), I found large numbers of a

* Freytag, paragraph under the Arabic word for Ant, in his *Lexicon Arabico-Latinum*, vol. iv. p. 339, where he quotes from a local dictionary.

minute, shining-brown beetle moving about among the seeds. These little creatures were themselves not unlike some very small seeds, and were of an elliptic form, measuring a trifle less than one line in length. They proved to belong to the scarce and very restricted genus *Coluocera*.* This species, named by Kraatz *C. attæ*, on account of its inhabiting the nests of ants belonging to the genus *Atta*, has been found in Greece.

Mr. Bates,† in his most interesting account of his travels on the Amazons, remarks upon the singular fact, of which the above instance is an example: "that some of the most anomalous forms of Coleopterous insects are those which live solely in the nests of ants," and he then goes on to allude to the strange snake *Amphisbæna*, a native of that region, which also lives in the nests of the Sauba ants (*Ecodoma cephalotes*), observing how curious it is that an abnormal form of snakes should be found in the society of these insects. He is of opinion, however, that the *Amphisbæna* is not an inoffensive guest, but lives upon the ants whose nest it selects for its home.

Another remarkable inhabitant of ants' nests is a minute cricket, of which I found a single example in the midst of a colony of black ants at Mentone in February, 1874. This miniature cricket is scarcely as large as a grain of wheat, the body, excluding the antennæ and other appendages, measuring only two lines in length. It has been described by Dr. Paolo

* I am indebted to Mr. F. Smith of the British Museum for the name of this beetle and for the following reference to its description; Kraatz in *Berliner Entomologische Zeitschrift* for 1858-9, p. 140.

† *Naturalist on the Amazons*, p. 61-2 (Ed. 2, 1864).

Savi* under the name of *Gryllus myrmecophilus*. He detected it in the nests of several species of ants in Tuscany, where it lived on the best terms with its hosts, playing round their nests in warm, and retiring into them in stormy weather, while allowing the ants to carry it from place to place during their migrations.

Gryllus myrmecophilus has also been observed in nests of the turf ant (*Tetramorium cæspitum*) near Paris.†

At Mentone I have never found more than this one specimen, and the ants among which it was domiciliated were of a species new to me (*Camponotus (Formica) lateralis*, Oliv.). This colony of ants was composed of many winged males and females, as well as workers, the last-named measuring from two and a half to three lines in length, and black in colour. In other colonies I have found the workers black, with red head and thorax.

Another ant, not enumerated in my list in *Ants and Spiders*, is *Camponotus (Formica) sylvatica*, which I detected in March last under stones on Cap Martin, near Mentone. When disturbed, this ant runs along with its abdomen raised vertically in the air, much as the devil's coachhorse (*Staphylinus*) does. The same curious habit of erecting the abdomen is found in another ant, not uncommon in decaying wood in the South, *Crematogaster scutellaris*; and probably all three insects adopt this threatening attitude, which is that of the scorpion preparing to strike and sting, in

* Dr. P. Savi, *Osservazione sopra la Blatta acervorum di Panzer in Bibliotheco Italiana*, tom. xv. p. 217.

† *Bulletin Soc. Entom. de France* (1872), p. li.

order to intimidate their enemies, though *Crematogaster* is the only one which really possesses a sting.

Camponotus sylvatica has the same long legs and slender body as *Formica cursor*, and is of about the same size; the workers, which are of a dark brown colour, measuring about $3\frac{1}{2}$ lines in length.

Perhaps it may be well, in concluding these remarks on Harvesting Ants, to call attention to the principal questions which still await solution. The first is one which any observer who travels in Central Europe during the summer may help to solve.

1. Do *any* ants collect and store seed in Switzerland, Germany, North France, England, or indeed in any of the colder parts of the world?

2. What are the habits of *Atta structor* and *A. barbara* when living, as they are known to do, in Switzerland, Germany, and Northern France?

3. How do the ants contrive to preserve the seeds in their granaries free from germination and decay?

4. How are the seed-stores of tropical ants disposed below ground, and of what do they consist?

5. Do harvesting ants exist in the southern states of North America, in Australia, New Zealand, or at the Cape?

SUPPLEMENT
TO
TRAP-DOOR SPIDERS.

THERE would doubtless be a just feeling of pride and satisfaction in the heart of a naturalist who could say that he had made himself thoroughly acquainted with all the species of a particular group of animals, had learned their most secret habits, and mastered their several relations to the objects, animate and inanimate, which surrounded them. But perhaps a still keener pleasure is enjoyed by one who carries about with him some problem of the kind but partially solved, and who, holding in his hand the clue which shall guide him onwards, sees in each new place that he visits fresh opportunities of discovery. The latter is certainly the condition of those who take an interest in searching out the habits and characters of trap-door spiders; for this subject, far from being exhausted, expands under the light of recently acquired facts, and invites research in many parts of Europe, north as well as south.

We have only to compare the number of types of trap-door nest which were known before the publication of *Ants and Spiders*, with those at present re-

corded, to see how fruitful this field of inquiry has already proved.

Before this little work was published, only one type of trap-door nest was known in Europe: two new types were described in its pages, and I have now the pleasure of being able to bring three more hitherto unknown European types before the notice of my readers, thus raising the number to six in all. I do not include in these six types the very curious, and still imperfectly-known nest of *Atypus*;* a spider which is a true representative of the trap-door group as far as its structural characters are concerned, but which, although it excavates a silk-lined burrow in the earth, does not appear to construct any kind of door at the mouth of its tube.

Much uncertainty still hangs over the habits of this spider, as the facts hitherto recorded, though perfectly authentic, are difficult to piece together into a satisfactory whole. One thing, however, is clear, and that is, that the nests and habits of the spiders of the genus *Atypus* (of which, as Mr. Pickard-Cambridge, informs me, two if not three distinct species inhabit England) merit attentive study, and would most certainly repay it. Hastings, Portland, the coast of Dorsetshire, and the neighbourhood of London and Exeter, are the habitats hitherto cited for this spider, but I cannot doubt its existence in many sheltered localities on the south coast of England.

The most recent contribution to our knowledge of

* See *Ants and Spiders*, page 78. *Atypus* belongs to the sub-family *Atypinae*, a division which does not include any of the *Nemesius* or *Ctenizas*, and of which indeed *Atypus* is the only European representative.

this genus is contained in a paper by M. Eugene Simon,* who describes three species (two of which are new), as inhabiting France, and it remains to be ascertained whether our British *Atypus* agree in their characters with any of these.

He describes (p. 113-4) the nest and mode of life of *Atypus piceus*, Sulzer (= *A. Sulzeri*, Latr.),† the commonest of the three species, as follows:—"They (the spiders) seek dry and somewhat sandy slopes, sometimes also woods, chiefly plantations of evergreens; their retreat is always concealed either by stones, or in moss which one must remove carefully and in large masses (*plâques*) in order to detect them."

"This *Atypus* excavates an oblique hole of 15 to 20 centimetres deep, and of the size of its body; it lines it with a rather narrow silken tube of a very close texture, the upper part of which, exceeding the subterranean portion in length, lies horizontally on the surface of the ground, and ends in an open tapering point. Near its lower extremity the tube is suddenly contracted, and then dilates into the form of a fairly spacious apartment, in which the spider lives; the cocoon enclosing the eggs is suspended by a few threads at the contraction. I have frequently surprised *Atypus* in the act of holding earth-worms in their falces, and I think that these Annelids constitute the larger part of their food; indeed, if one examines the lower portion of the silk chamber, one

* Note sur les Espèces françaises du genre *Atypus*, Latr. in Ann. Soc. Entomologique de France, 5^e ser. tom. iii. (1873), p. 109.

† Thus named by M. Simon.



Wm. Woodbury & Son Imp.

may remark a part where the tissue is thinner and more transparent. I have not been able to detect an opening, but it is probable that the *Atypus* can easily part the not very compact threads, and thus obtain for itself an easy prey, and dispense with the necessity of ascending to the surface of the ground. When taken out of its tube, *Atypus* does not even attempt to escape; it is therefore plain that it is not organized for the pursuit of an active prey; and, on the other hand, the upper extremity of the tube is ill-adapted for an ambuscade, being almost closed, and without support. This small opening would seem to be solely intended for the entrance and exit of the male (a very much smaller creature than the female) during the breeding season, which occurs in the month of October.”

M. Simon says that this species of *Atypus* is common in all the centre, east and west of France, and that he has detected it in great abundance in the neighbourhood of Troyes, in Champagne, in the month of October, when the male was inhabiting the same tube with the female.* I am greatly indebted to M. Simon for having given me the specimen of a silk tube taken entire from a nest found in this locality, which I have figured in Plate XIII., fig. A. It will be seen that the tube has collapsed, but one may still trace the enlargement near the base which forms the chamber, the elbow where it is bent at the surface

* M. Simon has discovered another species of *Atypus* at Digne in the Basses Alpes which constructs a similar nest to that described above. This species was detected for the first time by M. Simon and described by him under the name of *Atypus bleodonticus*.

of the ground, the moss, scales, and fibres of plants which are woven into, and serve to conceal the aërial portion, and its termination in a twisted and apparently-closed mouth.

Indeed, I believe that, in this specimen, the upper extremity of the tube is really closed, for, when I succeeded in inflating this aërial portion, the lips did not part, but remained drawn together.

It seems very extraordinary that the mouth of the tube should be thus closed, so that the female spider becomes a prisoner, self-immured, and I can only suppose that this is a temporary condition, limited perhaps to the period during which she receives the visits of the male.

At the very base of the tube I found a mass of earth, roots and vegetable fibres, and in this I hoped to have detected the *débris* of insects or other food, such as I sometimes find at the bottom of and below the tubes of the trap-door nests in the South, but of this there was no trace.

It is difficult to me to imagine how the spider could contrive to live by the capture of worms, after the fashion suggested by M. Simon; for who does not know the speed with which, on the slightest alarm, worms draw back into their holes and escape pursuit, and the muscular power which they exert in resisting any attempts to drag them out of the earth?

M. Simon's account of the closed tube and capture of worms by this spider corresponds, however, with that given by Mr. Joshua Brown, the first discoverer of *Atypus* in England.

This gentleman communicated his discovery to Mr.

Edward Newman* in 1856, since which time (with the exception of M. Simon's paper quoted above) little or nothing seems to have been done to clear up the points which remain doubtful in the history of these singular creatures.

Several nests of *Atypus* were discovered by Mr. Joshua Brown in the neighbourhood of Hastings, when traversing a lane bounded on either side by high and steep sand-banks, partially covered with grass and bushes.

His attention was at first arrested by the sight of "something hanging down which looked like the cocoon of some moth;" but, on closer examination, the silk case proved to be empty, and was continued as a tube into the ground to a depth of 9 inches, where he came upon the spider lying at the bottom. Further research revealed the existence of a number of these nests in the same locality, but the length of the different tubes varied much; they were usually about 9 inches long, but some were much longer, often baffling his attempts to follow them; the longest which he was able to secure entire measured 11 inches. All the nests were, however, alike in having a tubular silk lining, about $\frac{3}{4}$ of an inch in diameter, a part of which protruded from the ground for about 2 inches, and was pendent, inflated, and covered with particles of sand, assimilating it to the surrounding surface; it was closed at the upper extremity, leaving no exit to the open air.

Mr. Brown took home some of these tubes in a

* Note on *Atypus Sulzeri* of Latreille, by Mr. Edward Newman, read before the Linnean Society; a report of this communication is given in *The Zoologist*, vol. xiv. (1856), p. 5021.

collapsed state with the spider at the bottom. In one case, on opening the box in which the nest was placed, he perceived a movement throughout the tube, as if it were being inflated; this however soon subsided, but the following morning he was surprised to see that the whole tube was inflated, especially at the end which had lain exposed on the bank. He failed to find any aperture by which the spider could enter or leave her nest, and his captives, though passing backwards and forwards in their tubes, never came out at either end. He never saw flies or any fragments of insects in the nests; but, on drawing out one of the tubes, he observed a worm at the lower end, partially within it, partially outside, and he perceived that the spider had evidently been eating a considerable portion of its anterior extremity.

It will readily be seen that there are some discrepancies between the different accounts which have been given of the nests of *Atypus* found in England and France,* and I think it quite probable that some at least of the nests described may really differ, and be the work of distinct species belonging to this genus. Mr. Brown describes his nests as having by far the greater part of their length under ground, while in those observed by M. Simon, as shown in my figure, Plate XIII. fig. A, the exposed portion of the tube equalled or exceeded the subterranean.

An imperfect specimen at the British Museum, from some English station (exact habitat not given), appears to have the proportions described by Mr. Brown; the length of the aërial portion of the tube

* A subject already alluded to in *Ants and Spiders*, at p. 78.

being less than one-fourth of that of the subterranean ; the upper end of the tube is however open, but I am doubtful whether this was originally so or not, for the silk is torn at this point, and the opening may be a rent caused by rough handling.

After a comparison of the above description, it appears to me that the following are the principal points which remain to be cleared up :

1. What is the precise structure of the nests of *Atypus*, and are they always uniform in character at all seasons of the year ?

2. What is the use of the exposed aërial portion of the tube ?

3. Do the two British species make similar nests ?

4. What food, besides worms, does the female live upon, and how does she obtain it ?

5. Does she ever leave the nest ?

6. What becomes of these spiders and their nests in the winter, and how long do they live ?

7. When do the young leave the nest ; and do they, like their relatives in the South, construct nests like those of their parents in miniature ?

I would commend all these points to any lover of Nature who may seek the southern coasts of England during the autumn and winter months, and I think it more than likely that a careful search in the sandy banks near St. Leonards, the slopes under the fir-woods of Bournemouth, and the deep lanes in the neighbourhood of Torquay, would be rewarded with success.

If the breeding season in England only commences in October, as appears to be the case in France, it would seem most probable that the spiders survive

the winter. Very possibly these spiders and their nests might be transplanted and placed for observation in a garden; and if room were granted them in a greenhouse or Wardian case, or even in a large flower-pot in a living-room, it is not unlikely that the warmer temperature might waken them up to renewed activity.

It seems clear that *Atypus* has to fear the insidious attacks of enemies; for not only is the external portion of the tube closed or almost closed at certain seasons, but it is covered outside with such materials as may serve to make it resemble the surrounding surface of the ground. Thus Mr. Brown's nests, lying on a sandy bank, were covered with particles of sand, while my specimen from Troyes has moss and fibres of plants woven into its upper extremity.

Indeed, all the European representatives of the sub-order *Territelariæ* which I have myself met with, conceal their nests with great care and skill. There appear to be others, however, which either make no nests at all but hide under stones, or only construct a simple silk tube, open at the mouth, and without any special contrivance for its dissimulation. Further observation of the habits and dwellings of these apparently unworthy members of the trap-door group is much to be desired.

Mr. Bates,* in his work on the Amazons, describes *Mygale (Theraphosa) Blondii*, a large and powerful spider of that region, as burrowing into the earth and "forming a broad slanting gallery about three feet long, the sides of which he lines beautifully with

* Bates, H. W., *Naturalist on the Amazons*, Ed. 2. (1864).

silk." This spider "is nocturnal in his habits," and may be seen "just before sunset keeping watch within the mouth of his tunnel, disappearing suddenly when he hears a heavy foot-tread near his hiding place."

This nest would therefore appear to have an open tube undefended by any door; but in this case the great size of the spider and the depth of the burrow, which is more than twice as long as that of the average European nests, may help to explain this apparent want of precaution.

But, if we wish to learn with what different materials and by what varied means the same end of self-preservation can be attained, we have only to cast a glance at the sketch of a portion of a nest at fig. B, Plate XIII., p. 183, where it will be seen that the entrance to the nest, far from being concealed or obscured in any way, is rendered a most striking object, and one which appears devised for the very purpose of attracting attention. The nest to which I refer is the work of *Cyrtarcheus elongatus*, from Morocco, and consists, according to the account given me by its discoverer, M. Simon, of a deep cylindrical burrow in the soil, the silk lining of which is prolonged upwards for about three inches above the surface of the ground, and enlarged into a funnel shape, so that it becomes from two to three inches across at the orifice. This aerial portion being snow-white, at once attracts the eye even from a considerable distance, and the nests rising up amid the sparse grasses and other small plants which serve to support but not to conceal them, present the appearance of scattered white fungi.

This is therefore quite a new type among the nests constructed by trap-door spiders, new in form and

probably in function also, and I would propose to distinguish it provisionally as the *funnel type*.

Now the female *Cyrttauchenius* is, like its near relatives the *Nemesias*, a sluggish and rather helpless creature, and shows no apparent physical superiority which might countenance its dispensing with the methods of concealment which form the characteristic habit of the group.

How then does this spider manage to escape its many enemies, especially the insidious attacks of the insects of the *Sphex* and *Ichneumon* families, which certainly abound in Morocco?

Mr. Wallace, to whom I put the question, suggested that this species may perhaps be chiefly nocturnal in its habits, and that, if this is the case, the bright white and flower-like tube of the nest may possibly serve to attract night flying insects, which would thus become its prey.

In any case, whether we can discover them or not, some curious points of difference must exist between this spider and its allies, which secure to it a comparative immunity.

It appears to me that there are few questions which can be of greater interest to the naturalist than those which have to do with the conditions determining the existence of a given species in a given place.

Of the questions, Who are your relatives? Where do they live? and How are you able to live here? surely the last is not the least important.

And, if we wish to try to answer this question, we must do all in our power to find out how the habits and conditions of life of the creature in question,

differ from those of its competitors; for we may be quite certain that it does not exist where we see it by grace and favour, but by merit; if it is neither stronger, cleverer nor more numerous than its neighbours, we may be sure that it has found some means of living which does not interfere fatally with their requirements. Hence the endless diversity of function and habits in all living creatures, which forms such a prolific and marvellous subject for our study and contemplation.

I am indebted to M. Simon for permission to publish the details given above on *Cyrttauchenius elongatus*, and also for having given me such directions as enabled me to make the sketch from which the drawing at Plate XIII., fig. B, was copied.

I must however state that this illustration is not taken from an actual specimen, but is prepared solely from his description; so that it cannot pretend to complete accuracy of detail. M. Simon assured me nevertheless that it conveyed the general appearance of this remarkable nest with sufficient fidelity, and I have been induced to reproduce it here in the hope that it may serve to make my meaning plainer, and to suggest the kind of object which one should look for, if an opportunity offered.

Another species of the same genus, *Cyrttauchenius Doleschallii*, is known to inhabit Sicily, but the nest is undescribed. M. Lucas has described two species,* belonging to the closely-allied genus *Cyrtcephalus*, both of which appear to construct nests somewhat similar in form to that discovered by M. Simon.

* *Cyrtcephalus Walckenaëri* and *terricola*, Lucas (H.), *Animaux articulés de l'Algérie* (Paris, 1847-9), vol. i. p. 94-5.

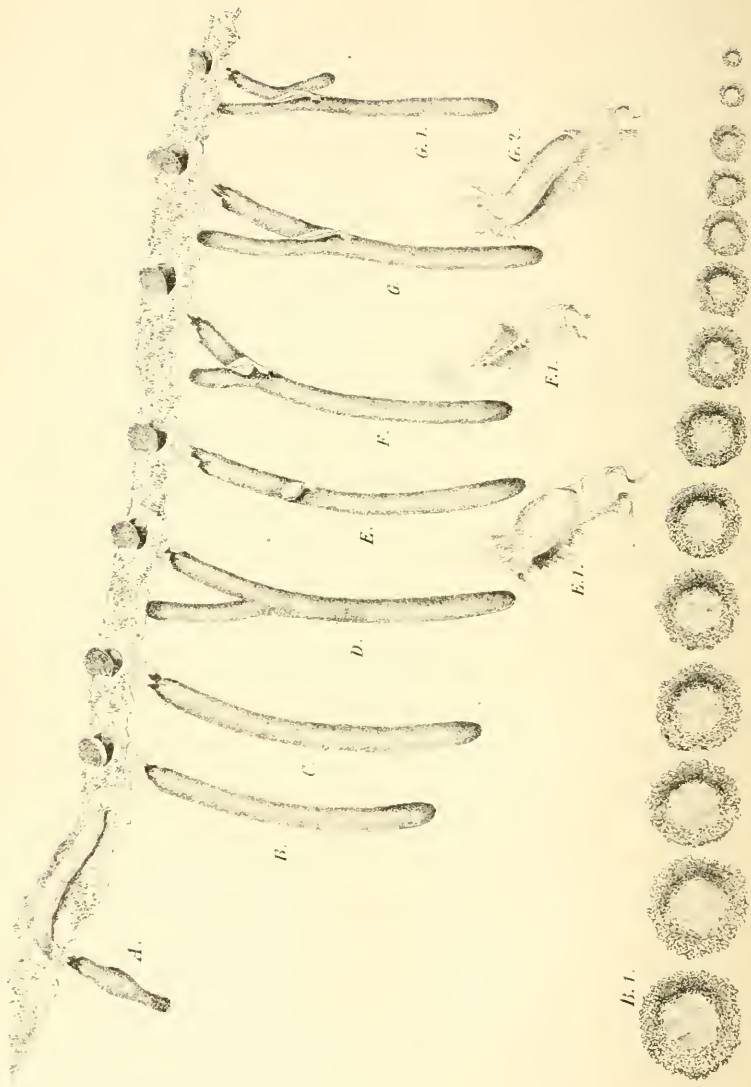
Whether these nests are equally showy we cannot tell, as the account is brief and few details are given ; but one, that of *Cyrocephalus terricola*, appears to differ in having threads stretched from the opening of its funnel, which serve to ensnare insects and to give notice of these captures.

The great trap-door group therefore comprises spiders which differ widely in respect of their dwelling places. Some construct no nest at all or only an irregular web, and live under stones ; others, like *Theraphosa Blondii*, make a simple cylindrical tunnel, or, like those just described, a tube having a prolonged, uncovered, funnel-shaped mouth : others again, belonging to the genus *Atypus*, form the curious and as yet imperfectly-understood nests with a silken tubular lining, part of which hangs down outside ; while on the highest rung of the architectural ladder, stand the builders of the veritable trap-door nests.

It seems quite possible that, when we know more of the structures made by *Territelaria* generally in various parts of the world, we shall find that nests of various degrees of complexity and perfection of structure exist, bridging over the gulf between the barbarous dwellers under stones and the highly civilized inhabitants of the branched wafer and cork nests.

Indeed, thanks to recent discoveries, I am already able to do something of this kind for one small group of spiders, namely, for that of the European *Nemesias* having nests with wafer doors.

I hope to make this plain by reference to the diagrams on Plate XIV., where the figures C, D, E, F,



and G represent on a reduced scale five types of wafer nest constructed by as many distinct spiders, and where a gradation may readily be traced between the simplest type at C and the most complicated at G; but we shall speak more fully of this matter by-and-by.

In these diagrams I have placed that representing the nest of *Atypus* on the extreme left (A);* next to this stands that of a nest of the cork type (B), a type which must be carefully distinguished from all the rest. It must not be supposed that the solid cork door (so called from its resemblance to a short cork closing the neck of a bottle), is nothing more than a thicker edition of the wafer door; it is not so, but, on the contrary, possesses a very characteristic structure of its own, being composed of many layers of silk, each furnished with a sloping rim of earth, while the wafer door consists of but a single layer of silk.

I have represented at B 1 the 14 layers of silk and earth which went to make a single cork door examined by me. It will be seen that the outermost of these layers is the largest, and the innermost the smallest, and I have already (*Ants and Spiders*, p. 150) shown reason for believing that the latter constituted

* These types may be briefly enumerated as follows:

A, nest of *Atypus*.

B, cork nest, and B, 1, layers of silk and earth forming the door of the cork nest.

C, single-door, unbranched wafer nest.

D, single door, branched wafer nest.

E, double-door, unbranched wafer nest, and E, 1, lower door of the same.

F, the Hyères double-door branched wafer nest, and F, 1, lower door of the same.

G, double-door branched cavity wafer nest, as seen in the oldest and largest specimens, and G, 1, the same in the younger specimens. G, 2, the lower door of this nest, being of the same form in young and old nests.

the first door the spider ever made, and that the consecutive layers mark successive stages in the enlargement of the nest.

There is therefore a broad distinction as to construction between cork nests and wafer nests; moreover, while the former are, as far as we know at present, all of one type, and only differ in size or proportion, the latter appear under five distinct types.

Thus, every known cork nest, whether found in Europe, America, or the Antipodes, has the same solid door and simple tube; while of the wafer nests, some have branched and others simple tubes, and some again possess a lower door in addition to the upper or surface door.

In the following pages I intend to treat of the trap-door spiders and their nests in the same order in which the latter are placed in the diagram, commencing with those of the cork type B, and then dealing successively with the several wafer nests from C to G. We have already spoken of A, the nest of *Atypus piceus*, and seen that our present knowledge of this nest, of the habits of its occupant and of those of its relations, is still far from complete.

The cork type is, as my readers will perhaps remember, the great cosmopolitan type which ranges round the world, and which, curious to say, is built by many different spiders belonging to distinct genera.

The idea of planning this very perfect bit of mechanism appears to be the common inheritance of these several spiders, separated though they are by wide intervals of geographical space as well as of structural divergence.

At Mentone two distinct spiders construct nests of the cork type, one of these being a *Nemesia* and the other a *Cteniza*. They are as unlike each other as they well can be, and it seems remarkably strange that their nest-building instinct should be so similar. The nest of the *Cteniza* is indeed shallower than that of the *Nemesia*, and a practised eye can usually trace a difference between the slightly less angular lower surface and more semicircular outline of the door of the former, and the more abruptly bevelled and more circular door of the latter.

These spiders and their nests have been already described and figured in *Ants and Spiders* under the names of *Ct. fodiens* and *Nemesia cæmentaria*. Recent discoveries have however shown that these spiders possess distinctive characters of their own, and, though closely allied to the species indicated, should be separated from them.

Last spring when pulling down an old terrace-wall (by permission) I had the good fortune to discover the very remarkable male *Cteniza* drawn at fig. A, Pl. XX., p. 254. I found no trace of a nest or web of any kind, and the spider was merely hiding between the stones.

There appears to be scarcely any doubt that this is the male of the female Mentonese *Cteniza* which has, up to this time, been called *Ct. fodiens*. A comparison with typical specimens of the true *Ct. fodiens* from Corsica, has however shown that the two are certainly distinct, and Mr. Pickard-Cambridge* now

* Mr. Pickard-Cambridge has once more kindly undertaken the task of

describes the Mentonese form under the name of *Ct. Moggridgi*.*

The females of the true *Cteniza fodiens* are far larger than those of our new Mentonese species, and construct their nests in dry and exposed places, instead of in the moist and shady ivy-covered banks selected by the latter. I have found *Cteniza Moggridgi* at San Remo and Mentone, and it will probably be also discovered at Nice, but I failed to detect it either at Cannes or Hyères.

The Corsican male at the first glance curiously resembles that found at Mentone, but differs essentially in details and especially in having the surface of the caput unbroken, whereas the caput of the latter presents a very peculiar character in an impressed line which runs across it from side to side (figs. A 1 and A 2). Both agree, however, in being strangely unlike their females.

The other builder of a nest of the cork type at Mentone was, as has been already stated, described and figured in *Ants and Spiders* under the name of *Nemesia cæmentaria*. Now the true *N. cæmentaria* of Latreille is found at Montpellier, the classical habitat where the first discovery of trap-door spiders in Europe was made towards the end of the last century, but its true characters have been hitherto but imperfectly known.

I have lately been able to secure several specimens at this place, and they certainly differed in their

naming and describing my collections of trap-door spiders, and the results of his labours will be found at the end of the present work.

* I take this opportunity of thanking him for the compliment. A description of this new species will be found at p. 254, below.

markings from the so-called *cæmentaria* of Mentone. M. Simon had previously informed me that he considered our Mentonese spider distinct from the typical *cæmentaria*, and had kindly proposed to give my name to the Mentonese species ; and now Mr. Pickard-Cambridge, on the receipt of the specimens collected by me at Montpellier, coincides with M. Simon, and adopts his nomenclature, calling the Mentonese *Nemesia N. Moggridgii*.*

I found but one nest of the cork type at Montpellier, where it was most abundant, and invariably inhabited by the same spider, so that there can be little doubt that this is the celebrated *Nemesia cæmentaria* of Latreille, the nests of which were described by the Abbé Sauvages in 1763.

When living, the pattern on the abdomen is far more distinct and is traced on a paler ground than in *N. Moggridgii*, and the patterns on the back of the caput, as seen in specimens preserved in spirits, and the relative sizes of the lateral eyes, as well as other details enumerated by Mr. Pickard-Cambridge, afford characters by which they may be known apart ; and it is probable that when the males, which are at present unknown, shall be discovered, they will be found to present other distinctive peculiarities. In the present instance we have the reverse of the case described above, in which two very distinct spiders constructed a similar nest, for here both spiders and nests are much alike.

We have yet to learn what are the special advantages which each type of nest affords ; but it is plain

* See below, p. 273.

from the fact of the same type being adopted indifferently by both nearly- and most distantly-related spiders, that the form of the nest is governed far more by the conditions which it is contrived to meet, than by the affinity or resemblance of the spiders which construct it.

I have found *N. Moggridgii* at San Remo, Mentone, Cannes, Hyères, and Marseilles, but thus far, I only know of the true *N. cæmentaria* at Montpellier.

The latter spider is rather bolder than the former, and I frequently saw it at Montpellier watching at the slightly raised door, with the tips of the claws projecting from the nest, and it rarely failed to resist most vigorously any attempt of mine to force the door open.

During the summer of 1873, I received two specimens of trap-door nests from California. Both of these nests were of the cork type and nearly entire, wanting only a small portion of the base of the tube; they most closely resembled one another and were probably the work of the same spider. For one of these, coming from the San Joaquin valley, between the Calaveras and the Tejon, I have to thank M. J. C. Puls, a Belgian entomologist residing at Ghent; and for the other, containing the spider which had constructed it *alive within its tube* (!), I am indebted to Mr. G. H. Treadwell of San Francisco. The former nest is drawn at fig. A, Plate XV., and the spider* from the latter at fig. B of the same plate.

Mr. Treadwell had carried this spider and its nest,

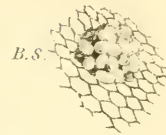
* This spider, which proves to be a new species, is described below (p. 260) as *Cteniza Californica*.



B. 9.



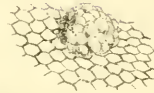
B. 5.



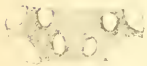
B. 6.



B. 7.



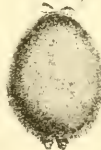
A. 1.



B. 3.



B. 1.



B. 5.

B.

P I II III IV



B. 10.



B. 4.

B. 2.



with the block of earth in which it lay, all the way from Visalia, a town about 350 miles south of San Francisco, where he had taken it; the nest and spider travelled safe to London enclosed in an empty cocco-tina tin, $4\frac{1}{2}$ inches deep, and $2\frac{3}{4}$ across.

The nest was then entire, for these spiders appear to make singularly shallow tubes; and it might have remained so up to the present day had it not been for the rash curiosity of a chambermaid in the London hotel where Mr. Treadwell was staying, who, smitten with a great desire to learn what the heavy little box which came from the land of gold might contain, proceeded to examine the earth, when the sudden appearance of the spider frightened her so much that box and nest and all were thrown with a crash upon the floor.

Were it not for this unlucky incident I might have seen a complete specimen of this curious nest; but as it was, though the spider miraculously escaped uninjured, the bottom of the nest was pounded into dust, and only the upper portion remained intact.

Both this nest and that sent to me by M. Puls, were of the true cork type, and presented a solid door with a bevelled edge, fitting into the correspondingly bevelled lip of the tube, and shutting flush with the surface of the ground. The lining of the tube was strong and thick, but soft and silky to the touch.

The tube itself in Mr. Treadwell's specimen, when intact, cannot have measured more than $3\frac{1}{2}$ inches in length; and we learn from Dr. Lanzwert, who collected the other specimen, that the average length of these nests does not exceed three inches. Dr.

Lanzwert, writing in one of the local papers* of "The Mygales or Ground Spiders," says, "the poisonous black tarantulas, so well known to naturalists, are extremely common in California, but only in places upland, or lowland which are very hot and dry. Their principal haunts are the San Joaquin valley, between the Calaveras and the Tejon. A similar species from the coast is not only smaller than the interior variety, but the colours are much deeper. They both make a curious habitation under the ground, composed of a glutinized, web-worked purse, about three inches long, and which is furnished with a tightly-fitting lid which they can open or shut at pleasure, and which is as cunning a piece of insect architecture as is to be found in nature. These ugly loathsome Californian spiders are often mentioned by thoughtless scribes as carrying no more danger than a common wasp, like the species of Italy, but it is well known that several persons, young and old, have lost their lives in this State from the bite of such tarantulas as are met with in our coast and interior country. Their enemy in the Tulare valley is an immense shining black wasp,† fully an inch long, which will pounce upon them, and after a short battle drag the tarantula along in the most valiant style of heroic conquest. These interior taran-

* *The Evening Bulletin* for Oct. 25, 1866.

† This insect was probably not a true wasp, though belonging to an allied family; it may perhaps have been a *Pepsis*, certain species of which genus Mr. Bates informs me he has frequently seen near Santarem on the Amazon, hawking over the ground where the huge trap-door spiders lived, and suddenly pouncing down upon one of these creatures, often many times larger than themselves, when, after paralyzing their victim with their sting, they would deliberately saw off the legs before dragging away the bodies!

tulas are often seen measuring two inches in the spread."

Mr. Treadwell was quite as much impressed as Dr. Lanzwert with the belief that the bite of these spiders is fatal, but it does not appear that either of these gentlemen have obtained conclusive evidence in support of this allegation.

I have occasionally been bitten by the trap-door spiders in South France, but have never experienced the slightest subsequent inconvenience, nor was there any trace of inflammation or poisoning about the punctures which they made. Mr. Blackwall* has made a very careful set of observations on this head, and has caused some of the largest species of British spiders to bite his finger and wrist until the blood flowed, without the slightest ill effects. He also inoculated himself at the same time with the poisonous secretion of the spider and with that of the wasp; when the latter wound became extremely painful, while the former was not perceptibly aggravated. Mr. Blackwall obtained the spiders' poison by causing a spider to seize a slip of clean glass with its mandibles, when a small quantity of a liquid showing a slightly acid reaction was deposited.

Mr. Treadwell informed me that these Californian trap-door spiders leave their nests in the daytime, and may be seen walking by the roadside, though they are always prepared to hurry back to their nests on the approach of danger.

I received the spider which I have represented at

* Mr. J. Blackwall, *Researches in Zoology*, ed. 2, 1873; chapter on "The Poison of the Araneida," pp. 240-256.

fig. B, Pl. XV., p. 198 (*Cteniza Californica*), from this gentleman alive, and still within the remaining portion of her nest, on the 6th of July, 1873. She then had the legs and cephalothorax of a brownish-black, and the abdomen of a dull, uniform, dusky chocolate brown, but with an indistinct median line near the anterior end on the upper side, intersected at right angles by a shorter line. Mr. Treadwell said, however, that when captured, this spider was much darker, and of a pitchy black colour. The hairs all over the body were short, but especially so on the abdomen, which had the appearance of cloth or felt.

This creature in many ways recalls *Cteniza fodiens* of Corsica, and in a less degree the *Cteniza* of Mentone and San Remo.

We find not only the same general form of body, but also the same claws furnished with only one tooth, instead of many as in *Nemesia*, and other distinctive features; and it is interesting to observe in the nest that the more semicircular form of the door and the wider hinge also connect it rather with *Cteniza* than with *Nemesia*.

Here, as in all spiders yet observed in cork nests, we find the habit of resisting any attempt to open the door, and many a time when I have wished to raise the lid in order to drop in flies or other food, I have been obliged to desist because the bending blade of my penknife showed that I should injure the nest if I used greater force.

No doubt the shallowness of the nest is an advantage to its occupant in one way—namely, that it enables the spider to start up at the shortest notice, and cling on to the door.

It is curious to find that, far as California is removed from the Riviera, the same habits of construction and self-defence are common to the spiders of both countries, and that the bond of kinship sets time and space at defiance.

I kept this spider all through the summer and early autumn at Richmond (Surrey), sprinkling the nest from time to time with water, and constantly supplying its inhabitant with flies, woodlice, grasshoppers, earwigs, and other similar dainties. She did not, however, seem eager for food, and the insects provided for her, and actually placed within the nest, were often turned out again almost untouched.

When I placed living insects, such as grasshoppers, for example, within the nest over-night, she would often allow them to remain there unharmed, so that I found them ready to escape on opening the door the following morning.

I never saw her leave the nest of her own free will, and when I made her come out and set her to run in the garden, she began at once to seek for a place to hide in, hobbling along in an ungainly way and at a slow pace.

She must, however, have left the nest on more than one occasion, unseen by me, for she deposited several clusters of eggs at various times upon the under-surface of the gauze net which was fastened over the mouth of the box in which she was imprisoned.

The first of these groups of eggs was laid during the night between the 12th and 13th of July, and formed a raspberry-shaped cluster attached to the gauze.

I have represented this cluster of the natural size at fig. B, 6, and magnified at fig. B, 7, on Plate XV.,

only in an inverted position, for they really hung downwards from the under side of the net.

These eggs were greyish white or pale brown, and varied in shape from globose to oblong.

All were very small, the largest only measuring $\frac{1}{2}$ line in its greatest length, but it is doubtful whether any of these eggs were fertile, and, though they appeared full and plump, many presented an irregular and fissured surface.

A fortnight later (July 27) another cluster of eggs was laid, and this time between the hours of five and eight P.M. When the lamp was brought in at the latter hour, I perceived what I took to be a drop of water hanging from the gauze cover above and rather in front of the spider's door, the very position occupied by the cluster of eggs previously described. On closer inspection this proved to be a drop of a pellucid colourless liquid, in which some thirty eggs floated. One egg was laid on the gauze at some distance from the main group, and several were also attached to the inside of the tin box.

At midnight I found that the drop had coagulated and contracted, and by the following morning the mass was quite dry and resembled the former group, only that it was not quite so convex.

Some of the eggs forming this cluster were much larger than any in the preceding one, and one measured as much as a line in length by half a line in breadth. This group is shown magnified at fig. B, 8, Plate XV., and some of the separate eggs more highly magnified at fig. B, 9.

Between this date and the end of November when the spider died, eggs were laid on seven distinct occa-

sions—viz., on July 31, August 11, 15, 31 (when I again found the eggs floating in a drop of liquid, having been deposited on the gauze between two and half-past four o'clock in the afternoon); September 9 (23 eggs laid on the earth near the entrance to the nest); September 19 (about 30 eggs on the gauze), and November 4 (about 30 eggs on the gauze).

Thus, between July 13 and November 4, this spider laid nine clusters of eggs, all but one of which were placed on the same part of the gauze cover, above and a little in front of the door, and the total number of eggs deposited cannot have been less than 250. It is difficult to understand why she should have laid these eggs outside the nest, unless indeed she knew them to be sterile, and so treated them as refuse. I can scarcely believe that such a procedure is in accordance with the ordinary habits of these spiders; for, if the eggs and young are habitually exposed, then the perfect concealment of the nest would lose one of its most important uses. When we remember that there are minute hymenopterous insects which lay their eggs within the eggs of the spiders, we can see how important it may be that the entrance to a nest, which is at once nursery and stronghold, should be closed by a well-fitting door, and one which may exclude, not only the larger and more powerful enemies of the full-grown spiders, but also the tiny and almost imperceptible assailants of the eggs and young.

This Californian spider was always careful to eject from the nest the remains of insects with which I had supplied her, and, as she did so deliberately and by day as well as by night, I had frequent opportu-

nities of watching her. Sometimes, if not alarmed by any sudden movement, she would remain for one or two minutes at the mouth of the nest with the door partly raised, and I was glad to seize these opportunities for making some experiments, with a view to learning whether she would prove as sensitive to sound as she did to other vibrations and to the sight of moving objects.

Placing myself so that the partly-opened door screened me from her view, I was able to approach close to the nest without causing her alarm, and to make different sounds and noises at distances varying from three to fourteen inches.

In no case, however, did she pay the slightest attention; and neither shrill and sudden whistling, deep chest and buzzing sounds, an octave of piercing notes struck upon brass bells, my best imitation of the whirring of the fern owl, or finally, the angry hum of a large humble-bee imprisoned in a paper box, and held within three inches of the door of the nest, appeared to produce any kind of effect. This surprised me, I confess, for, though I am aware that no auditory apparatus has as yet been discovered in spiders, I can scarcely believe that they stand at so great a disadvantage as creatures would seem to do which lack the power of hearing.

These experiments must not, however, be taken for more than they are worth; and the results obtained may have been due rather to apathy in the individual spider than to a want of perception in the race generally. In any case they suggest the need of further experiment and observation in this direction.

In October I carried this Californian spider out with me to Mentone, and she lived there and appeared plump and well until the end of the following month, when she suddenly died, having laid one more group of eggs in the interval. On examination, I found a dark brown spot on one side of the abdomen, and this, I think, probably indicates that her death was caused by some insect of the ichneumon family, which had laid its eggs within the spider's body, after having stabbed it at the place indicated by the discolouration.

Not very long before this melancholy event occurred, I had put the spider to some inconvenience in order to secure her portrait from life, to effect which I took her from her nest and placed her in a deep china saucer.

She exhibited the strongest dislike to exposure, and sought to hide herself even under a fold of blotting-paper which lay in the saucer with her. I also noted that she appeared quite incapable of walking up the sides of the saucer, and it would therefore seem that she was destitute of the viscid hairs which enable some spiders to traverse glazed and polished surfaces.

Seeing this anxiety on the part of the spider for concealment, it came into my mind that, perhaps, if she were placed on the surface of a pot full of garden mould she might excavate a tunnel in order to hide herself from view. This I accordingly did in the evening of November 15, and on the following morning I was delighted to find that she had commenced to dig and was still at work.

In little more than an hour's time the hollow had

become about the size of half a walnut, and resembled in its nearly semi-circular outline and size the surface of the door of her own nest. I was greatly pleased to be able to watch the creature at the work of excavation, a sight which I believe no naturalist has ever had before.

The legs took no part in the digging, and the palpi were but little used, the mandibles and their fangs being the implements chiefly employed. As soon as a little earth had been loosened and gathered up, the spider walked up to the edge of her excavation and deposited there her mouthful of particles of earth, separating and working the mandibles up and down in the effort to part with the pellet, which had been carried between the fangs and the mouth-organs. Each pellet was very small, and the operation appeared to be excessively tedious and laborious. I had expected to see the spider scrape out large quantities of earth at a time, and either drag it backwards or kick it out behind her as a terrier does when working at a rabbit-burrow; but no, every little pellet removed was carried forwards, and deposited separately on the "tip."

On the two following days, the 17th and 18th November, the spider remained almost inactive, and brooded over the cavity she had made, and which still remained too shallow to conceal or even contain her. At 4 P.M. on the latter day I made a hole for her in the earth, and, after some indecision, she took possession of it. Next day, however, finding that she remained motionless in the hole which I had made, and displayed no apparent intention of either lining

it with silk or furnishing it with a door, I replaced her in her own nest.

Within a few days after this date I found her dead at the bottom of her tube, and at first I was inclined to fear that the treatment to which she had lately been subjected might have caused her end. When, however, I detected the brown spot on the side of the abdomen, described above, and which so strongly recalled the marks frequently observable in caterpillars attacked by ichneumons, I came to the conclusion that she had really died from the internal injuries caused by the gnawing of these cruel parasites; and that the eggs, laid long before by one of these insects, had been hatched within her body and developed into larvæ, which, living upon her tissues, had at length destroyed some vital part. It is surprising that a creature, carrying within itself such a fatal brood, should not only live, but be capable of undergoing such adventures and misadventures as this travelled spider endured with seeming indifference; but similar facts are familiar to all those who have attended to the rearing of caterpillars, and the frequent disappointment caused by the death of apparently sound specimens which have been attacked in this way is but too well known.

It would appear that *Cteniza Californica* is peculiarly amenable to captivity, and indeed to captivity of the strictest kind.

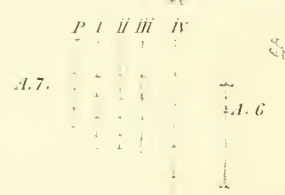
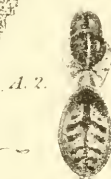
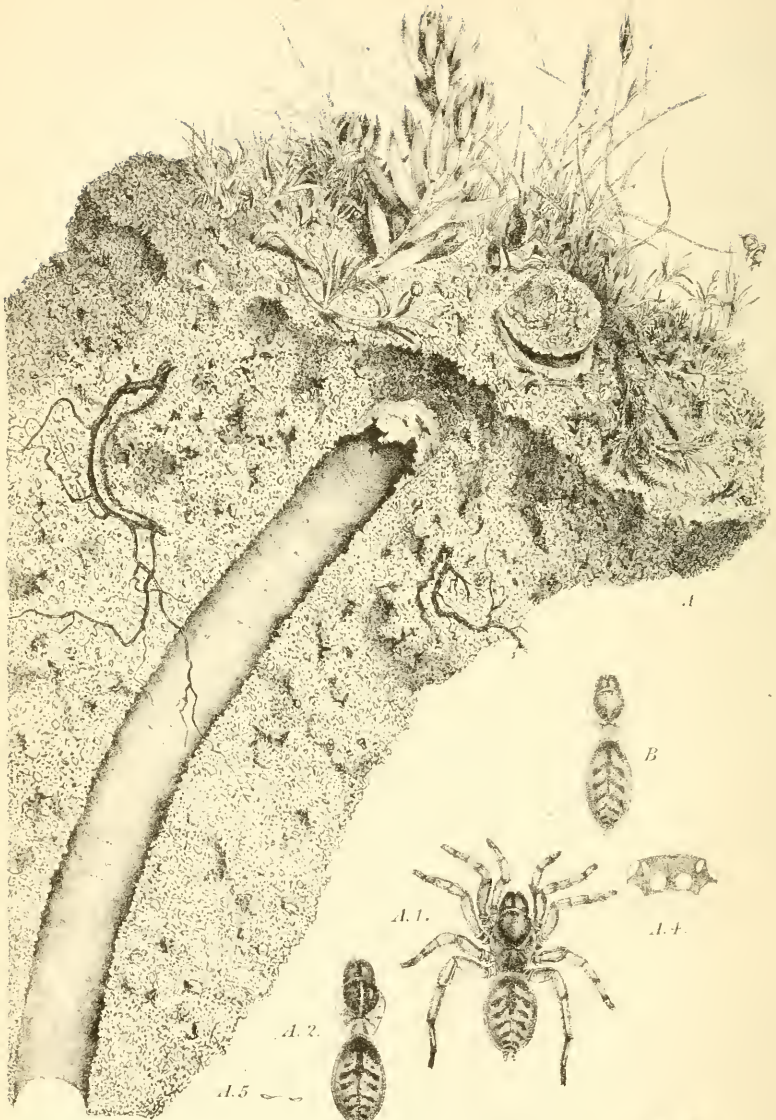
My specimen lived during all the time she was in my possession in a cocoatina tin, a cylindrical box $4\frac{1}{2}$ in. deep and $2\frac{3}{4}$ in. in diameter, which always stood among the books and papers on my writing-

table. It is probable that those trap-door spiders which inhabit nests with short tubes, and which therefore can be transported nest and all, would be less disconcerted by imprisonment than is the case with other kinds living at the bottom of a long burrow which it is almost impossible to carry away entire. This is borne out by what has been related (*Ants and Spiders*, p. 122) of the habits of *Cteniza ionica* in captivity, which not only endured to have its nest set upside down in a flower-pot, but actually furnished the inverted base of the tube with a door appropriate to its new position.

Canon Tristram (the well-known author and naturalist) was so kind as to send me two trap-door nests from Palestine for inspection; these were small cork nests, the doors of which resembled those of the Mentonese *Cteniza* (*Ct. Moggridgi*), but the tubes were exceedingly short, and that of the more perfect specimen, as I gather from Canon Tristram, measured only two inches and an eighth in length when entire.

The nests of *Cteniza ionica* are but little longer, and that of the Mentonese *Cteniza*, though never so shallow as these, are far less deep than those of *Nemesia cæmentaria*, the builder of the typical cork nest.

And now we will leave the nests of the cork type and their inhabitants, and turn to the more intricate group of nests belonging to the wafer type. Following the order indicated in the diagrams, we will begin with the simplest type of all, fig. C, and afterwards take the remaining types one after the other, advancing until we reach the most complex type, G.



A. 3.

The nest represented diagrammatically at fig. C, in Plate XIV., is shown of the natural size in Plate XVI., with the spider (*Nemesia Simoni*, Camb.) which constructs it (fig. A 1).

It belongs to the single-door unbranched wafer type, of which one example has already been described in the West Indian nest (see *Ants and Spiders*, p. 79, fig. B in woodcut); for, though this latter has a shorter tube and a much stouter silk lining than is the case with its European representative, there does not appear to be sufficient difference to justify their separation as distinct types.

This, which is the simplest known form of trap-door nest, is quite new to Europe, and the spider inhabiting it proves also to be one hitherto undescribed; it has received from Mr. Pickard-Cambridge, the name of *Nemesia Simoni*,* being so called in honour of M. E. Simon, the well-known arachnologist.

During last May (1874) we spent a few days at Bordeaux on our homeward route. While there my sister was fortunate enough to discover a single nest of this type when we were out together on a spider-hunt near the little village of Lormont, which is situated on the opposite bank of the river to that on

* Mr. Pickard-Cambridge describes *N. Simoni* at p. 297 below. This species is remarkably well characterized, an assertion rarely to be made in the case of those *Nemesias* of which, as in the present instance, the female only is known. The elevated, rounded, and glabrous caput at once distinguishes it, not to speak of other peculiarities. Mr. Pickard-Cambridge alludes to the presence, in the specimens forwarded to him in spirits, of two singular indentations on either side of the caput (fig. A 3, Plate XVI.). I did not observe this when these spiders were alive, but I remember that the caput of one of these spiders which had been injured in capture contracted and expanded spasmodically, presenting a painful resemblance to laboured breathing. I have not observed this in other spiders.

which the city stands. We subsequently found these nests in tolerable abundance in a deep shady lane near a restaurant called Mon Répos, on the same side of the river, but rather farther up.

Here the hedge banks were high, and the soil was composed of a fine even-grained loam of great depth, which permitted the spiders to carry their tubes very far down, some of them attaining a length of 15 inches.

This made it very difficult to follow them throughout their whole course and so to assure oneself of the real structure of the nests, but I succeeded in doing this in twelve instances.

In every one of these I found the tube cylindrical and unbranched throughout, and destitute of any trace of a lower door.

This deficiency alone distinguishes the present type from that to which the nest of *Nemesia Eleanora* belongs; the latter being of the *double-door* and the former of the *single-door, unbranched wafer type*.

But perhaps it may be asked whether it is safe to assume that because twelve examples of this nest were found to correspond in structure, and were tenanted by the same occupant, that therefore all the Bordeaux nests in which this particular spider might be found would present similar peculiarities.

I greatly hope that other naturalists will put this question to the test of actual investigation on the spot, but I do not hesitate to assert my conviction that this will prove to be the case.

The result of my experience among the nests of the other *Nemesias*, scores of which I have carefully examined in many widely separated localities, shows

that a given spider is invariably associated with a fixed type of nest.

Thus, Cannes is from fifty to sixty miles distant from San Remo, but the nests of *N. cæmentaria*, *N. Manderstjernæ*, and *N. Eleanora* show precisely the same characteristics in either place.

Moreover, the twelve nests referred to were not all taken from one restricted locality at Bordeaux, but were found presenting the same characteristics and occupied by the same spider in three distinct habitats, distant some miles from one another. In two nests several young spiders were found with the mother, and, in one case where the family consisted of twenty-three young ones, I observed that they were not all equally small, and some had nearly attained one-third of their full size.

This agreed with the fact that no very small nests were observed, and it seems probable that the young are not turned out of their nursery quite so early as some of their relations are at Mentone. This, however, varies perhaps in accordance with changes of climate and local conditions.

We failed to detect any other type of nest at Bordeaux than the one described above: and even the cork nests, which we had shortly before seen in such abundance at Montpellier, were apparently absent.

Bordeaux is by far the north-westernmost point in Europe* at which any spider constructing a true trap-door nest has as yet been discovered; and the fact that they exist in a climate so different from

* Cork nests have however been mentioned as occurring in the neighbourhood of Lyons, which lies in nearly the same parallel of latitude with Bordeaux.

that of the Riviera and of the whole Mediterranean region, leads me to hope that their range may in reality be much more widely extended than has hitherto been supposed to be the case.

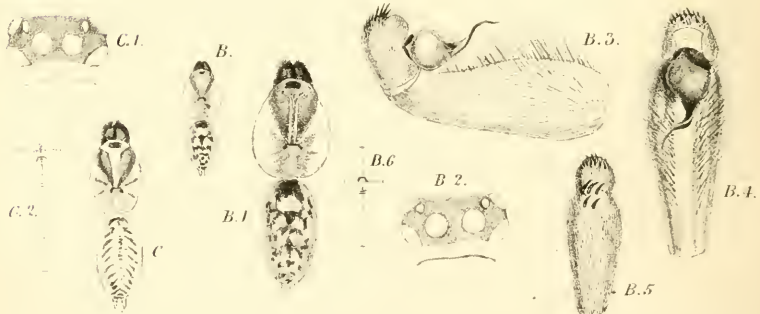
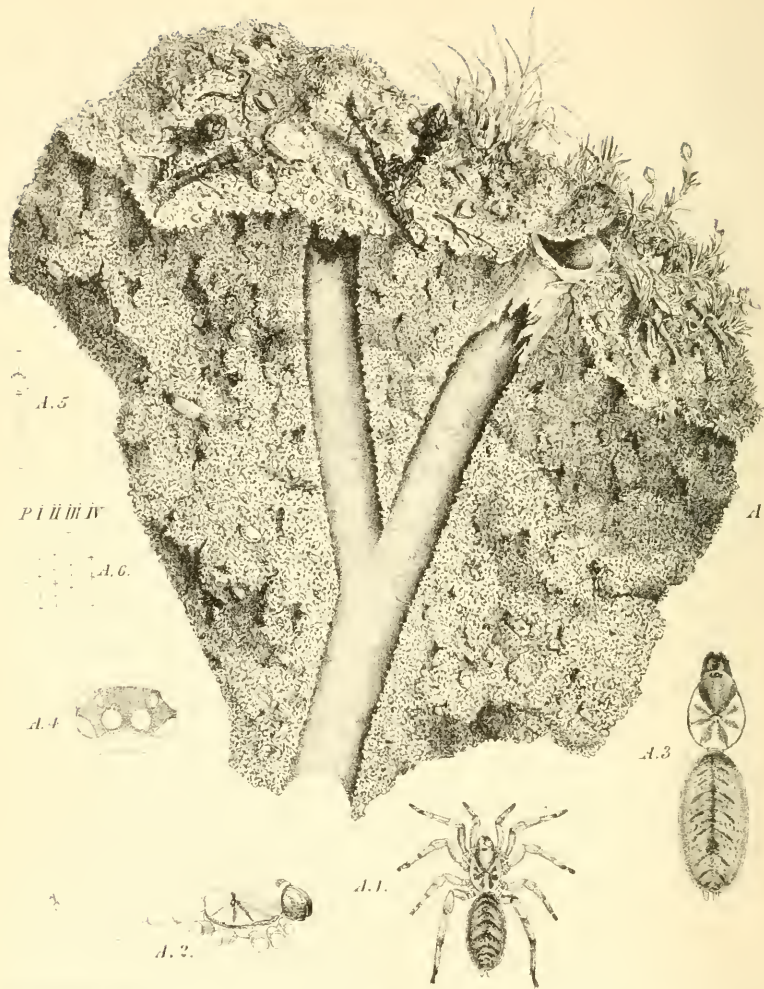
A glance at the vegetation of this district will suffice to show how little there is that betokens either a warm or dry winter climate; for here the myrtles, oranges and olives are left far behind, and in their place we see tall hedgerow elms, and poplars bearing mistletoe on their branches.

Here therefore we are met by the question, How do these Bordeaux spiders contrive to live under conditions so different from those to which their relations on the Riviera have adapted themselves? How do they bear the cold and damp of the long winter, and how is it that one frail upper door suffices to protect their nest from molestation?

The thick coating of dead leaves, which covered the banks even when we found them, no doubt aids largely in their concealment, and the colder climate probably diminishes the number of their enemies, but their means of subsistence are most likely also less abundant and their period of active life shorter.

The next type we have to consider is a totally new one, and may be distinguished as the *single-door branched wafer nest*. I detected this nest at Montpellier but a few days before the visit to Bordeaux alluded to above.

Circumstances unfortunately prevented me from following up my discovery as closely as I could have wished, and it appears moreover that this nest is far less common at Montpellier than the typical cork nest (*Nemesia cæmentaria*).



I hope therefore that other naturalists will make further investigations, and especially that they will endeavour to secure the male.

I obtained twelve spiders and thoroughly followed the course of ten nests; I opened thirteen more nests, but failed to trace their structure satisfactorily.

The upper part of this nest is shown of the natural size in Plate XVII. with the spider (*Nemesia suffusa*, Camb.*) which constructs it. This is again a wafer nest without any lower door, and this absence of a lower door alone distinguishes it as a type from the branched nest represented at F in the diagram, just as the same deficiency separated the Bordeaux type from that at fig. E.

In this new single-door branched type, the branch makes a more or less acute angle with the main tube, and reaches the surface of the ground, but is there closed by a layer of particles of earth slightly bound together with silk, forming an immovable cover or thatch. This cover constitutes, however, but a slight obstruction and could easily be torn away by the spider if she needed to use this passage as a way of escape.

These nests were tolerably plentiful at a place called Les Mourines, a short distance from Montpellier, where they were mixed with cork nests in the steep hedge banks. The nests were from 8 to 10 inches deep, and, as in all the trap-door nests which I

* We have again in this instance an exemplification of the rule that a new type of nest indicates the presence of a new spider, and hitherto, this rule has proved without exception. Mr. Pickard-Cambridge's description of *N. suffusa* will be found at p. 295, below. Its slender proportions, cylindrico-ovate abdomen, marked with narrow linear chevrons, and caput without, or almost without, any median line or marking, form some of its more striking characteristics.

have examined, were tenanted by the female alone. It seems strange that this spider, building as she does a nest apparently but poorly furnished either for concealment or defence, should be able to enter into competition with *N. cæmentaria*, whose solid, closely-fitting door appears so perfectly contrived for both. It will probably be found, however, when we are better acquainted with their respective ways of life, that they are really more nearly on a footing than they seem to be at first sight. I detected the remains of ants and the elytra of a beetle in one of these branched single-door nests. Now these may also be found in cork nests, so that *Nemesia suffusa* evidently competes with *cæmentaria* for its food, and this is of course the main cause of contention between all living creatures.

It is possible, that, if we knew all the uses to which the branch is put by the spider which constructs it, we should find that the advantages derived in the way of security from the existence of this second passage, counterbalance those possessed by the cork nest, which, though so perfectly closed, has only the one tube, and no other possible way of escape.

It may perhaps be no more than a coincidence, but we can scarcely avoid commenting upon the fact, that, just as this Montpellier wafer nest is simpler in construction than any found along the Riviera, so in like manner is the Bordeaux nest simpler than that of Montpellier. It thus becomes tempting to ask whether, in the case of these wafer nests, we shall not discover that the colder and damper climates are the homes of the builders of the simpler types, while the warmer and drier ones, where more food, more

enemies and more competitors are found, are reserved for the architects of the more complicated nests.

Doubtless naturalists will soon discover wafer nests on the slopes of the Pyrenees, as for example at Pau and other winter stations in South-western France ; and perhaps the coast of the Bay of Biscay may also yield specimens, even to the north of Bordeaux. If so, this curious speculation as to whether there is any relation between simplicity of structure and warmth of climate, will be put on its trial.

About the very time when I was engaged in digging out these new wafer nests at Montpellier, the celebrated arachnologist, Dr. L. Koch of Nuremberg, had just published* an account and figure of a very remarkable nest which he had received from Australia, and which, though differing both in form and proportions from the Montpellier nest, may nevertheless perhaps be referred to the present single-door branched wafer type.

This Australian nest, the exact habitat of which is not mentioned, is constructed by a spider now described for the first time under the name of *Idioctis helva*. The nest has a wafer-door about the size of a sixpence, closing a vertical tube less than half an inch long, which meets and opens into a horizontal tube about three inches in length, and forms with it what may be roughly likened to the figure of a capital T inverted, thus, \perp .

The upstroke of the T is however, very short, and one of the arms is longer than the other, and curved downwards at its extremity. This is, as far as I know, the first recorded example of a wafer-nest from the

* Dr. L. Koch, *Arachniden Australiens*, 10te. Lieferung, Nurnberg, 1874, tab. xxxvii. fig. 3, p. 484.

Antipodes, and it may be regarded as one of the first fruits of a harvest which lies ready for the reaping of any naturalist resident in those parts. Hitherto the only nests which I have seen or heard of from Australia were of the cork type (*Ants and Spiders*, p. 132).

Next in order to the single-door branched wafer comes the *double-door unbranched wafer* type, which is the simplest of all the nests possessing two doors. This habitation, the work of *N. Eleanora*, has been already described (*Ants and Spiders*, p. 106), and I have not much to add to the account there given.

Perhaps some of my readers may remember that, while I was actually engaged on the proofs of *Ants and Spiders* I had one of these *Eleanora* spiders in captivity, and that I gave an account (p. 148) of her behaviour up to the latest moment possible. She had been captured on October 23, 1872, and placed, together with five young ones found with her in the nest, on the surface of some earth in a medium-sized flower-pot covered over with gauze. The young ones soon made nests for themselves in the earth, each furnished with its little door, but the mother roamed about on the surface of the soil, and it was not until she had been twenty-one days in captivity that she commenced spinning a silk cell.

This cell in twelve days' time presented the form of a rude figure of 8, and had an aperture at either end; it was just large enough to contain the spider when the legs were extended; its upper surface was attached to the gauze covering of the pot, and its lower to the earth. It was at this stage that the record was broken off, and I will now relate the remainder of the history.

Four days before the cell was commenced, the spider had covered the under surface of the gauze with a semi-transparent film of a substance resembling varnish, which formed a band about three inches long by half an inch wide, close to where the rim of the flower-pot threw the most shade. It was at one extremity of this band that the silk-cell was formed, but it is important to note that this band of varnish was longer than the cell, which only measured an inch and a quarter from end to end, for we shall see that the layer of varnish was apparently laid with a view to further operations.

In four days after the completion of the cell its form was modified, and, during the next ten days (up to December 21st), the spider gradually thickened the walls, and made the form of the cell more and more cylindrical, sometimes closing and at other times opening the extremities.

Between December 14th and 25th, she lengthened out the cell by spinning a cylindrical silk tube in prolongation of one end, and this tube followed the course of the band of varnish, the whole measuring three-and-a-half inches in length by about half an inch in diameter.

It would appear therefore from the correspondence in length between the band of varnish and this silk tube, that she had contemplated the construction of the latter when she first commenced her work on November 3rd.

On January 19th the silk tube parted from the gauze, leaving only the enlarged end which formed the cell still adhering to it. On the following day I observed the very curious fact

that when I sprinkled the nest with water, as it was my custom to do every morning, the tube, which had become somewhat flaccid since it had lost its attachment to the gauze, gradually recovered its perfect shape. This was repeated for eleven days, until on the morning of the twelfth day (January 31st), finding the tube completely collapsed, instead of merely sprinkling water over it, I drew a large camel-hair brush loaded with water along its whole length, when the tube started up, and almost instantaneously regained its cylindrical form.

This morning the spider had left her cell, and was roaming about the pot when I wetted the tube, thus proving that she was in no way concerned with its movements, which were no doubt due to hygrometric action.

Between this time and February 25th, I constantly restored the tube to its shape by wetting it in the way above described, but on this day it remained very flaccid, and only expanded partially. For some days previous to this date, the spider had left the tube when it collapsed, and only returned to it again when it had resumed its shape. On the following day I found the entire silk tube and the cell again collapsed and lying flat upon the ground, and this time water failed to produce its previous effect.

The spider then became very restless and excited, and I observed that the door of one of the little nests constructed by one of her five offspring which had been imprisoned in the same pot with her, had been torn off, and thrown on one side, and there could be little doubt but that the mother had been guilty of this very un-maternal action. By the evening she had

pulled up her collapsed tube from its attachment to the earth, and had coiled it in a confused heap. Seeing this, and fearing that, in her distress and excitement, she might do further damage to the young spiders, which had up to that time thriven well, I made a cylindrical hole for her in the earth, supposing that she would at once take possession of it. On the following morning, however, the mother spider had advanced some way in building another figure-of-8 cell, using the shrivelled silk of her previous dwelling as a foundation.

In twenty-four hours this second cell was complete, and closely resembled the former one, save that the smaller end of the 8 was turned in the opposite direction, but, on examining it, I found to my surprise that it was empty! The spider had taken possession of the hole I had made for her, which she had at first refused to notice, and was busily employed in lining it with silk and furnishing it with a covering composed of silk with earth and fragments of moss woven into the surface. By mid-day the aperture was completely closed, but there was no moveable door. From this time (February 28) up to April 12, the spider lived in this hole, which she eventually furnished with a distinct wafer-door, and, as I found on opening the nest, with a typical lower door also. This latter was not neatly made, but still it possessed all features the essential which characterize these lower doors in the nests of *N. Eleanora*.

So this captive *Nemesia Eleanora* lived in a flower-pot in my bedroom for more than five months and a half, during which time she absolutely refused to burrow or to attempt any kind of excavation, but

passed the greater part of that period on the surface of the earth in a silk tube ending in an oblong enlargement, utterly unlike her normal habitation. Finally, when I had done the digging for her, she furnished the cylindrical hole I had bored in the earth with a silk lining, and made it secure with her own two typical doors.

The figure-of-8 cell which she constructed at first, and subsequently modified until it became the oblong enlargement of the tube alluded to above, was totally unlike any form of trap-door spider's nest known to me; but in its ultimate shape (which resembled that of the glass part of a thermometer with an oblong bulb, save that it was curved and not straight), I think we may trace some resemblance to the silk tube which is made by *Atypus*, and of which a figure is given at A, Plate XIII., p. 183; the mouth of the tube made by my captive was, however, open. It is curious, also, when we recall this resemblance, to note that Mr. Brown has recorded, in his observations alluded to above (p. 185), that the tube of one of the nests of *Atypus*, which he brought home in a collapsed state, showed a somewhat similar tendency to become distended. For, on opening the box in which they had been carried, he perceived a movement throughout the tube as if it were becoming inflated, and though this inflation appeared to subside shortly after, yet the following morning the tube had recovered its cylindrical shape. I am tempted to believe, though this is mere conjecture, that the box in which these tubes were put contained moisture, and that their apparent inflation was due to the same hygrometric action

which was displayed in the tube of *N. Eleanora*. I regretted that I was unable to continue my observations on this captive spider, as it would have been interesting to know how long she would have lived contentedly and in good health under the conditions described above, but I left Mentone at the end of April, and was unable to take her alive with me to England. When removed from her nest in the pot on April 12, she appeared in perfect condition, and I placed her in a hole which I made for her among some stones in a garden at the back of the house, hoping to find her again on my return to Mentone in the autumn; this hope was, however, not destined to be realized.

I shall, however, have occasion to speak again of the young captives of this species (*N. Eleanora*), in the concluding remarks which will follow these detailed accounts of the nests and their occupants, when the behaviour of captive trap-door spiders generally will be treated of.

The next type of trap-door nest is one to which I have found it difficult to assign a descriptive name, and I am compelled for the present to speak of it as the *Hyères double-door branched wafer* nest.

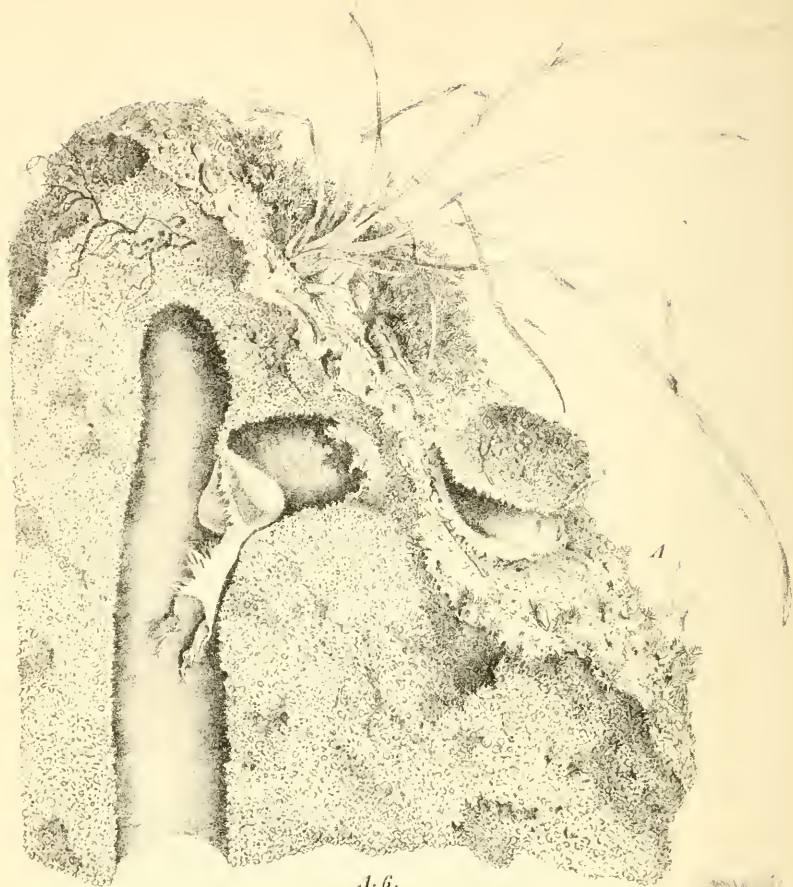
One of its most distinctive features is found in the shape of the lower door, fig. F 1, Plate XIV., and figs. A 1, A 2, Plate XVIII., which may be said to be double, presenting two crowns, one of which fits into the main tube and the other into the branch, but I could not see my way to employing this character in naming the type. The nest is, however, quite distinct from all the others, and is inhabited by a new species of

trap-door spider (*N. congener*, Camb.*). The characteristic portions of this nest are shown in Plate XVIII., and fig. A 3, in the same Plate, represents its occupant.

The hedge-banks near Hyères, and also about the railway station of the same name, which is some 4 miles from the town itself, are frequently tenanted by this spider. During a short stay there in May, 1873, I secured a large number of specimens, and verified the structure of the nest by a careful examination of thirty-eight examples. The nest is invariably branched and furnished with a lower door, but the branch is of variable length, usually short, and never, as far as I could detect, quite reaches the surface. In some cases this branch was so short that it could scarcely contain the spider, and, under these circumstances, it is not easy to conceive any other use for it than that of retaining the lower door when not in use. It may, however, enable the spider to take up a rather better position when engaged, as she frequently is if disturbed, in keeping the main tube closed by pressing the lower door upwards with her feet, for then her head points downwards, and her abdomen rests in the branch.

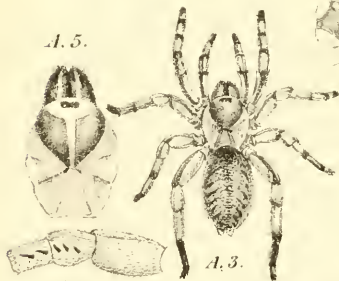
I have seen her in this attitude on several occasions when I had cut out a block of earth similar to that figured in the plate. The lower door is quite unlike that of either of the other two double-door wafer nests, being wedge-shaped, tapering from below up-

* Mr. Pickard-Cambridge's description will be found at p. 292, below. In its characters this female spider (the male is unknown) most nearly resembles *N. cementaria*, but differs, among other points, in markings and in having one or more spines on the genual joint of leg, these spines being almost always absent in the same joint in *cementaria*. The nests of the two species are totally unlike.



A. 6.

A. 5.



B. 1.



A. 2.



A. 1.



B.



A. 7.



A. 3.



A. 4.

wards to the hinge, which is always placed at the point of bifurcation of the tubes, and having two crowns separated from each other by the gusset-like web of silk which connects the door on either side with the lining of the main tube, one of these crowns fitting into and closing the main tube, while the other fits into the aperture of the branch.

The wedge-shaped structure of the door is seen in its most exaggerated form in the nests of the younger spiders (figs. B, B 1, Plate XVIII.), and becomes less so in the older and larger ones (figs. A 1, A 2). I have even seen some of these lower doors, evidently made by old spiders, which were so much flattened as to bear a considerable resemblance to that of *N. Eleunora*.

The main tube of the nest is from 10 to 12 inches long, and usually enters the earth almost horizontally, bending downwards from the point at which the branch joins it, and where the lower door is hung. This causes the lower door to lie nearly horizontally when not in use, and its lower crown probably serves, by fitting into the aperture of the branch, to sustain it in this position and prevent it from falling forward. The point of bifurcation is placed, as a rule, much nearer to the entrance of the nest, than it is in the two other branched nests, and occurs usually within two inches of the surface of the earth; so close is it indeed that, on lifting the upper door and looking in, one may frequently see the lower door move across and close the passage down the main tube, pushed by the spider from below. This frequently enabled me to secure the spider without having to follow her to the bottom of the nest; and, when fortune favoured me, I secured a block of earth by one rapid sweep of

the knife (a common table-knife), which furnished me at once with a good specimen of the nest and of its occupant.

When the spider has once fairly determined upon resistance, it is scarcely possible to make her retreat without destroying the nest, and, in one case, when I tried to push the lower door down from above, while she was pressing it upwards from below, I found that, without crushing my opponent, I could not succeed.

There were probably young in the nest on this occasion, for I have frequently found them in the nests with the mother at this season. In no case did I even catch a glimpse of the male, and this sex is at present unknown.

The young spiders make their nests at an early age, and there can be no doubt that *N. congener* enlarges its dwelling from time to time as growth demands, just as the trap-door spiders at Mentone do. Indeed in one of these new Hyères nests I found, outside the main tube and some way above the existing lower door, a former and disused lower door much smaller than the one then in use, and which had evidently belonged to the nest at a previous stage of its development. I have observed this before in the nests both of *N. Manderstjernæ* and *N. Eleanoræ*.

This new type is strictly intermediate between the double-door unbranched wafer nest constructed by *N. Eleanoræ*, and the double-door branched wafer with the descending cavity which I am now about to describe.

This latter nest, the work of *N. Manderstjernæ*,

Auss.* (formerly called *N. meridionalis*), has already been partially made known by the figures and description given of it in *Ants and Spiders* (Plates IX., X., and XI., pp. 98, 100, and 104); but I have to confess, with great regret, that when these illustrations and descriptions were published, I was not fully acquainted with the true structure of this nest, having overlooked the existence of a short descending cavity which leaves the main tube a little above and on the opposite side to the ascending branch. This cavity is always present, but the very largest and oldest spiders usually allow it to become filled up with remains of food and particles of earth, and sometimes even spin silk across its entrance, in which case it can only be traced on very close examination.

It was from an old nest such as this, in which the descending cavity had been closed up, that the large drawing at fig. A on Plate IX. of *Ants and Spiders* was made, and this figure, therefore, still remains substantially correct.

But in the case of the other illustrations—namely, fig. B, Plate IX., fig. A, Plate X., and figs. B and B 1, Plate XI., where nests of young spiders, or of spiders

* This spider was described by Mr. Pickard-Cambridge at p. 101 in *Ants and Spiders*, under the name of *N. meridionalis*, Costa. This name has now to be abandoned for reasons given in full by Mr. Cambridge at p. 283, below. It would appear that a spider discovered by M. Simon in Corsica corresponds more closely with the *N. meridionalis* of Costa than our spider of the Riviera does. Moreover, since *Ants and Spiders* was written I have had the good fortune to obtain at Mentone four male examples of our supposed *meridionalis*, and these prove to possess the same characters as those assigned by Prof. Ausserer to a male spider which was captured at Nice, and named by him *N. Manderstjerne*. This specimen is now in the possession of Dr. L. Koch, to whom I am much indebted for having kindly entrusted it to me for examination. This enabled Mr. Pickard-Cambridge to assure himself of the specific identity of his *N. meridionalis* with *N. Manderstjerne*, which latter name it must for the future bear.

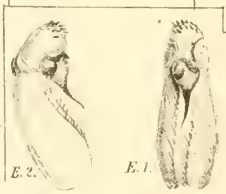
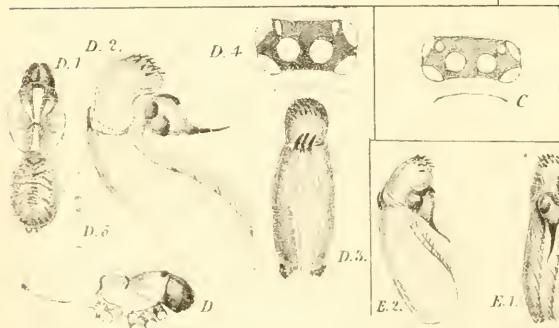
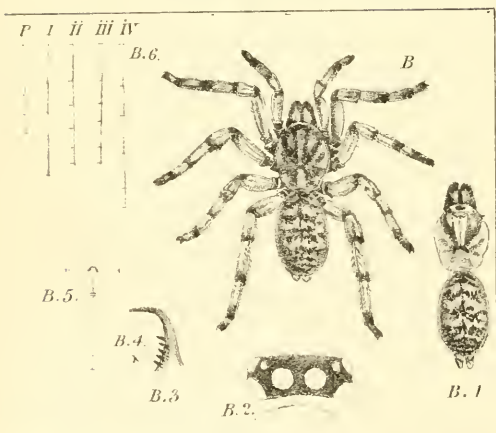
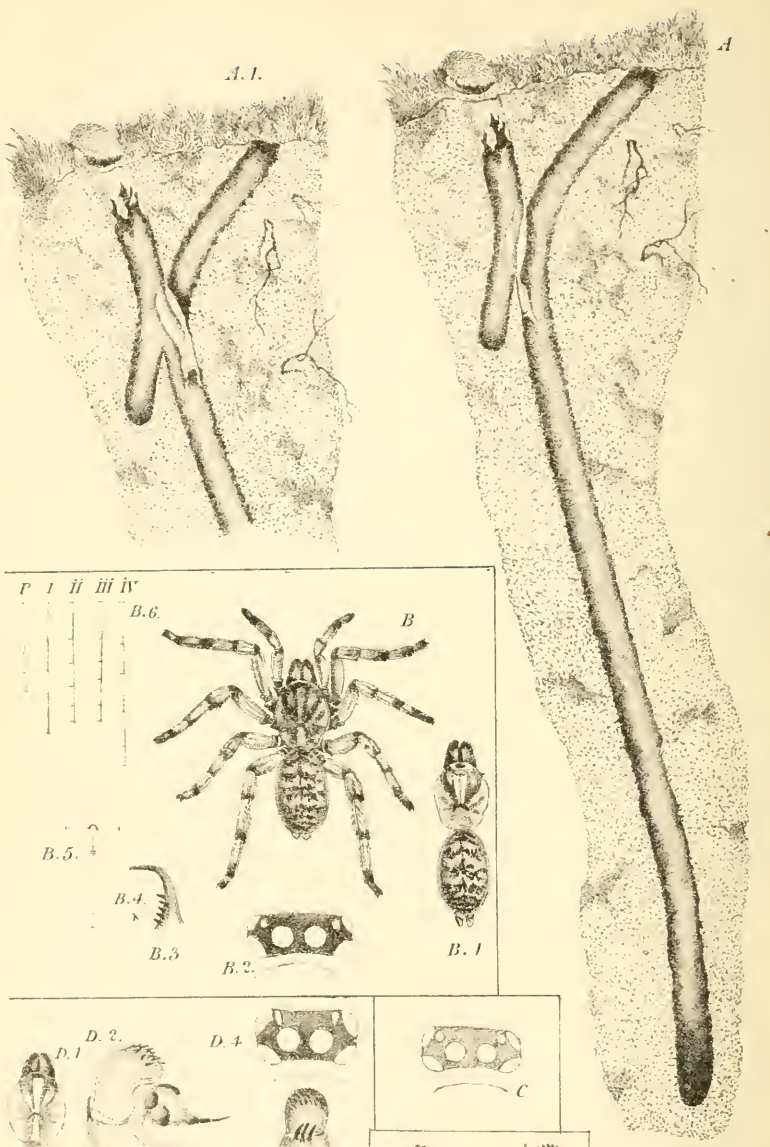
which, though adult, have not attained the maximum size, are represented, this descending cavity, though overlooked by me, should have been shown, for it must certainly have existed.

Its presence was first observed by the Honourable L. G. Dillon, who detected it when tracing the course of the main tube upwards from below. I had always followed the tube from above downwards, and in so doing must have unwittingly filled up the descending cavity (the existence of which I was far from suspecting) with detached particles of earth.

I will own that, when Mr. Dillon first showed me this new feature, I hoped that it might prove to be something accidental and exceptional; and it was only after careful examination of a large series of nests of all sizes, that I gradually and almost unwillingly admitted that this descending cavity formed an important feature in the typical structure of the nests.

I now see, however, that the presence of this cavity adds considerably to the interest of the structure as a whole, and places its architect quite at the head of all the builders of trap-door nests. This type should now be called, for the sake of distinction, the *double-door, branched, cavity, wafer* nest, to avoid confusion with the *Hyères branched nest*.

I am now about to endeavour to atone for my past oversight by giving new illustrations (Plate XIX., figs. A and B) and descriptions of this very remarkable nest; while I would at the same time beg the indulgence of my readers for past and present shortcomings, reminding them that the interest which attaches to structures of this kind is proportioned to the com-



Vincent Brooks Day & Son, Imp

plexity and subtlety of their contrivance, and, therefore, to the difficulty we experience in properly understanding and describing them.

It will be seen by a reference to Plate XIX.,* figs. A and A 1, that in addition to the cylindrical branch, which mounts upwards, there is a shorter branch which leaves the main tube on the opposite side (on the left as seen in the Plate), and takes a downward course. Now this descending branch, which is barely more than an inch in length, is a cavity of variable form, being sometimes cylindrical, and sometimes egg- or even watch-shaped,† but there is one particular in which it never varies, and that is the position of its elliptic orifice. This orifice is always situated on the opposite side of the main tube to that on which the ascending branch leaves this latter, so that the whole nest, when seen in section, presents the figure of a St. Andrew's cross, only with arms of unequal length.

But the most remarkable point is that, when the lower door is pushed across so as to close the main tube (as shown in fig. A, Plate XIX.), it will invariably be found to lie in such a position that its lower extremity exactly meets the lower lip of the orifice of the descending cavity, when it will be seen that the semi-cylindrical surface of the lower door then coincides with, and appears to continue and form part of, the lower wall of the descending cavity

* A nest of a scarcely half-grown spider is here represented in order that sufficient space might be gained to show the lower door in its two positions. The perfect cavity is still found in nests of much larger dimensions, and occasionally, indeed, in nests of almost the maximum size.

† I take the liberty of coining a word to replace "lenticular," the form of a watch being more familiar than that of a lens.

on the one side, and of the corresponding wall of the main tube on the other. When the upper portion of the main tube is thus united to the cavity the two combine to form what appears like a short, independent unbranched nest.

Now, if we fancy ourselves an insect entering the nest in search either of the spider, her eggs, or young, I think it is plain that, when the lower door is in this position (fig. A), we should probably walk straight down to the bottom of the cavity, expecting to find our prey there, and should then return by the way we came, impressed with the belief that we had explored the whole nest, the secret of the lower door remaining undiscovered.

Whether this imaginary case may, or may not, represent what really takes place, is of course mere conjecture; but the constant occurrence of this beautiful adaptation of the various parts to one another, surely points to the conclusion that this is no mere coincidence, but rather a subtle contrivance having some very definite use and meaning.

We must admit, however, that it is difficult to conceive why, if this structure is of such great utility, it should be abandoned by the oldest and largest spiders.

Among the possible answers to this question I think that one of the more probable is that this arrangement may have been specially devised for protection against some enemy which the aged spiders have ceased to fear.

Indeed it is not unlikely that these aged spiders may have come to a time of life when they no longer lay eggs, and so do not need to keep up all the

defences which they employed when they had families to protect.

Since my attention was drawn to the existence of this cavity in the dwellings of *N. Manderstjernæ* I have never noted the presence of young in those nests in which the cavity was filled up and disused; but then I have only exact records with reference to this point in the case of seven nests.

In these seven nests, however, there was no free cavity, and there were no young spiders, though it was at the season when it was common to find young in the nests.

The question, therefore, remains open, and further observations on this head would be very acceptable. I detected the *débris* of insects, and especially the horny coats of ants, in the descending cavity, in many nests; and in some of the oldest, where it had become completely blocked up, these remains still indicated its former outlines and position.

The nests of *N. Manderstjernæ* at Cannes correspond both in respect of the cavity and of their other characteristics with those at Mentone. *N. Manderstjernæ* occurs pretty abundantly at San Remo in the olive-grounds east of the Sanctuary, but I can say nothing as to whether the nests there possessed the cavity or not, for, when I was there, I was not aware of its existence. I obtained a single example of *N. Manderstjernæ* and its nest at Hyères, and this is the westernmost point at which this species has as yet been detected.

We have now passed in review all the seven known types of true trap-door nest, and have taken note also of the lower and more rudimentary forms of nest,

such as that of *Atypus*, and the funnel nest of *Cyrtanichenus elongatus*, neither of which is furnished with a door.

Among the true trap-door nests, those of the cork type stand in a measure alone, being distinguished from all the others by their solid surface doors, composed of many layers of silk and earth; and we do not at present know of any intermediate forms linking the cork and wafer types together. But among the various nests which represent the wafer type the case is different, for here the types naturally fall into a progressive series, such as that represented in the diagrams (Pl. XIV., p. 193).

If we try to picture to ourselves the stages through which the most complicated wafer nest—namely, that of the *double-door, branched, cavity* type (Diagram G 1) may have passed in the course of its development from a simpler ancestral form, we should *à priori* expect to find precisely such structures as the *Hyères double-door branched* nest (Diagram F), and the *single-door branched* nest (Diagram D) forming successive halting-places in the advance from the primitive *single-door, unbranched* nest (Diagram C).

The *double-door unbranched* type may in like manner find its prototype in the same original single-door unbranched nest (C), which we may look upon as the parent idea, from which all these structures have been derived.

Bearing this in mind, and remembering that kinship between living creatures is not only revealed to us by likeness in structure and colour, but also by similarity in habits and instincts, it becomes of interest to trace any resemblance that may exist between

these wafer-nests and the dwellings constructed by *Lycosa narbonensis*, a species belonging to the allied family of *Lycosidae*, and which closely resembles the true *tarantula** of Southern Italy.

I first made the acquaintance of *Lycosa narbonensis* near the glass-works west of Cannes, where this spider may not rarely be found living in tubular burrows in sandy clearings among the pine woods along the shore (*Pinus pinea*, the stone pine).

I have already (*Ants and Spiders*, p. 146), alluded to an account given by M. Léon Dufour of his observations on the nest and habits of the true tarantula (*Lycosa tarentula*), which he discovered in Spain.

The nests of *L. narbonensis* at Cannes resembled those described by M. Dufour, but the cylindrical, subterranean burrows were apparently shorter. It was extremely difficult to trace their course, on account of the loose sand which poured into the tubes and choked them up, and I only succeeded in doing so completely in one case, when I stuffed the tube with cotton-wool before proceeding to dig. Here the open tube, which was quite simple, and about 1 inch in diameter, descended vertically for $3\frac{1}{4}$ inches, and was then suddenly bent so as to become horizontal, terminating shortly afterwards in a triangular chamber, the floor of which measured 2 inches across at the widest part, and was strewed with the remains of beetles and other insects.

The nest was lined throughout with coarse silk,

* In the United States, and indeed in the New World generally, it seems to be the custom to call all the larger "ground spiders," and especially the trap-door spiders, Tarantulas, but these, in fact, form a distinct group by themselves, belonging to the family *Lycosidae*.

which had a blackish hue, owing to the presence of the filaments of what I believe to have been some undeveloped fungoid growth. The mouth of the tube was open, and frequently surmounted by a short tubular prolongation, commencing at the surface of the ground, which formed a sort of chimney about an inch high and from an inch to an inch and a quarter across; this was composed of fibres of plants, pine-needles, and especially of a large branching lichen, very common in the neighbourhood of the nests, and all these materials were woven together and kept in place by a few threads of silk spun here and there.

It was not every nest that was furnished with a chimney, nor were all the chimneys equally complete, for in some cases they consisted merely of a small rim or one-sided lip, while in others they resembled little birds' nests, and were sufficiently firm and compact to permit of my carrying them away. It appeared to me that these chimneys served as screens to prevent the loose sand from being swept into the burrows by the winds which rage over that open sea-shore plain, and that they were more or less complete in proportion as the exposure was greater or less, and the sand looser or more bound together.

I captured eight of these spiders, and here, as in the trap-door group, the female alone inhabited the nest.

Besides this habit, they have other points in common with trap-door spiders; such, for example, as the resemblance which exists between this nest and that of *Theraphosa Blondii* from Brazil (see p. 188, above), and between the chimney of this *Tarantula*

and the aërial prolongation of the tube sometimes found in nests of the wafer type.

But perhaps the most suggestive point of resemblance consists in the habit which this *Tarantula* possesses of covering and closing the aperture of the nest during the winter with a thin layer of materials, similar to those of which the chimney is composed, and, like them, bound together with silk. This is, in fact, an immovable wafer-door, and precisely resembles those which I have seen constructed by *Nemesia Manderstjernæ*, and *N. Eleanora*, when captive and placed in an artificial hole in the earth.

The tubes are, as has been already stated, open during the spring, and we may suppose that the spider, on the approach of warm weather, wakes up from her winter lethargy, and tears away this concealing thatch. But if one of these spiders should by chance happen to free this silk-woven thatch by cutting round some three-fourths of its circumference, so as to leave it still attached to the rim of the aperture of the nest by the remaining quarter, she would then have made for herself a veritable, though rather rude trap-door of the wafer kind.

It is most likely, however, that the spider knows what she is about and that a door to her dwelling would be the reverse of an advantage to her, for she is more powerful and swifter than the generality of European trap-door spiders, and, as she probably lives by leaping out upon and hunting her prey, she no doubt needs to have the entrance to her nest free of all encumbrance.

I am indebted to the Rev. W. G. Brackenridge for evidence of the very interesting fact that

Lycosa narbonensis closes her nest at Cannes in the winter.

I was aware that Latreille stated that the Tarantula possessed this habit,* and I was anxious to know whether the species which I had detected at Cannes, inhabiting as it did open nests in the month of May, would also exhibit this curious custom. Being unable to visit Cannes myself during the winter, I applied to Mr. Brackenridge, who, on the 28th of January last (1874), secured a very perfect specimen of the aerial portion or chimney of one of the nests having the orifice closed in the way above described, and most kindly transmitted it to me.

I have, on a very few occasions, found the doors of a wafer or cork nest spun up during the winter at Mentone, and on digging have discovered the spider alive, though partially torpid, inside; but this is quite an exceptional event. I should much like to know, however, whether this becomes the rule in the case of the nests of those trap-door spiders which inhabit climates less favoured than that of Mentone.

In my concluding remarks in *Ants and Spiders* I called attention to the importance which attaches to a knowledge of the food and manner of feeding of any creature whose life-history we may wish to study, and I would now once more press the subject on the attention of my readers. For the range and distribution of a species largely depends upon the nature of its food, and this will also be an indication of the rivals with which it has to compete in

* P. A. Latreille, Mem. Soc. Hist. Nat., Paris (an. VII. de la République), p. 124: "L'araignée *tarentule* ferme aussi son habitation, mais cet opercule n'est pas mobile, et n'est construit que pour l'hiver."

the struggle for existence; the times and seasons of its activity, and in many cases even the structure and position of its dwelling-place will be governed by this same all-important question of food-supply.

I have now detected the remains of insects, and of ants especially, in the nest of every species of trap-door spider which I have examined *in situ*; very frequently, however, one may open several nests in succession without finding any of these *débris*, and at other times they will only be detected beneath the existing bottom of the tube, layers of silk having been spun over successive layers of refuse.

The horny coats of ants form by very far the largest proportion of these remains, and I have lately been much struck by the number of instances in which, while digging out ants' nests at Mentone, I have found trap-door nests (especially those of *N. Manderstjernæ* and *N. Moggridgii*) in their midst, the tubes often traversing the very heart of the ants' colony and coming into close contact with the galleries and chambers of the ants. The doors in these instances had almost always escaped my notice, and, indeed, they so closely resembled the surface of the ground that even when I knew, from having accidentally cut across the tube below ground, that one of these doors must lie near a given spot, yet I could only discover it by following the passage from below upwards. This perfect concealment is doubtless of essential importance to the spiders' success in life, for, if they once alarmed the whole colony of ants and let them know the exact whereabouts of their lurking-place, they would soon learn to avoid it.

But, as it is, the work of opening the door, snatching in an ant, and closing it again, is but the affair of a second or two, and before the companions of the victim have time to realize the nature of the phenomenon, the gaping earth has closed again and become once more, to all appearance, part of the solid and trustworthy ground.

I have seen *N. Manderstjernæ* snatch at insects in this way during the daytime, and I well remember how I started on one occasion when, as I was looking fixedly at a small blue gnat which I had taken for a moth, I saw the earth suddenly open and one of these spiders partly emerge, make a swift stroke at the insect, and withdraw again as swiftly.

I have found the remains of ants, of beetles of many species and different sizes, of wood-lice (*Oniscus*), and of earwigs (*Forficula*) in the nests of *N. Eleanora* and *N. Manderstjernæ*, and the wings of a large green field-bug in the nest of the former. I have only once detected traces of food in the dwellings of *Cteniza Moggridgii*, and these consisted of minute fragments of the integuments of insects, none of which were certainly recognisable, though I believe that they partly consisted of the coats of a small species of ant. The rarity or complete absence of the wings of insects which habitually fly rather than crawl on the ground, and my inability to discover either snares or any evidence that these spiders ever leave the nest, lead me to believe that they live (at any rate from October to May) by dragging into their nests any insects which approach within reach.

Ants, earwigs, beetles, and wood-lice are precisely the very creatures which would fall a prey to the

spider without obliging her to leave her nest, and it is accordingly their remains that we find.

On one occasion, however, at Montpellier, my sister detected *N. cæmentaria* in the act of devouring a fair-sized caterpillar, to obtain which there is some reason to think she must have left her nest. We were out together on the 8th of May last (1874), hunting for the new wafer nests of that district, under the kind guidance of M. Lichtenstein, when my sister called our attention to a caterpillar, the body of which partly projected from the tube of a cork nest (*N. cæmentaria*), and prevented the lid from closing.

On closer examination we found that the spider was in the act of devouring the caterpillar, and had already sucked out the juices from the anterior portion, while the middle and posterior parts of the body still resisted, and the legs clung tenaciously to the lip of the nest.

M. Lichtenstein told us that this larva, which when entire must have been rather more than an inch long, was that of the mullein moth (*Cucullia verbasci*).

It was not full grown, and as there were no mullein plants within some two feet of the nest and this caterpillar will not leave the plant on which it feeds unless compelled, it would seem as if the spider must have gone afield in order to capture it. It is possible, nevertheless, that the caterpillar may have fallen within reach of the spider when blown off the mullein leaves by the wind.

I have, unfortunately, but few details to give of the nocturnal habits of the trap-door spiders. It would appear, however, that they are more active by night than by day, and that it is more common to find

their doors ajar at night, with the spiders posted on the look-out at the narrow opening. This is borne out by my observations on captive spiders, to which I shall allude shortly.

When at Hyères on the 11th of May, 1873, the evening being very warm and a bright moon shining, I went at 8.30 P.M. with my father and sister to see what the spiders would be doing on a hedge bank where we had previously marked five cork and eight wafer nests. The moonlight did not fall upon this spot, but I was provided with a lantern, and by its light the nests at first appeared to be tightly closed, but we soon perceived first one and then another with the door slightly raised, ready to close on the smallest alarm, whether from a footfall or from the flickering of the lamp. When the light of the lantern was steady it did not appear to frighten the spiders in the least, even when brought to within a few inches of the door,* and this enabled me to watch them very closely. On either side of the raised door of one of the wafer nests I could see the feet of the spider projecting, and just at that moment I caught sight of a beetle close at hand, feeding on the topmost spray of some small plant below. Using every precaution, I contrived to gather the spray without shaking off the beetle, and gradually pushed it nearer and nearer to the nest. When it almost touched the lip of the nest the door flew open, and the spider snatched at the beetle and dragged it down below.

For a few seconds the door remained tightly closed,

* This had been observed before both by my father and Mr. Dillon when watching the trap-door spiders at night at Mentone.

and then, to our great surprise, was suddenly opened again, and the beetle was cast alive and unharmed out of the nest. I immediately secured the insect, which proved to be the common *Chrysomela Banksii* *

I cannot doubt that this beetle was distasteful in some way to the spider, for it was neither so large nor so powerful as many beetles the remains of which I have found in the spiders' nests, and, besides, it did not escape from the nest, but was distinctly rejected by its captor.

This shows that this spider does not know instinctively what insects to reject and what to take.

This little episode was scarcely ended when I espied a wood-louse (*Oniscus*) walking down the bank, not far from another of these wafer nests. By a little guidance I managed so to turn its course that this unsuspecting crustacean went straight to the very point I wished, and made as if it would walk over the spider's door; but no sooner was it well within reach than, quick as thought, the spider clutched it and dragged it in. No rejection followed on this capture, and, though I could not actually witness the conclusion of this adventure, I do not doubt that it ended in a tragedy and a supper.

In these two cases, as in all those previously noted, the spiders did not leave the nest nor allow the door to close behind them, but kept it propped up on the abdomen and hindmost pair of legs. In this way the act of seizing their prey, and that of withdrawing into the nest, were almost simultaneous.

In no case did we see any of these spiders out of

* I am indebted to Mr. F. Smith for the name.

their nests, and their behaviour by night appeared to be the same as by day, only that they were bolder and more on the alert.

The spiders in the cork nests (*N. Moggridgii*) resisted our attempts to raise their doors just as rigorously as in the daytime.

All the spiders which I have kept in captivity have shown themselves more active at night than during the day, and I imagine that experience has taught them that fewer of their enemies are then abroad, while ants, beetles, wood-lice, and other creatures upon which they prey are quite as nocturnal as themselves.

I brought back to England some young cork and wafer spiders from Hyères, and one adult cork (*N. Moggridgii*). The latter was placed in a small tin box, with moss and a little earth at the bottom, on the evening of May the 10th, 1873, and by next morning she had made a silk tube through the moss, carrying up earth from below for the purpose of strengthening its walls on the outside. On the 13th of May the tube was furnished with a perfect door.

I hoped that this spider might lay eggs in her prison,* and therefore broke up her nest from time to time after my return to London in order to search for them. Between the 27th of May (when her nest had been transferred into a box of earth) and the 6th of October I destroyed her dwelling four times, and after each demolition she furnished the cylindrical hole which I bored for her with a lid, having thus made five doors since her capture. I got no eggs

* Strange to say, though I have opened so many nests at different seasons of the year, and found young apparently quite recently hatched, I have never been able to find the eggs of a trap-door spider.

however, though the spider appeared in perfect health.

Neither this spider nor the true *N. cæmentaria* of Montpellier appears to have any idea of digging a hole when placed on soft earth if they are adult; and the same thing is true of *N. Manderstjernæ* and *N. Eleonora*, but the young of all these spiders readily excavate nests for themselves.

I have once seen a nearly full grown, and probably adult, *Cteniza Moggridgii* make a perfect tube and furnish it with a moveable door in a single night when confined under gauze on moist earth, but this is the only instance (except that of *Cteniza Californica*, recorded above) in which I have known an adult trap-door spider excavate or attempt to do so.

These *Ctenizas* seem to be peculiarly able to adapt themselves to circumstances, for two young ones, which I sent by post to M. Lucas at the Jardin des Plantes in Paris in little wide-mouthed, cylindrical, blue glass bottles, not only lined the bottles with silk but also closed them at the mouth with a door fitting accurately into a bevelled lip, in the manufacture of both of which fragments of moss, the only material at their disposal, were used in place of earth.* It is curious to see how quickly the young trap-door spiders, both of the cork and wafer kinds, when taken from the nest of the mother, will make their own perfect little dwellings in captivity, and I have known them construct tube and door within fifteen hours.

* M. H. Lucas, in *Bull. des Séances de la Soc. Entom. de Fr.* No. 27 (1874), p. 101.

I have watched the proceedings of the young spiders, when taken from the mother's nest, in the following species: *Nemesia Manderstjernæ*, *N. Eleanora*, *N. congener*, and *N. Moggridgii*, the three first constructing wafer, and the last a cork nest. All of these very young spiders will excavate their own tubes and bring out pellets of the earth, which closely resemble those carried out from their galleries by the ants.

As has been stated before, the young brood, while still in the mother's nest, will often comprise individuals of different sizes, and though the majority are no larger than the baby-spider represented at Fig. B 2, Pl. IX., *Ants and Spiders*, some may occasionally be found that are fully twice as large.

The little nests which they make in captivity vary accordingly in size. Thus, out of sixteen young taken from the mother's nest (*N. Eleanora*), eleven, three days after capture, had made nests in the earth of a flower-pot, and the wafer doors of six of these nests measured 2 lines across, of four $2\frac{1}{2}$ lines, and of one 3 lines. The first nests of another similar lot of young *Eleanora* spiders had wafer doors measuring respectively 2, $2\frac{1}{2}$, $2\frac{1}{2}$, 3 and 3 lines. In another case when I captured fourteen young (the entire brood found in the nest of the mother, *N. Manderstjernæ*), after the lapse of five days every one of them had made a nest, but these were smaller and more uniform, ten of the wafer doors measuring 2 lines across, one $1\frac{1}{2}$, and one $2\frac{1}{2}$.

These little spiders need to be kept constantly supplied with flies, which should be killed and placed near their nests; they are often so greedy that they will

attempt to drag a house-fly entire down their tubes for which it is much too large, when the door is pushed open, and the fly remains sticking in the entrance to the nest with its legs up in the air. One may even feed these spiders oneself by approaching carefully and, without causing any vibration, pushing the fly, placed on the end of a pencil, within reach of the spider.

I have given my reasons before (*Ants and Spiders*, p. 127) for believing that the trap-door spiders do not as a rule desert their nests, but enlarge them from time to time to meet their own requirements of growth; showing, by a comparison of the measurements of the doors of eight nests in April with those of the same nests in the following October, that all had increased in size.

Subsequent observations have confirmed this; I find that the young spiders taken from the mother's nest enlarge their nests in captivity in a precisely similar way.

Thus, for example, the wafer doors of three young *Eleanora* spiders, made within a few days after their removal from the mother's nest on February 20th, 1873, and first measured on February 28th, had increased between that date and Nov. 29th following from 2 to 4 lines, $2\frac{1}{2}$ to 4 lines, and $2\frac{1}{2}$ to 6 lines respectively.

It is unfortunate that the male and female spiders are undistinguishable when very young, as it would be interesting to know whether the males construct nests before they take to their adult life, during which they roam from place to place and hide under stones.

In one case fourteen young spiders, forming this entire family taken with a female *N. Mandersstjernæ*,

made nests ; so that unless all of these were females, we have evidence here to prove that the males do commence life by building nests for themselves.

I kept the male *Cteniza Moggridgii*, for ten days on damp earth in captivity, but he made no attempt to excavate or spin, and wandered restlessly about, scarcely touching the flies* with which I supplied him.

Seeing this I could not venture to prolong his captivity, as I feared to risk injuring a specimen which was quite unique and which there was little likelihood of my being able to replace. It is rather curious that M. Simon should also have found one male, and one only, of the closely-related *Ct. fodiens* of Corsica, and that his specimen should be, like mine, the only one known.

Bearing in mind the curious problems which arise as to the affinities of the flora and fauna of the Alpes Maritimes with that of Corsica, the fact that the species of *Cteniza* which is found at Mentone, though allied to, is yet distinct from the insular species, gains a new interest.

We ask ourselves whether the Corsican species sprang from that of the Alpes Maritimes, or *vice versá* ; or again, whether both diverged in remote times from a common ancestor. Questions such as these cannot be answered at present, but I hope the day may come when the geographical distribution of the various

□ * I habitually fed my captive spiders with common house-flies, and it was curious to see how entirely the latter were wanting in any instinctive fear of even the largest spiders. They would creep between the spiders' legs, causing them to start as if electrified, and frequently it was not until the flies, after repeating this annoyance several times, actually walked up to and almost touched the fangs of the spider, that they were punished for their ignorance and presumption.

existing forms of life will be traced with sufficient accuracy to enable us to follow on the map the lines along which affinity travels; and thus point out at once the probable relationship between two given forms, and also the route by which they reached their present stations. Records of local varieties, and the careful discrimination between forms which have small but permanent points of difference, thus acquire an importance which they would not otherwise possess.

The geographical distribution of trap-door spiders is of peculiar interest on account of the sedentary habits maintained during life by the females. Most animals are capable of travelling long distances, or of being accidentally transported from place to place in such a way that colonies are frequently established far away from the parent settlement, and we are left in the dark as to whence they came and who are their nearest relations. But, in the case of spiders inhabiting true trap-door nests, this is not so; they begin life immediately on leaving the parent nest by making homes for themselves near at hand which they will not desert, and there is no likelihood of their being accidentally carried from place to place unless occasionally by running water. Thus it happens that whenever we find the same trap-door spider at two distant localities, we may feel tolerably sure that the species has travelled from one to the other by gradual extension, and that, either now or in times past, it occupied all the intervening country.

For instance, we find *Nemesia Eleanora* at Mentone, and again at Cannes, while it has not yet been detected at Nice, Antibes, nor any other intermediate point; but according to this hypothesis, this species

either does actually live, or has done so formerly, along the whole intervening line. I will now enumerate the species alluded to in the preceding pages and indicate briefly the habitats which they are known with certainty to occupy.

I. *Alypus piceus*, Sulzer (ex Simon). The builder of the tubular nest the silk lining of which is figured at A in Pl. XIII. It is stated by M. Simon* to be common in all the centre, east, and west of France, but it remains doubtful whether this exact form is found in England or not, the true characters and habits of the English species being still uncertain.

II. *Cyrtuchenius elongatus*, Simon, constructing the funnel type of nest. It inhabits the neighbourhood of Fez in Morocco.

III. *Cteniza Moggridgi*, Cambridge (formerly described under the name of *Ct. fodiens*†), one of the many builders of a nest of the cork type; I have hitherto found this spider only at Mentone and San Remo. It will probably be discovered in shady valleys in the neighbourhood of Nice.

IV. *Ct. fodiens*, Camb. (*Ct. Sawagii*, Rossi ex Simon): large nest of cork type; inhabits Corsica. It has been said that the species found near Pisa (*Ct. Sawagii*) is the same as that which is so common in Corsica, but it is desirable to have further confirmation of this.

V. *Ct. Californica*, Camb.—Large nest of cork type. Found near Visalia, about 350 miles south of San Francisco, by Mr. G. Treadwell.

* L.c. sup., p. 183.

† *Ants and Spiders*, p. 89.

VI. *Nemesia cæmentaria*, Latr.—Nest of cork type. Only known with certainty to inhabit the neighbourhood of Montpellier.

VII. *N. Moggridgi*, Camb. (formerly described under the name of *N. cæmentaria*, Latr.*)—Nest of cork type; is found at San Remo, Mentone, Cannes, Hyères, and Marseilles. Its range probably extends some distance to the eastwards, but I doubt whether it does so towards the west, for there I think it likely that it will be found to be replaced by the typical *cæmentaria*.

VIII. *N. Simoni*, Camb.—Nest of the single-door unbranched wafer type, discovered at Bordeaux in May, 1874.

IX. *N. suffusa*, Camb.—Nest of single-door branched wafer type, discovered at Montpellier in May, 1873.

X. *N. Eleanora*, Camb.—Nest of double-door unbranched wafer type; is found at San Remo, Mentone, Cannes, Vaucluse near Avignon. M. Simon says† he has also found it at Digne, in the Basses Alpes.

XI. *N. congener*, Camb.—Nest of double-door branched wafer type; discovered at Hyères in May, 1873.

XII. *N. Manderstjernæ*, Koch, in Ausserer (formerly described under the name of *N. meridionalis*, Costa).‡—Nest of double-door, branched, cavity wafer type; is found at San Remo, Bordighera, Mentone, Nice, Cannes, and Hyères (apparently very rare at the last-named place).

* *Ants and Spiders*, p. 92.

† E. Simon, *Aranèides nouveaux du Midi de l'Europe*, in "Mém. Soc. Roy. Sc. de Liège," 2^{me}. ser. tom. v. p. 30.

‡ *Ants and Spiders*, p. 101.

XIII. *N. meridionalis*, Costa.—Structure of nest doubtful (see description in *Ants and Spiders*, p. 138). Found near Naples and in Ischia. M. Simon has discovered a spider in Corsica which he considers the same as that described by M. Costa under the name of *meridionalis*, but it seems desirable, in order thoroughly to establish this conclusion, that specimens of the spiders and their nests from these distant habitats should be compared together.

We can scarcely suppose that the real geographical distribution of the above-named twelve species is as restricted as it would appear to be from the above enumeration, and there is little doubt, I think, that many more habitats will be added in time. Indeed, our knowledge of the habits and distribution of these spiders can only as yet be said to be in its infancy, the whole subject being, for the most part, new and untrodden ground.

But, it may be asked, what are the chances in the future for the discovery of undescribed spiders and types of nests: and what reward of this kind may the travelling naturalist expect in order to compensate him for the time and pains which such a search demands, and which must divert him in a great measure from making other collections?

The reply is not doubtful.

Europe alone, most probably, contains many trap-door spiders the specific characters and habits of which are at present unknown; and as for the warmer regions of other parts of the globe, we only know enough to lead us to surmise that still stranger and more startling discoveries await us there.

Dr. L. Koch's description of the very remarkable

branched-wafer nest from Australia, alluded to above (p. 217), and the fragmentary specimens of giant cork-nests from the same country exhibited at the British Museum, give us a hint of what the Antipodes will some day reveal to us; while a stray allusion to a trap-door nest found near Lake Dilolo, in Southern Africa, by Livingstone,* affords an indication of their existence in another quarter of the globe. Hitherto but little importance has been attached by naturalists to the study of the nests of trap-door spiders, but a knowledge of their structure is often of the greatest assistance, and will, I venture to predict, be found to afford a clue leading to the discovery of many new species; for it not unfrequently happens that, while two spiders appear so much alike as to pass for representatives of the same species, their nests are totally dissimilar and proclaim them, as in fact they are, quite distinct from one another. For an example of this we have only to turn to the seven species of *Nemesia*, treated of in the foregoing pages, of which six construct dissimilar nests, and only two, building nests of the cork type, make them alike, though the general resemblance between the spiders themselves is extraordinarily close. Thus far, indeed, it will be seen that no two distinct species of European trap-

* "A large reddish spider (*Mygale*), named by the natives 'selali,' runs about with great velocity. Its nest is most ingeniously covered with a hinged cover or door, about the size of a shilling, the inner face of which is of a pure white silky substance like paper, while the outer one is coated with earth precisely like that in which the hole is made, so that when it is closed it is quite impossible to detect the situation of the nest. Unfortunately the cavity for breeding is never seen except when the owner is out, and has left the door open behind her."—*Dr. Livingstone, from "Popular Accounts of Travels in South Africa,"* chap. xvii. p. 221.

door spider make wafer nests of the same type, each kind of wafer nest having its own peculiar spider.

This strikes me as a very curious fact, and I await with interest the discovery of new species of wafer-building spiders in order to learn whether this will continue to hold good or not.

That such discoveries will be made I entertain no doubt; indeed, I have reason to believe that, even at Mentone, where perhaps more pairs of eyes have been at work searching for trap-door spiders than anywhere else, new species still remain to be detected. In April, 1873, the surface door of a wafer-nest together with a very small portion of the tube was brought to me from the summit of the Aiguille mountain, near Mentone. I was greatly surprised to learn that a trap-door spider could live in such a situation, for the earth on that plateau, which has an elevation of 4032 feet above the sea, is always frozen hard for weeks and even months together during the winter, and snow frequently lingers there. The spider, therefore, which endures these conditions is scarcely likely to be of the same species as any one of those inhabiting the lower country. The trap-door spiders of these spurs of the Maritime Alps, are probably of distinct species from those of the plains, but they are absolutely unknown at present.

Then the males of several species, as, for example, those of *Nemesia Simoni*, *N. suffusa*, *N. congener*, and *N. Moggridgii*, have yet to be discovered; while of the habits of the males in general we know little or nothing.

Indeed, there is no one species with the habits of

which we can say we are thoroughly acquainted, and we must admit that up to the present time these ingenious little architects have been at least as successful in concealing themselves from the intrusion of naturalists as from the attacks of their proper enemies.

Surely these trap-door spiders, which have lain quiet in the earth century after century, have hidden themselves long enough from our inquisitive admiration, and the time has now come for us to seek them out and learn their ways.

;

SPECIFIC DESCRIPTIONS OF TRAP-DOOR SPIDERS,

BY

THE REV O. PICKARD-CAMBRIDGE.

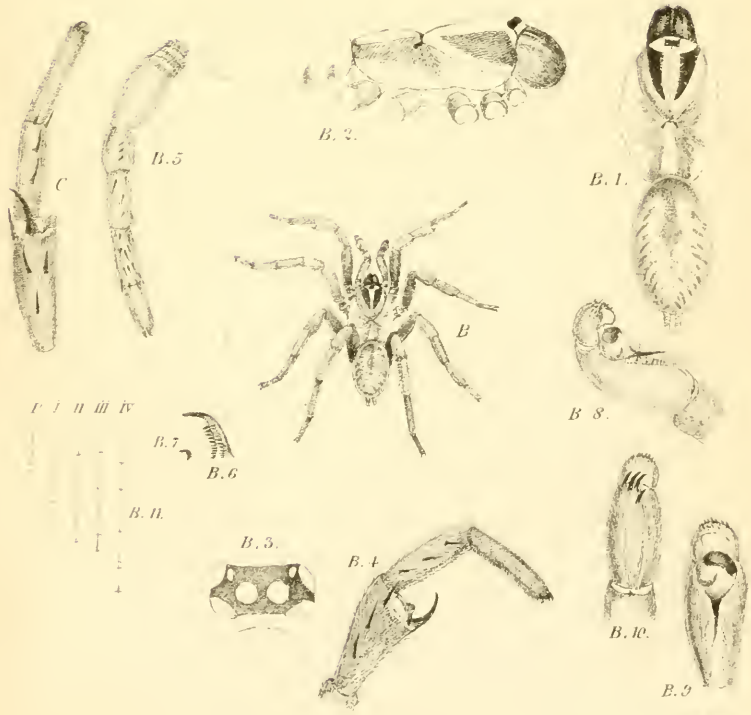
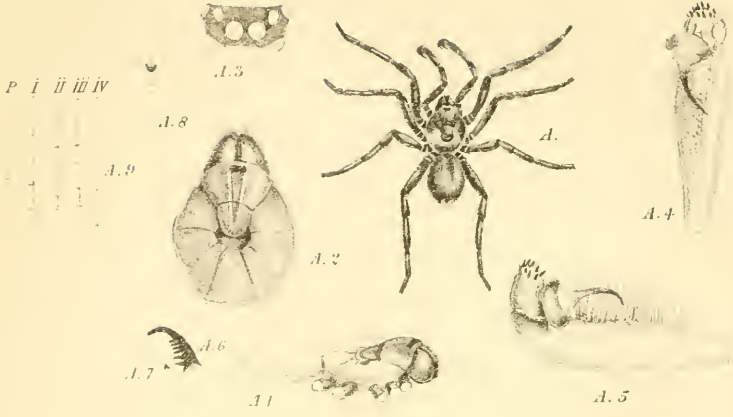
GENUS CTENIZA, Latr.

CTENIZA MOGGRIDGII, sp. n., Plate XX., fig. A,
p. 254.

Cteniza fodiens (Camb.)? ♀ in *Harvesting Ants and Trap-door Spiders*, J. T. Moggridge, 1873, p. 89, Plate VII., excluding synonyms there quoted.

Adult male length $5\frac{1}{2}$ lines, length of cephalothorax 3 lines, breadth $2\frac{1}{2}$.

The *cephalothorax* is of a short, broad-oval form, its length being only half a line greater than its breadth; it is flattened-convex above, and depressed near the margins, the *caput* (when looked at in profile) scarcely rising above the level of the thorax. At the junction of the caput and thoracic segments is a deep, circularly-curved indentation, or fovea, the curve of which is directed backwards; the extremities of this indentation are continued obliquely forwards on either side, forming the normal ones which indicate the junction of the caput and thorax. Rather more than one-third of the distance between the above curved indentation and the fore margin of the caput is a very perceptible and deep but narrow, slightly curved, transverse indentation which divides the caput into



Vincent Brooks Jay & Son

two distinct parts; the curve of this indentation is directed forwards. The normal thoracic indentations are well marked, but not very strong; the surface of the thorax, though shining, appeared under a lens to be covered with fine rugulosity. Its colour is yellow-brown; a large triangular patch on either side of the caput being tinged with orange, and the rest suffused with dark brown. The caput is of a dark reddish yellow-brown, showing (in spirit of wine) two longitudinal bars, or strong lines, of a clearer orange yellow-brown colour; its surface is glossy, though, under a lens, the sides of the fore part are very finely striated or rugulose. These lines begin behind the extremities of the hinder row of eyes, and gradually converge to a point at the thoracic junction; the ocular region and central longitudinal line of the fore-segment of the caput have some long and very prominent black bristles. When alive, the cephalothorax appears to have been suffused with a purplish hue, corresponding to that of the abdomen and other parts.

The *eyes* form a rectangular figure, whose fore side is a little shorter than the hinder one, and whose transverse, or longest, diameter is as nearly as possible double the length of its shortest one; the eyes of the central or fore-central pair are small, and separated by a diameter's distance from each other. The hind laterals are the smallest of the eight, and each is almost contiguous to the hind-central nearest to it, this latter being of a sub-triangular form, and separated from the fore-central on its side by an interval equal to that which divides the two fore-centrals, but less than that which separates each fore-central from the fore-lateral on its side. Looked at as in two

transverse rows of four each, those of the foremost row are darkish coloured, while those of the hinder row are pearly white. Omitting the eyes of the hind-central pair, the remaining three on either side form as nearly as possible an equilateral triangle.

The *legs* are long, moderately strong, their relative length being 4, 1, 2, 3. They are of a dark brown colour, generally paler on the under sides, furnished with hairs, fine bristles, and spines; the latter are numerous and strong beneath the metatarsi and tibiæ of the first and second pairs; on those of the third pair they are less strong and more uniformly disposed; on those of the fourth pair they are fewest and least conspicuous. The genual joints of the third pair have some strongish spines on the outer side; the right leg has eight, the left nine. The tothing of the superior tarsal claws does not appear to be uniform on the different legs of the same example; on those of the fourth pair there were five teeth; on those of the first pair eight or nine, with two others, quite rudimentary, towards the point of the claw; and even on one of the fourth pair of legs one of the claws had six, the other five teeth. The tarsal claws of the second pair are toothed throughout nearly their whole length with from eight to ten teeth; on *one* of the third pair the teeth were but five or six, while on the other there were on one claw but three ordinary teeth and a much stronger one a little way off in front of them, on the second claw only a single strong tooth about the middle, and a smaller one close to its base.

The *palpi* are long and rather slender, measuring rather over six lines in length; they are similar in colour to the legs, and excepting a few—from twelve

to fourteen—short strong spines on the upper side of the extremity of the digital joint, furnished with hairs only. The cubital joint is more than half the length of the radial; this latter is equal in length to the humeral joint, and nearly as long as the femora of the first pair of legs. The digital joint is short, of an oblong oval form, broadest at its extremity. The palpal organs consist of a nearly spherical corneous lobe, prolonged at its fore extremity into a long, slender, tapering, beak-like spine, curving upwards (*i.e.*, with its point near to the radial joint), and inwards.

A broad, conspicuous, shining, corneous band, of a deeper red-brown than the rest, runs round the middle (or equatorial line) of the spherical portion of these organs, covering the greater part of their surface.

The *falces* are of moderate length and strength, and of ordinary form. They are similar in colour to the legs, and furnished in front, chiefly on their inner edges, with hairs, and at their extremities on the inner sides, with a few, but not very strong nor conspicuous, short spines; their under side (along which the fang lies) is toothed on the inner edge only; the fang is strong and curved, but presents nothing remarkable in form, nor could I detect either denticulation or serration.

The *maxillæ* are strong, straight, divergent, with a small prominent point at the inner extremity of each; they are as strong, but not so long, as the basal (coxal) joints of the legs of the first pair, of a yellow-brown colour, furnished with hairs, but with no spines of any sort or size.

The *labium* is similar in colour to the *maxillæ*, and

somewhat quadrate in shape, rounded at the apex ; it is furnished with hairs only.

The *sternum* is of a sub-pentagonal form, much broader behind than in front ; its colour is dull yellowish-brown, and it is furnished with hairs, leaving two largish, bare, round, slightly impressed patches, not far from each other, in a transverse line near the middle.

The *abdomen* is short-oval in form, and very convex above ; it projects a little over the base of the cephalothorax, and its upper side is of a purplish grey-brown hue, mottled with a pale dull whitish-yellow, and furnished sparingly with hairs. The sides and under side are of a uniform dull whitish-yellow. The *spinners* (four in number) are, as usual, of very unequal size, those of the superior pair longish, strong, three-jointed, and up-turned, the inferior pair short but stout, consisting of one joint only and pretty close together.

The *female* (as it is conjectured to be) of this species was described, in the work to which the present publication is supplementary, from examples found at Mentone. There is little doubt now but that it is not *Ct. fodiens*, Walek., but whether or not identical with the male above described is not absolutely certain. I think myself (with Mr. Moggridge, see p. 195) that it is so, in spite of some differences in the relative size of the eyes, the tooting of the under side of the falces, and the denticulation of the tarsal claws. With regard to the eyes and falces, I am not inclined to lay special stress upon these differences. It is found that in other groups of spiders whose cephalothorax varies very markedly

in development in the two sexes, differences of this nature occur. In the present genus, the male has an almost flat caput, while the female has a strongly elevated one; and with respect to the variation in the tarsal claws, no special weight can be attached to it in the present instance, since these claws are not uniformly denticulated in the different feet of the same individual. Another difference is the absence in the male of sundry small but distinct tooth-like spines at the apex of the labium and the inner corner of the base of the maxillæ; the female is also wanting in regard to the very characteristic transverse indentation which divides the caput of the male into two parts. I can, however, trace in the female the slightest possible corresponding depression, scarcely amounting to an indentation, and placed rather nearer to the junctional thoracic pit.

With regard to the differences between this species and *Ct. Sauvagii*, Latr. (*Ct. fodiens*, Walck.), size alone would suffice to distinguish them; two females of the latter now before me measuring 13 lines in length; while the male (*Aran. nouv. ou peu connus du Midi de l'Europe*, par Eugène Simon, Mém., Liège, 1873) measures 8 lines (17 mm.) and the female rather over 14 lines (30 mm.), the fore-central eyes in the female of *Ct. Sauvagii* appeared to be smaller than those in *Ct. Moggridgii* and placed rather farther forwards, but the eyes in both are otherwise remarkably similar both in size and position. The males, however, cannot be confounded inasmuch as, according to M. Simon, no trace of any transverse indentation on the caput exists in *Ct. Sauvagii*.

The denticulation of the tarsal claws in the females

of both species is similar, but M. Simon does not mention this portion of the structure of the male he describes of *Ct. Sauvagii*.

The adult male of *Ct. Moggridgii* above described, was found behind the stones of an old wall at Mentone, but not in any kind of nest.

Nest-making, and excavating for that purpose, is, probably, no part of the work of the adult males in this and other allied genera, and hence we can see a reason for differences in the development of the caput, and the denticulation of the falces. The usual habitat of the females and their nests is in damp and shady spots, whereas *Ct. Sauvagii* constructs its nests in dry exposed banks.

Habitat. Mentone and San Remo.

CTENIZA CALIFORNICA, sp. n., Plate XV., fig. B, p. 198.

Adult female; length very nearly 14 lines; length of the cephalothorax, $5\frac{1}{2}$; greatest breadth of ditto, 5; breadth of fore part of caput, 4 lines; length of caput rather over 3 lines.

The *cephalothorax* of this spider is rather broader in proportion to its length than that of *Ct. Sauvagii*, Walck., Sim. = *Ct. fodiens*, Walck. The convexity, or elevation, of the caput is also less, but that of the thorax is greater, so that (when looked at in profile) the profile line of the two forms a tolerably even and continuous slope, interrupted only by the thoracic fovea; the profile, however, of the occiput is curved.

The thoracic fovea, or junctional indentation, is strong, deep, and semilunar in form, the horns of the crescent pointing forwards; the other normal

indentations are well marked, but those which divide the caput from the first thoracic segment do not unite with the extremities of the junctional fovea, being in this respect unlike *Ct. Moggridgii*, but more like *Ct. Sauvagii*. The *clypeus*, although transversely impressed, yet slopes forward more gradually than in either of those species, its breadth is about equal to that of the ocular area, or amounts to half that of the facial space. The colour of the cephalothorax, taken from the specimen preserved in spirit of wine, is a deep reddish-yellow brown, gradually getting paler towards the margins. When alive, I understand that the general colour of the whole spider was a dark blackish chocolate brown, the legs and cephalothorax being darker than the abdomen; there are a few prominent bristly hairs in the medial line both before and behind the ocular area.

The *eyes* form a narrow transverse oblong figure, its length being about two and a half times its width, and its fore side is a little the shortest; the fore-lateral eyes are large and oval, and by far the largest of the eight; the rest do not differ much in size, though perhaps the hind laterals, which are also oval, are a little the largest; the longest diameter of these, however, is less than half the longest diameter of the fore laterals. The interval between the fore and hind laterals is small, only equal to the shortest diameter of the hind lateral; and this interval is nearly double that which separates each hind lateral and the hind central nearest to it. The hind laterals and hind centrals form an almost perfectly straight line, the former being very slightly indeed within the straight line of the former; the intervals which separate the

fore centrals from each other, and each of them from the fore lateral on its side, are as nearly as possible equal, though very slightly, if at all, less than that which separates each of them from the hind central on its side: the interval which separates the fore laterals is double the length of the longest diameter of one of them.

The *legs* are short and very strong; they are like the cephalothorax in colour, but paler underneath the femora; this joint in the third pair is proportionally much stronger than in the other legs; all are furnished with hairs, bristles, and spines, a group of erect bristles among the rest occupies the fore part of the upper side of the metatarsi of the first and second pairs; strong spines of different lengths are thickly placed beneath and on the lower part of the sides of the tibiæ tarsi and metatarsi of the first and second pairs. On the tarsi and metatarsi of the third and fourth pairs similar spines are distributed more uniformly over the whole surface of the joints, and on the genual joint of the 3rd pair there is one short strong spine near its extremity on the outer side, those on the tibiæ both of the third and fourth pairs being confined to a few on the outer side, and towards the lower side only. Each tarsus terminates with three claws, of which the two superior ones have a single strong tooth towards the base on the lower side.

The *palpi* are rather long, strong, and similar in colour to the legs. They are furnished with hairs, bristles, and spines; of the latter the radial and digital joints have some short and strong ones, pretty thickly grouped along both their outer and inner

sides ; the digital joint ends with a single untoothed claw.

The *falces* are strong and massive, more so than in *Ct. Sauvagii*, but of normal form. They are furnished with hairs and bristles, and with strong spines near their inner extremities on the upper side ; the fangs are strong, folded along the under side of the falces in a furrow which is toothed along either edge. The colour of the falces is a rich deep red-brown.

The *maxillæ* are strong, straight, divergent, with a prominent point at the inner extremity, and some very short, strong, tooth-like spines at their base ; their colour is dull yellow-brown, and, with the labium and sternum, they are thickly clothed with short strong hairs.

The *labium* is dark yellow-brown, tipped slightly with black ; it is of a somewhat semilunar form, and has a few very short tooth-like spines near its apex.

The *sternum* is of a rough oval form, broadest behind and shorter and broader in proportion than that of *Ct. Sauvagii* and *Ct. Moggridgii* ; its colour is dull yellow-brown, and it is destitute of the two shining bare patches conspicuous in both those species.

The *abdomen* is large, short-oval, broadest behind and very convex above ; it is of a dull yellowish-brown colour, thickly mottled with minute dark points seen through a lens to be little rings, from the centre of each of which springs a bristly hair ; the under-side is paler ; the spinners and spiracular openings are normal. As observed above, the colour of the abdomen was rather different in life ; it was then of a deep blackish chocolate brown, with an indistinct

longitudinal line along the middle of its fore part on the upper side, intersected by a similar line at right angles; but these lines soon disappeared after death; the specimen had been in spirit of wine some months before the present description was made.

A single example, with its tubular nest of the cork-lid type, was received alive from California in 1873, and appears to have been hitherto undescribed; though no larger than *Ct. Sauvagii*, it is yet a stouter and more massive spider, and may readily be distinguished by the large size of its fore-lateral eyes, the narrower ocular area arising from the far greater proximity to each other of the eyes of each lateral pair, the less convexity of the caput, and the greater convexity of the thorax, as well as by its being altogether a darker coloured spider, and having shorter stouter legs.

Habitat. Visalia, 350 miles south of San Francisco, California.

Gen. NEMESIA, Savigny.

NEMESIA CÆMENTARIA, Plate XIX., fig. B, p. 229.

Mygale cæmentaria (Latr.) *Hist. Nat. des Crust.* t. vii. p. 164.

—♀—Walck., *Hist. Nat. des Ins. Apt.* 1, p. 235.

— — Cuvier's *Règne Animal*, ed. Paris. 20 vols. 18—? Pl. I., *A. Dugès del. ♂ et ♀.*

Adult female, length 7 to 9 lines.

Cephalothorax oval, truncated and almost equally broad at each end; the upper surface is moderately convex, the caput elevated a little above the rest, and equally rounded on the sides and upper part; the profile of the whole cephalothorax forms a general sloping slightly curved line, broken by the thoracic

junctional pit or fovea, which is narrow but strong, and gently but equally curved, the convexity of the curve directed forwards; the thorax next to this fovea is rather gibbous, but not over any great extent of surface; the other normal indentations are tolerably strong; the colour of the cephalothorax is yellow-brown, darkest on the sides of the caput, and along the thoracic indentations, palest on the margins, forming a pale marginal border indistinctly vandyked on the inner edge. The surface is clothed, but not densely, with yellowish-grey adpressed hairs; there are a few black bristles in a straight transverse line, directed forwards from the lower margin of the clypeus; also a few more bristles curved and of various lengths before and behind the ocular area, their points meeting over this area, and a row of strong, nearly erect ones in a longitudinal central line from the ocular area to the junctional fovea; besides these are a few more, finer and less conspicuous, along the middle both of the caput and thorax; the colour on either side and in front of the ocular area is orange yellow-brown, and joining with this a broad band of the same runs backwards from the ocular area to the thoracic fovea. The band begins as wide as this area, it then directly enlarges a little, and thence tapers slightly and gradually to its termination, forming a truncate wedge, with the margins rather irregular, but on the whole a little curved. This band is not immaculate, there being two dark yellow-brown tapering lines or bars along the greater part of its length; these bars begin from each outer pair of eyes of the hinder row, and tapering to a fine line, converge to the thoracic fovea, but do not quite meet. It is important to note the

exact form and distribution of the central band and these tapering bars, as their differences from the character of the similar part in another closely allied species are strongly specific; the above description holds good in above twenty examples before me.

The *eyes* are in two transverse lines, forming an area whose length is rather less than $2\frac{1}{2}$ times its width; the foremost line is curved, and the curve directed backwards, the hinder one is also curved and in a similar direction, but less strongly, looking laterally the extreme margin of the four eyes of the hinder row forms a straight line. Considered as in pairs, those of the fore-central pair are separated by an interval equal to that which separates each from the fore-lateral and hind-central nearest to it; the fore-laterals are divided by about two and a half diameters; they are the largest of the eight, only slightly however, in some examples, larger than the hind-laterals. Each of them is separated from the hind-lateral on its side by not quite half the diameter of the latter, and each hind-lateral is very nearly but not quite contiguous to the hind-central on its side; the hind-centrals are roughly rounded, smallest of the eight, though in some examples equal in size to the fore-centrals, and are separated from the fore-central nearest to it by about one diameter, which gives a clue to the absolute distance between the eyes of the foremost pair. The four lateral eyes are oval, the fore-centrals round; those of the foremost row are darkish coloured, while those of the hinder row are pearly white.

Although it is of great importance to observe as accurately as possible the relative position and size of

the eyes, yet we must be prepared to find exceptions to the rule derived from the most exact measurements in any individual instance.

In the present species the above conclusions, as to position and size, are drawn from a consideration and comparison of 20 examples, and are, it is believed, pretty true, but yet in one example, one of the hind central eyes was but half the size of the other, and in another example one of the same eyes was but one-fourth of that of the other, a mere dot in fact, and the relative size of the respective lateral eyes of the two rows do not appear to maintain exactly the same proportions in all individuals. The height of the clypeus appeared to be as nearly as possible half that of the facial space.

The *legs* are strong, moderately long, their relative length 4, 1, 2, 3, though in some examples those of the second and third pairs are equal in length; in others, those of the third pair are slightly longer than those of the second; here again, as with the eyes, although the relative proportion of the legs of spiders is an important specific point, and in general tolerably reliable, yet accurate observation and measurements prove that there are small differences in individual instances. The legs are yellow-brown in colour, furnished with hairs, bristles, and a few spines. The outer sides of the genual joints of the third pair are destitute of spines; in two instances only out of 20, this joint had a single, not very conspicuous, spine. The superior tarsal claws have 4-5 minute pectinations underneath near their base.

The *palpi* are moderately long and strong, and

similar in colour and general armature to the legs; they terminate with a single, strong, sharply curved untoothed claw.

The *falces* are of a deep black red-brown colour, strong and prominent, and flat, but not cut away, on their inner sides; they are furnished on their upper sides with black bristles and yellowish-grey hairs, disposed in longitudinal lines; these bristles are strongest and most numerous on the inner margin of the upper side, increasing in strength forwards where, near the extremity, are some strong spines.

On the inner edge of the under side of each falx is a row of teeth, and each fang is also denticulate or finely serrate, beneath towards its hinder part.

The *maxillæ* are strong, cylindrical, and divergent; and each has a small bluntish angular prominence at the extremity on the inner side; their inner margin has a thick fringe of pale reddish hairs, the fore surface being clothed (as ordinarily) with dark bristly hairs, and there are a few black minute tooth-like spines in a line (sometimes in a small group) near the inner corner of their base.

The *labium* is short, broad, its breadth nearly double its length, and the upper corners rather rounded off; there are some strongish bristles, mostly towards the apex, but no tooth-like spines nor denticulations.

The *sternum* is oval, rather convex, broadest towards the hinder part, which is pointed at this extremity but hollow-truncate before.

The *abdomen* is sparingly clothed with hairs; it is of a stoutish regular oval form, and of a dull brownish yellow colour; its fore extremity on the upper side is thickly blotched with deep blackish-brown, and the

whole length spanned by a series of about five curved, or slightly angular, stoutish bars or chevrons, formed of more or less confluent, dark, blackish-brown blotches and markings; a more or less indistinct line of a similar nature also divides the fore part of the upper side of the abdomen longitudinally. There is some variety in the extent, depth, and distinctness of these markings, but the figures given (Pl. XIX., p. 229, figs. B, B 1) show the appearance of an average example.

It must be remembered that this description is made from examples in spirit of wine, and that in life the markings (especially on the cephalothorax) are often considerably obscured by the hairs on the surface; when seen through spirit the actual tints of colour are sometimes misrepresented, but the characteristic markings are seen more distinctly.

The lower part of the sides and the under-side of the abdomen are of a uniform pale dull brownish-yellow; the spinners of the superior pair are short, strong, and 2-jointed; those of the inferior pair are very minute, and near together at the base of, and almost between, the others.

Adult and immature females were found in 1873-4 abundantly at Montpellier in France, in unbranched tubular nests closed at the surface with a close-fitting "cork" lid.

In *Harvesting Ants and Trap-door Spiders*, p. 92, a spider inhabiting similar nests, and found commonly at Cannes and Mentone was described as *N. cæmentaria*, Latr. The subsequent discovery however of a very closely allied, but certainly distinct, species in abundance at Montpellier (the locality in which the

original *N. cæmentaria*, Latr., was found) makes it more than probable that the *Montpellier*, and not the *Mentone*, species is the true *N. cæmentaria*. Certainly as yet no other species more likely than this to be the one described by Latreille has been found at Montpellier; in fact, the one here described is the common one found there, and alone answers to Latreille's character of having a nest with a lid of the cork type.

It has become therefore necessary now to record the *Mentone* species under another name, and under that name, "*N. Moggridgii*" (p. 273) will be noted the specific differences by which the two species may be at once distinguished from each other.

The male of the spider here described has not been yet found. A description is given (p. 276) of a male spider, *Nemesia incerta* (no doubt closely allied), found by M. Eugène Simon at Digne; but reasons will be given why it is not probable that this Digne spider should be, as conjectured by M. Simon, the male of the *Montpellier* species. Whether the *N. carminans* (Latr.) is the male of *N. cæmentaria* (Latr.) or not, is another question, and one surrounded with some obscurity and difficulty. Latreille described *N. cæmentaria* (female) from Montpellier, and *N. carminans* (male) from Aix in Provence; the latter being specially characterized by a bifid point to the prolongation of the palpal bulb; L. Dufour appears subsequently to have considered *N. carminans*, Latr. (male) to be the male of *N. cæmentaria*, and Latreille appears to have agreed with L. Dufour upon this, *vide* Walek. *Ins. Apt.*, i. p. 236; but Dufour afterwards (*Ann. Gen. Sc. Phys.*, tom. v. Bruxelles, 1820,

p. 103) introduced an element of confusion into the question by describing *N. carminans* as having the point of the palpal organs simple, “nullement bifid,” and throwing out a suggestion that it might be the male of *N. Sauvaggi*, Latr., (= *N. pionnière* or *fodiens*, Walck.) Latreille upon this (*Vues générales sur les Aranéides*, Acad. Roy. des Sc., 1830, pp. 64, 65) explains Dufour’s suggestion as an inadvertence, but takes no notice of the difference of the form of the palpal organs as described by him; at the same time however Latreille explains why, probably, Walckenaer “still considers (in his *Faune française*) *N. carminans* to be a distinct species.” We may conclude from this that Latreille never altered *his* opinion that his own *N. cæmentaria* and *N. carminans* were the two sexes of the same species; and we shall probably rightly agree with Walckenaer that Dufour had another species before him, which he wrongly (l.c.) described as *N. carminans*.

Subsequently again a male and female spider, evidently of one species, were figured by Dugès to illustrate *N. cæmentaria* male and female in Cuvier’s *Règne Animal*—Edition in 20 vols. not numbered and without date, published in Paris, “*accompagnée de Planches par une réunion de disciples de Cuvier, MM. Audouin, Blanchard, Deshayes, Aleide d’Orbigny, Doyère, Dugès, Duvernoy, Laurillard, Milne Edwards, Roulin, et Valenciennes.*” Of these figures, that of the male has the point of the palpal organs distinctly bifid, and the nest figured is of the cork-lid type.

On the whole it may be concluded that the male of the true *N. cæmentaria*, Latr., will be found to have the bifid point to the palpal organs, but the

question cannot be considered settled until further researches at Montpellier and Aix (in Provence) shall have furnished *males* of the *N. cæmentaria* now described, and *females* of the bifid pointed male—*N. carminans*, Latr.—for of course it is possible that Latreille's *first* views of the distinctness of *cæmentaria* and *carminans* may be the correct ones.

The characters of the species now described accord so well with the figures of the female in Dugès' plate (above mentioned) that little doubt can be entertained of *their* identity, and if so there would seem to be little doubt also, but that further research at Montpellier will reveal a male similar to the male figured by Dugès.

Habitat. Montpellier, France.

NEMESIA ELEANORA.

Syn. Nemesia Eleanora, Cambr., male and female, in *Harvesting Ants and Trap-door Spiders*, by J. T. Moggridge, p. 180, Pl. XII. and woodcuts, p. 109.

Nemesia Alpigrada (Simon) male, *Aranéides nouv. ou peu connus du Midi de l'Europe*, 2^e Mémoire. Liège, 1873, 2^e sér. t. v. p. 27 (separate copy.).

There is but little to add to the descriptions given (i.e. *supra*). It must however be noted that the spines on the outer side of the genual joints of the third pair of legs, then supposed to be a characteristic of the present species only, are now found to exist in several others, with some small exceptions in regard to number, and also in respect to strict uniformity, on both legs of the same individual. In *N. cæmentaria* (p. 264), however, there is rarely found even a single spine on either of these joints; and not one out of

ten examples of another species, *N. Simoni* (p. 297), had even one of these spines.

Shortly after the publication of *Harvesting Ants and Trap-door Spiders* the male of this species was described by M. Simon (l.c.) from two examples taken at Vacluse near Avignon.

Habitats. San Remo, Mentone, Cannes, Vacluse near Avignon, and, according to M. Simon, Digne, Basses Alpes.

NEMESIA MOGGRIDGH, sp. n., Plate XIX., fig. C, p. 229.

Syn. Nemesia Cæmentaria, Cambr., in *Harvesting Ants and Trap-door Spiders*, (by J. T. Moggridge), p. 93, Pl. VIII.

This spider is exceedingly closely allied to the foregoing and was thought to be the true *N. cæmentaria*, Latr., until subsequent researches at Montpellier (the locality where Latreille's types were found) have resulted in the belief that the Montpellier, rather than the Mentone species, is that described by him. At present the females only of the two species are known, and these may readily be distinguished by the pattern on the caput.

In the foregoing (the *Montpellier Spider*) a broad orange yellow-brown band runs from the ocular area to the thoracic fovea, tapering gradually to that part, where it is truncated, forming a wedge with the point cut off. This wedge-shaped band is charged with two longitudinal, more or less distinct, dark brown irregularly-tapering lines, running throughout its whole length and converging towards each other but not touching.

In the *Mentone Spider* there are three orange-yellow-brown well-defined bars or longitudinal lines between the ocular area and the thoracic fovea; the central bar tapers and reaches from the eyes to the fovea, the lateral ones never more than two-thirds of the distance from it to the eyes, diverging a little from the central bar as they run forwards. These two lateral bars are not straight, *i.e.*, their margins are more or less notched or roughly angular, forming in some examples a line of a somewhat zigzag or bent character. It may perhaps be observed that when the two dark brown lines which run along the broad orange-yellow-brown band on the caput of the Montpellier spider, are well marked, this also leaves three longitudinal yellow lines, somewhat similar to those just described in the *Mentone* species, but there is this difference even then (and it is constant throughout a long series of examples), the lateral lines in the Montpellier spider *always run through to the eyes*, equalling in length the central line, while in the *Mentone* spider the *lateral bars never reach the eyes*, always stopping short of the ocular area, by one-half, or nearly so, of their length.

Another distinction which appears constant is the form of the thoracic fovea; in the Montpellier species this forms a slight but uniform curve; in the *Mentone* spider it is more sharply bent at the apex (or centre of the curve), forming in most examples a bluntish-angular line.

In the eyes there appears to be but little reliable difference; if there be any at all constant, it seems to be that in the present (*Mentone*) species the fore-laterals are constantly smaller than the hind-laterals, and sometimes smaller than the fore-centrals. A close

examination, however, of the relative size and position of the eyes in a series of examples, lowers one's estimation of the *absolute* value of this character in the determination of the species of *Nemesia*; still it is a specific character not by any means to be overlooked, though to be used guardedly, and often with great reservation.

In regard to other characters and general description there seems but little to add to the description given (i.e. *supra*), except that the labium has no denticulations at its apex and the outer sides of the genual joints of the third pair of legs are generally without spines. Occasionally (in one example out of sixteen) there is a single spine on this joint, of either the right or left leg. In this character, however (differing from several others described below), the Montpellier spider agrees with that from Mentone.

In both spiders, the fangs of the falces are (in some instances at least) denticulated. Also in regard to the relative lengths of the legs, like those of the Montpellier spider, the second and third pairs of the Mentone species are not constant in their relative proportions, though the differences either way are very slight, and there is often no difference whatever.

The nest and habits of the two species appear to be nearly, if not quite, similar.

In naming the present species (at the suggestion of M. Eugène Simon) the writer of these descriptions gladly testifies to his appreciation of the great value attaching to Mr. Traherne Moggridge's investigations of the habits of the closely-allied species of this very difficult, though most interesting group of spiders.

M. Eugène Simon (*Ann. Soc. Ent. Fr.* 1873, Bull. c.),

perceiving the difference between the present species and the one known to himself as *N. cæmentaria*, Latr., concludes it to be identical with *N. meridionalis*, Sim. Examples, however, of this latter, from M. Simon's cabinet, show that they are very distinct.

On *N. meridionalis*, Sim., see p. 289; and on *N. cæmentaria*, Sim., p. 280, M. Simon has, I understand, subsequently admitted the error of his conclusion, published l.c. *supra*.

Habitat. San Remo, Mentone, Cannes, Hyères, and Marseilles.

NEMESIA INCERTA, sp. n., Plate XIX., fig. D, p. 229.

Adult male, length slightly above $4\frac{1}{2}$ lines.

Cephalothorax oval, truncate at each end; moderately convex above, the profile line forming a pretty even, sloping, curved line, but flattish in the middle near the thoracic fovea, which is of a strongly curved form; the other normal indentations are not strong, though fairly defined; the colour of the cephalothorax is yellow-brown, palish and clothed with yellowish-grey adpressed hairs on the margins, and inclining to orange on the caput. The clypeus is somewhat steep, about equal to half the height of the facial space, and the sides of the caput are dark blackish-brown, leaving a longitudinal, central reddish orange-brown band tapering to the thoracic fovea.

The upper and hinder part of the thorax is strongly suffused with brown, leaving broad but irregular pale lateral margins; there is a group of strong bristles directed forwards from the margin of the clypeus, and two or three more in the median line behind the ocular area.

The *eyes* are on a strongish oblong dark brown transverse tubercular eminence; the fore-laterals are rather smaller than the hind-laterals, and the fore-centrals are larger than the hind-centrals, the latter being much the smallest of the eight; the interval between those of each lateral pair is about equal to, or slightly larger than, the diameter of one of the fore-central eyes; the intervals between the four eyes of the front row are equal, each interval being equal to the diameter of one of the fore-centrals; and each hind-central eye is separated from the fore-central nearest to it by as nearly as possible a similar distance, and from the hind-lateral on its side by a very small but distinct interval.

The *legs* are rather long, strong, of a brownish-yellow colour, suffused with blackish-brown on the upper sides of the femora, and furnished with hairs, bristles, and spines. Those of the hinder (fourth) pair were wanting, the relative lengths of the others being 1, 2, 3; 2 and 3 being very nearly equal. The spines are not numerous, being disposed mostly on the tibiæ and metatarsi of the third pair; some, however, had been evidently broken off; all the tarsi were without spines; each tarsus ends with three claws, the superior pair with several—6-8?—teeth on their under sides.

The tibial joint of each of the first pair is short, no longer than the genual joint, but it is strong and enlarged gradually beneath to its fore extremity, where it ends in a strong, sharp-pointed, tapering red-brown curved spine, directed downwards, forwards, and inwards. Each tarsus of the first and second pairs is pretty thickly fringed just below on each side along

its whole length, with short strongish hairs of an even length.

On the outer side of the genual joint of the third pair (left leg) are three spines in a longitudinal row; the other leg of this pair was wanting.

The *palpi* are moderately long, and similar in colour and general armature to the legs; the radial joint is strong, a little tapering forwards, and somewhat curved underneath towards its hinder part; its length is about double that of the digital joint, and from its fore extremity on the upper side, three strong, somewhat sessile, spines of equal length, and directed forwards issue, in a straight transverse line.

The palpal organs consist of a roundish corneous bulb drawn out into a longish, tapering, curved, sharp-pointed spine, the point being very fine, gradual, and directed outwards.

The *falces* are strong, prominent, of a deep red-brown colour, furnished above with dull greyish-yellow hairs mixed with dark bristles, and disposed in longitudinal stripes; and near the upper extremity on the inner side are four strongish spines.

The *maxillæ* are strong, divergent, cylindrical, with a small angular prominence at their inner extremity; they are furnished with hairs, but no denticulations, and there is a strong fringe of reddish hairs on their inner margins. The *maxillæ* are of the same colour as the *palpi*.

The *labium* is short and broad; its breadth double its height and its apex rounded. Its junction with the *sternum* appeared to be about at right angles. It is darker in colour than the *maxillæ*, but with a paler apex; its surface is furnished with bristly hairs, but there

are no denticulations at its apex. *Sternum* oval, truncate before, pointed behind, furnished with bristly hairs, and of the same colour as the legs.

The *abdomen* is of an oblong-oval form, truncate before, and tolerably convex above; it is of a pale dull yellowish colour clothed with yellow-grey hairs, among which are a good many prominent dark bristly ones; the fore part of the upper side is irregularly marked with black-brown; following this towards the hinder part, and reaching half way or more to the spinners, is an indistinct longitudinal central line of the same colour, throwing off numerous short lateral lines at right angles; towards either side of the hinder two-thirds of the abdomen are several oblique black-brown lines extending more or less over the sides; one, about the middle, extends farther over the sides than the rest, and almost unites with a curved deep black-brown transverse line crossing the under side of the abdomen a little way in front of the spinners.

The under side of the abdomen is similar in colour to the upper side, and, besides the transverse dark line above mentioned, there is another touching the anterior margins of the posterior spiracular plates; the superior pair of spinners are short and strong; the inferior pair small, and in the ordinary position, but apparently not (proportionally) so small as in the females of some other species.

A single adult male was received for examination from M. Eugène Simon, by whom it was found at Digne (Basses Alpes, France). M. Simon conjectures that it may be the male of *Nemesia Moggridgii* (p. 273), but some slight differences in the size and positions of the eyes, and in the pattern on the cephalothorax, and

on the under, as well as the upper, side of the abdomen, lead me to believe that it is of a different, and hitherto undescribed species, though probably very closely allied to some others, especially to *Nemesia Manderstjernæ* (*N. meridionalis*, Cambr., described, p. 283); in the present species however the hind-lateral eyes are much larger in proportion than in *N. Manderstjernæ*.

Habitat. Digne, Basses Alpes, France.

NEMESIA DUBIA, sp. n., Plate XIX., fig. E, p. 229.

Syn. *Nemesia cæmentaria*, Simon, *Aranéides nouv. ou peu connus du Midi de l'Europe*, Mém. Liège, 1873 (separate copy), p. 24.

Adult male, length $5\frac{1}{2}$ lines to 6 lines.

M. Eugène Simon (l.c.) describes, as *N. cæmentaria*, Latr., both sexes of a spider found by himself in the Pyrenees and Spanish mountain regions.

Languedoc and Provence are also given as localities, but it is not clear that he has himself found it in these latter parts, certainly not the male.

Two examples of this sex, found in the Pyrenees, and received from M. Simon, are now before me; these correspond, so far, very exactly to the description he gives (l.c.); the female I have not seen.

If the position assumed (p. 271) on Latreille's own authority, that the true male of *N. cæmentaria*, Latr., (*N. carminans*, Latr.), has a bifid point to the prolongation of the palpal bulb, it is clear that the present species is distinct from that of Latreille.

M. Simon describes this palpal bulb as having its extreme point "simple et plus effilée" (*i.e.* more slender than in the preceding species he has described *N. meridionalis*). That the examples now before me,

agreeing exactly with this description, are not the males of the species above described by myself as *N. cæmentaria*, Latr., from numerous females found at Montpellier, appears to me clear, not only because I assume that of the true *N. cæmentaria*, Latr., males will be found to have the point of the palpal bulb bifid, but because the position of the eyes is markedly different in M. Simon's Pyrenean males and the Montpellier females. In the latter the eyes of the front row are separated from each other by equal intervals, in the former the interval between those of the central pair is very perceptibly greater than that between each and the lateral of the same row nearest to it. The interval also between each of the fore-central eyes and the hind-central on its side is proportionally much less.

It appears therefore necessary to characterize *N. cæmentaria* (Sim. l.c.) by some other name, for if eventually it should be found that Latreille has erred in *N. carminans* (with the *bifid point* to the palpal bulb) being the male of his *N. cæmentaria*, and that the Montpellier species has a male with a *simple point* to this part, even then the present spider cannot retain its name (*cæmentaria*), being distinct from the females found at Montpellier.

It is possible, of course, that the present species may hereafter be found, perhaps abundantly, at Montpellier; in that case it will have to be decided which of the two is most likely to be the species described by Latreille. In that eventuality it seems to me that the spider, above described from Montpellier, would be more probably Latreille's species, for one of its specific characters is a tolerably distinct and bold series of, not more than, five dark angular bars

along the middle of the upper side of the abdomen, agreeing exactly with Dugès' figures in the *Règne Animal* of Cuvier, quoted above (p. 271); while in M. Simon's Pyrenean spider, the abdominal pattern of the female described by him, does not agree with this: "il est orné d'une fine ligne noire longitudinale, un peu ondulée, présentant de nombreuses ramifications, s'étendant sur les parties latérales" (l.c. p. 26). The males before me accord with this description, though (as M. Simon also remarks) the "série de fins accents bruns transverses" is "peu visibles et souvent effacés" (l.c., p. 25); in one example this pattern is fairly distinct, in the other it is scarcely recognisable.

The present is a larger spider than *N. incerta* (the male found by M. Simon at Digne); it is also less distinctly marked both on the cephalothorax and abdomen. The position of the eyes is different, and so also is the palpal bulb; in that species the spine describes a simple curve with a strong outward direction; in the present it is slightly but perceptibly *sinuous*, and its general direction is *parallel to the radial joint of the palpus*; the spines also at the upper fore extremity of the radial joint are 5-6 in number instead of three. The outer side of the genual joint of each of the legs of the third pair has three spines; that on the left side, however, of one example, has four. The palpal bulb also appears to be proportionally smaller than that of *N. dubia*, or of *N. Manderstjernæ*, Auss. (*N. meridionalis*, Cambr.)

Another difference may here be noted between the present species and the Montpellier *cæmentaria*. M. Simon (*in lit.*) separates his *N. cæmentaria* from all

others by the length of the patella and tibia (genual and tibial joints) of the fourth pair of legs, exceeding in length that of the cephalothorax and falces.

This character has not been found to exist in several females of the Montpellier species, minutely measured by Mr. Moggridge; in them the length of the cephalothorax and falces were found to exceed that of the genual and tibial joints of the fourth pair of legs, by from $1\frac{1}{2}$ to 2 mm.

In regard to the relative length of the legs of the present species this was 4, 1, 2, 3 in the one example examined, and 4, 1, 2-3 in the other, both being males.

It is a matter of regret that nothing, as yet, has been accurately observed in regard to the particular type or form of the nest of *N. dubia*.

Habitat. Pyrenees and Spanish mountain regions.

NEMESIA MANDERSTJERNÆ, Plate XX., fig. B, C, p. 254.

Syn. *Nemesia Manderstjernæ*, Auss. ♂, *Beitr. zur Kenntn. der Arachn. Fam. der Territelariæ*, p. 54.

Nemesia meridionalis, Cambr. (female), *Harvesting Ants and Trap-door Spiders*, by J. T. Moggridge, p. 101. Plates IX. X. XI.

Adult male, length $6\frac{1}{4}$ to $7\frac{1}{2}$ lines.

Since the publication of the description of *N. meridionalis*, Cambr. (♀ l.c. *supra*), I have had an opportunity of examining an adult example of each sex of a *Nemesia*, described about the same time by M. Eugène Simon as *N. meridionalis*, Costa, in *Ara-néides nouv. ou peu connus du Midi de l'Europe*, p. 21 (separate copy). The species described by M. Simon

was found by himself abundantly in Corsica. He also gives Italy and Provence as localities, but the former of these two is, I conclude, given as being *Costa's* locality for the spider described by this latter author in *Fauna d. Regn. Napl. Arachn.*, p. 14; the other locality (Provence) would seem to have been doubtfully given. On careful examination of the Corsican examples (male and female), and on comparing them with the male and female of *N. meridionalis*, Cambr., as well as the description and figure given by Costa, I feel no doubt but that M. Simon is right in according to the Corsican species M. Costa's name—*meridionalis*. It agrees, I think, decidedly better, on the whole, with Costa's figure and description than the species to which (l.c.) I had allotted the specific name *meridionalis* conferred by that author. Nor had I any hesitation in accepting the determination made by M. Simon, in *Bull. Ent. Soc. Fr.*, 1873, sér. v. tom. 3, c.; that my *N. meridionalis* ♀ is the female of *N. Manderstjernæ*, Auss., the more especially as since the publication of my description I have received from the same locality (Mentone) not only the male of the spider described by myself (l.c.), but also the type of M. Ausserer's description of *N. Manderstjernæ* (found at Nice), and believe these to be identical in species. There is, indeed, a difference in the, apparent, relative positions and colour of the eyes of the two spiders, but no more than may be well accounted for by the condition of M. Ausserer's type (most kindly lent to me for examination by its owner, Dr. Ludwig Koch); this example is much shrunken, having the appearance of having been allowed to get dry and then to have been

again immersed in spirit. This would (I have frequently found it so in other spiders) cause even the hard integument of the cephalothorax to contract, and so cause the eyes to shrink up together into a closer group, as well as to sink down into the cuticle, making some of them appear smaller than they really are. Alternate drying and wetting again in spirit would also account for the yellowish brown colour of the eyes, whereas in the male of the Mentone spider the eyes of the hinder row are pearly grey, and of the front row dark grey. Beyond these differences I can find no distinction between them.

The male of the present species is very nearly allied to both *N. incerta* (p. 276) from the Pyrenees, and *N. dubia* (p. 280) from Digne, of both of which, as remarked (l.c.); the male sex alone is known to me; it is, however, larger than either, more richly coloured, and more distinctly marked. In all three species the elongated portion of the palpal bulb has a simple point, but in the present spider it is not drawn out so finely and gradually: some portion of its extremity being, though very fine yet really, cylindrical, and not tapering off into a hair-like termination; the general direction of the palpal bulb is parallel with the radial joint, but the point which is equally curved is directed outwards and a little downwards; the radial joint has four spines at the fore extremity on the upper side (in one of the examples there were however seven on the radial joint of the right palpus), and the genual joint of each leg of the third pair, in both examples from Mentone as well as in M. Ausserer's example from Nice, has three spines on its outer side. This character was not remarked upon in the de-

scription of *N. meridionalis* ♀ (Cambr. l.c.). It is not invariable in a long series of female examples; occasionally one is found with four spines on one of these genual joints, in others there is occasionally but one spine and sometimes (but rarely) none; perhaps in this case broken off? I am inclined to attach some importance as a specific character to the number, presence, or absence of these spines on the outer side of the genual joint of the third pair of legs; not that it is an invariable character, few, if any, specific characters are absolute and invariable, nor that it is of more importance than the armature of other portions of the different legs, but as being more easily observed and less liable to injury than the larger and more numerous spines on other parts. Equally useful in specific determination are the spines at the fore-extremity on the upper side of the radial joint of the palpus. This, however, applies only to the male, whereas the character derived from the spines on the genual joints of the third pair of legs applies to both sexes.

Another character by which the present species (♀) may be distinguished from *N. dubia* (*N. cæmentaria*, Sim.) is that the former is rather narrower at the fore extremity of the caput, which is also less elevated, being almost equally level with the thorax.

The description of the female given (l.c. *supra*) needs but little addition. It may be noticed, however, that the central longitudinal tapering orange band on the caput is faintly continued to the extreme hinder margin of the thorax, and the thoracic fovea is rather sharply curved. The intervals between the eyes is the same as in those of *N. Moggridgii*, though

their absolute size in some examples appeared to be smaller. In both sexes there are several small, black, tooth-like, tubercular spines on the inner side of the base of each maxilla, but none at the apex of the labium.

The colour of the *cephalothorax* in the male is bright-reddish orange-yellow; a large portion of the sides of the caput, and the ocular area also, is black-brown; the middle of the thorax is distinctly marked with black-brown lines radiating to the thoracic fovea.

Other, less deep, brown markings are mixed with these radiating lines; there are a few prominent bristles in front of the ocular area, a single longitudinal line of erect bristles along the middle of the orange band from the eyes to the thoracic fovea, and the whole cephalothorax is more or less clothed with greyish-yellow adpressed hairs.

The *falces* are of a deep blackish red-brown colour, longitudinally striped with yellow-greyish hairs mixed with dark bristles; and there are some strong spines at the fore extremity on the inner side.

The *abdomen* is oval, tolerably convex above, of a dull, pale, straw colour, suffused with brown at its fore extremity, whence an indistinct central longitudinal band tapers to a point rather more than half way to the spinners; on either side of this band are some oblique, lateral, brown lines, which become broken chevrons, between the termination of the central band and the spinners. The sides are obscurely and irregularly marked with brown, and the under side is of a uniform dull straw-yellow; the abdomen is clothed thickly with mixed yellow-grey

and dark hairs ; the upper side is furnished also with strong, nearly erect bristly black ones.

Each *tarsus* terminates with three claws ; those of the superior pair are pectinated beneath, but the number of teeth appears to vary in the different legs, from six to eight. The tibial joint of the first pair is of the same character as that in the males of other species : it has a strong black curved spine directed inwards from the fore extremity of the under side, and a short bluntish-conical, but very distinct prominence at the same extremity on the inner side, not far from the base of the curved spine, Plate XX., fig. B 4 and C ; the colour of the legs is yellow, tinged with orange, the upper sides of the femora being nearly black ; the palpi are similar in colour, the upper side of the humeral joints being suffused with a blackish hue.

The relative length of the legs is not constant ; in one example it was 4, 3, 1, 2, in the other 4, 1, 2, 3, 2 and 3 being very nearly equal. Similar variations are also found in the legs of the female.

In regard to the nest of this species, researches made subsequently to the publication of *Harvesting Ants and Trap-door Spiders* have proved it to be of rather a different form from that there represented ; thus in the main tube, just before the inner door is reached, there is a descending branch running off from the main tube at the same angle as the ascending branch, but in an opposite direction ; in the older and larger nests the descending branch becomes choked with débris ; it is more distinct in the nests of the younger spiders, and is always more or less distinctly traceable.

N.B.—In the above details there have been only

one or two special distinctions observed between the two male examples examined. It should however be noted that in one (the one captured behind a stone wall) the ocular area was slightly narrower in proportion to its length, and the interval between the eyes of each lateral pair rather less.

Habitat. San Remo, Bordighera, Mentone, Cannes, and Hyères.

NEMESIA MERIDIONALIS, Plate XVII., fig. B, p. 215.

Syn. *Nemesia meridionalis*, Costa, *Fauna d. Regn. Napl. Arachn.*, p. 14, Pl. I., figs. 2, 3.

— — Simon, *Aranéides nouv. ou peu connus du Midi de l'Europe*, Mém. Liège, 1873 (separate copy), p. 21.

Adult male, length $6\frac{3}{4}$ lines (14 mm.), female adult, length $10\frac{1}{2}$ lines (22 mm.).

The examination of an adult example of each sex of this spider received from M. Simon, by whom they were found in Corsica, leads me to conclude that we have here the true *N. meridionalis*, Costa, as certainly at least as it is possible at present to identify the species by the insufficient description and figures given by this author.

The *eyes* appear to be less closely massed together than in *N. Manderstjernæ*, but in other respects no particularly tangible difference is to be noted; the interval however between the eyes of each lateral pair is perhaps rather greater. Between the male and the female of the present species there is a decided difference in the relative position of the eyes. In the female the fore-centrals are nearer together than each is to the fore-lateral on its side, while in the male, the

fore-centrals are wider apart than each is from its fore-lateral. I have also noted a similar difference in regard to *N. Manderstjernæ*. The fore-centrals are also smaller in the female than in the male.

The two species, although bearing such great general similarity to each other, may be at once distinguished by several very tangible differences. First in regard to the *male*. The *cephalothorax* of *N. meridionalis* has the whole caput of an almost uniform dark brown colour, two slender yellow lines beginning, one a little way behind each lateral pair of eyes, and converging rather quickly towards each other, run on nearly parallel, but in close proximity together to the thoracic fovea. The centre of the thorax is also dark brown, the brown portion formed by radiating confluent patches, rather than by distinct lines as in *Manderstjernæ*. The curve of the thoracic fovea is sharp, in fact more in the form of a straight line with the ends bent down.

The *cephalothorax* is of nearly one uniform level and convexity above; the caput being a little more rounded than the thorax; the eye eminence seemed to be rather higher than in *N. Manderstjernæ*, and the *clypeus*, which is steepish, is impressed in the middle and exceeds in height half that of the facial space; on the lower margin of the *clypeus* is a transverse row of several strong prominent bristles. There were no bristles behind the eyes, and no appearance of any having been broken off there (the female, however, has a single longitudinal row on the caput). The lateral and hinder margins of the cephalothorax, however, are, in the male (but not in the female) clothed with black bristles and bristly hairs.

The *palpi* are longer than in *Manderstjernæ*. The radial joints have, at the upper fore extremity of each, five spines, *three* in front in a transverse line, and *two* immediately behind them. The palpal bulb is more globular, and the spiny production, which is not very long, springs from it more suddenly, and is *strongly sinuous*, its sharp tapering point directed outwards. The strong sinuosity of this part distinguishes it at once both from *N. Manderstjernæ* and all other known European males with a simple point to the palpal organs.

The *legs* are longish and strong; their relative length 4-1, 3, 2 (male); 4-1, 2, 3 (female); they are furnished with hairs, bristles, and spines. These do not appear to call for special notice, except that each genual joint of those of the third pair has two spines on its outer side in both sexes.

The superior tarsal claws are denticulated, but the denticulations differ in number and strength, not only in the two sexes and in the different legs, but in some instances in the two superior claws of the same leg. The denticulations seemed to be more numerous in the female than in the male.

The *abdomen* is elongate oval, and of a straw yellow colour. In the *male* the fore part of the upper side is irregularly black brown, followed by an irregular somewhat broken longitudinal central bar, and some broken oblique lines and portions of chevrons. In the *female* the fore part is less densely blackish, the central longitudinal line is obscure, but the oblique lateral lines are more distinct and less broken, but none are quite united so as to form chevrons, though the two or three nearest to the spinners almost do so.

The upper side is furnished with numerous strong nearly erect black bristles.

The *labium* has a row, of bristles only, at its apex.

The markings of the cephalothorax in the female are very nearly like those of that sex in *N. Manderstjernæ*; the tapering orange yellow band, however, behind the eyes appears to be rather bolder, as in that species this band also is faintly traceable quite to the hinder thoracic margin. The inner corner of the base of the maxillæ, in both sexes, has several minute tooth-like black spines.

The form of the cephalothorax in the female differs from that of the male; in the latter sex (male) it is narrower before and rather rounded behind; in the former sex (female) it is broadest before and more distinctly hollow-truncate behind; the caput is also rounder and more elevated. In the female the tarsi and metatarsi of the two first pairs of legs have close set brush-like hairs beneath; these are wanting in the two hinder pairs, and also almost entirely wanting on the two first pairs in the male.

Various other characters, both peculiar and differential, are noted in regard to this species by M. Simon (l.c.). It is to be regretted that this painstaking observer did not note more exactly the form and type of its nest; from his description of it, however, it appears to be branched, but whether the door is of the wafer or cork type, or whether it has an inner door or not, is not mentioned.

Habitat. Corsica.

NEMESIA CONGENER, sp. n., Plate XVIII., fig. A,
p. 225.

Adult female, length 9 lines (19 mm.).

In general appearance, colours, and markings this spider bears great resemblance to *N. cæmentaria*. The eyes, however, appeared to be smaller, and the hind-centrals also smaller in proportion to the rest. The pale margins of the cephalothorax are in the present species generally confined to some rather indistinct pale patches.

The central orange band from the eyes to the thoracic fovea is, especially in immature examples, often only a simple tapering line; in others it is larger, and often composed of three converging narrow orange bands, which form, in some examples, a broad central tapering band, marked with two longitudinal dark lines. The thoracic fovea is curved, but not sharply.

The *abdomen* is broadish oval, of a dull clay colour, marked with dark brown lines, and markings on the sides and upper side. In some examples these form a longitudinal central series of curved or slightly angular lines; in others but little trace of regular chevrons can be seen.

In the present spider there is also a longitudinal pale yellowish patch on the inner upper margin of the falcæ near their base; they are furnished with hairs in longitudinal bands, and spines, like others of the genus.

The *legs* are moderately long, strong, and furnished with hairs and bristles, and, sparingly, with spines. The genual joints of the third pair have some spines on the outer side, varying from one to three in different examples. The tarsi and metatarsi of the first and second pairs, as well as the radial and digital

joints of the palpi, have strong lateral brush-like fringes of close-set sooty black hairs. The superior pair of tarsal claws are denticulated, but not uniformly either in strength, number, or position.

No doubt this will prove a very troublesome spider to distinguish with certainty from *N. cæmentaria*, but the almost constant presence of a spine or spines on the outer face of the genual joint of the third pair of legs seems to be a good distinguishing character; in no one example out of nine carefully examined could I detect their absence altogether, while a single spine even on *N. cæmentaria* is rare.

In the present species five examples had three spines on each of these joints; two had two spines on each; one had a single spine on each; another had one on one side, two on the other.

The nest, however, is very characteristic and peculiar. It is of the wafer-lid type, and so cannot, from even the outside, be mistaken for that of *N. cæmentaria*, which is of the cork-lid type; it is, moreover, branched below, while that of *N. cæmentaria* is a single unbranched tube. It has also an inside door, or valve, of very remarkable construction, having two perfect cork-like faces, securely shutting off either the branch, or the main tube just above the branch, at pleasure. By this latter character it is distinguished also from the tube of *N. Manderstjernæ*, as well as by the absence of a second short branch or cavity, lately discovered in the nest of this last spider. Examples of this spider were found, not unfrequently, but invariably in such nests as that above described, at Hyères.

The female sex only has yet been met with.

Habitat. Hyères.

NEMESIA SUFFUSA, sp. n., Plate XVII., fig. A,
p. 215.

Immature female, length $7\frac{1}{2}$ lines ($15\frac{1}{2}$ mm.).

Although no example was quite adult, this species may readily be distinguished from all others yet known to me, by its more elongated form, particularly the cylindrico-ovate form of the abdomen.

The *cephalothorax* is oval, broadest towards its posterior extremity, where it is rounded, the fore-margin being truncated; the caput is well rounded and convex, and the thorax perhaps more so than in other species, so that when looked at in profile there is a considerable dip or hollow at the thoracic fovea; this fovea forms a slight curve. Except that the lateral margins are rather broadly pale towards the hinder part (though the pale portion is ill-defined), the whole of the cephalothorax is of a uniform dull yellowish-brown colour; the extreme lateral margin is marked by a black line, and in one or two examples there was an indistinct yellowish central longitudinal line from the eyes to the thoracic junction, having a single row of prominent bristles upon it. The whole surface of the cephalothorax is fairly clothed with dusky yellowish-grey adpressed hairs: the ordinary grooves and indentations are well marked.

The *eyes* are on the usual eye eminence, which is perhaps rather more elevated than ordinary, and its summit black; their position is ordinary. It may, however, be noticed that the fore-centrals are placed more forward than in most of the other known species; the fore-centrals are about *equally* separated from each other, and from the fore-laterals nearest to each respectively; they are also separated from the hind-

central nearest to each, by an interval not differing much from that between each other; the hind-centrals are distinctly oval, or rather somewhat semilunar in form, smallest of the eight (except in one example, when they were almost, if not quite, as large as the fore-centrals), and at their hindermost point very near, but not quite contiguous, to the hind-laterals. The eyes of each lateral pair (of which the hinder is very nearly equal in size to the fore one, are very near, but not quite contiguous, to each other; the interval between them is narrower than that between the corresponding eyes in almost any other yet described species.

The *legs* are neither long nor very strong; their relative length is 4, 1, 2, 3, though between 2 and 3 there is in different examples the same variation observed in other species; sometimes they are equal, and sometimes one, and then the other, very slightly the longest: their colour is pale yellowish, and they are furnished with hairs, bristles, and spines, but the latter are not numerous, and appeared to be both longer and slenderer than usual; the genual joints of the third pair have spines, from one to three on the outer side, for the most part, three; the superior tarsal claws are pectinated (but not uniformly on all the legs) beneath their hinder portion.

The *falces* are strong, and similar in colour to the cephalothorax, but they do not appear to call for any special remark.

The *maxillæ* have a few minute tuberculiform black teeth at their base on the inner side, and, with the *labium* (which has no hairs at its apex) and *sternum*, are similar in colour to the legs.

The *abdomen* is of an elongated, or cylindrico-ovate

form, of a dull drab-yellowish colour, with a central, longitudinal, irregular, rather chocolate-brown bar on its upper side, and 6 to 7 well-defined lateral oblique slightly curved lines of the same colour and touching the central line; between these lines are some other irregular, but similarly coloured, markings.

The sides are almost immaculate, and the underside quite so; the spinners are ordinary.

About 10 examples (all immature) were found at Montpellier in branched tubes closed at the entrance with a wafer-lid. The branch arises some way below the entrance and runs up to the surface at an acute angle with the main tube; there is no lower door, and thus this tube forms the type of a new form of nest, being branched, with a wafer-lid, but without a lower door.

This species cannot be confused with *N. cæmentaria*, which is found abundantly in the same locality; both the general form, colours, markings, and nest readily distinguish it from that species.

Habitat. Montpellier.

NEMESIA SIMONI, sp. n., Plate XVI., fig. A, p. 211.

Adult female, length rather more than $9\frac{1}{4}$ lines (20 mm.).

This spider is of a proportionally broader and stouter form than others of the genus *Nemesia*, and the cephalothorax (which is entirely glabrous and destitute of adpressed hairs) has the caput more rounded and elevated than in any other species of *Nemesia* known to me, approaching *Cteniza* in these respects.

The *cephalothorax* is oval, truncate, and about equally broad at each end; the ordinary grooves and indentations are strong; besides the groove which indicates its union with the thorax, the caput has an indented or pinched-in appearance towards its hinder part on each side. Except that this was present in all the examples examined (ten) it might have been taken to be accidental.

The colour of the *cephalothorax* is dark brown tinged with yellow, darkest on the sides of the caput, which is divided longitudinally by a narrow, dull, orange-yellow line, and lightest on the margins towards the hinder part; the thoracic fovea is curved, but more deeply indented and the indentation is wider at each end than in other species, the ends being a little turned back: there is a single longitudinal row of long erect bristles along the central line of the caput, and a few more on the lower margin of the clypeus.

The *eyes* form a narrower oblong area than usual, owing chiefly to their small size and to those of each lateral pair being almost contiguous to each other, separated only by an interval equal to that which divides each hind-lateral from the hind-central nearest to it. The hind-centrals are smallest of the eight, and vary in form, being round, semilunar, or roughly wedge-shaped, differing at times in the same example. The eye eminence is less elevated than in most species, and this brings the fore-centrals nearer to the straight line of the fore-laterals; these last are the largest of the eight. The height of the clypeus exceeds half that of the facial space.

The *legs* are short and strong; their relative length

4, 1, 3, 2, or 4, 1, 2, 3, or 4, 1, 2-3; they are of a brownish yellow colour, deeper on their fore-sides, furnished with hairs, bristles, and spines, the latter not very numerous nor unusually strong; there are no spines on the outer sides of the genual joints of the third pair; the tarsal claws are longish and strong. Those of the superior pair have but one, two, or three pectinations on their underside; on some of the legs I could not detect any. There seemed to be no more uniformity in the tarsal-claw pectinations in this species than in others. The tarsal and metatarsal joints of the legs of the first pair have a fringe of close-set short blackish hairs on either side, as also have the digital joints of the palpi, these being similar to the legs in colour and armature; the humeral joints are very deep but narrow, being apparently bent and hollowed on their inner sides to allow of meeting well over the falces.

The terminal palpal claw has two teeth towards its base on the underside. I could not ascertain satisfactorily whether this is or not a uniform character in all examples; in one example these denticulations were very plain, but they seemed to be wanting in others.

The *falces* are very strong and massive, round in their profile, and very roundly prominent near their base on the upper side. They are of a rich deep black-brown colour, glossy, and furnished along their inner margins with black bristles and hairs, and with strong spines at their extremity on the upper side. The fang is strong, and the outer margin of the groove in which it lies when at rest has some strong teeth.

The *maxillæ* are strong, of normal form, but very convex on their outer surface.

The small tuberculous teeth noticed at the base on the inner side of the *maxillæ* of all the other species I have examined, were visible (though with difficulty) in this species also.

The *labium* is broader than it is high, convex on its face, and rounded at the apex; it is (as also are the *maxillæ* and *sternum*) of the same colour as the legs, and clothed with numerous strong bristly hairs.

The *abdomen* is short-oval, and strongly convex above; it is of a dull clay-coloured brown tinged with chocolate, and along the centre of its upper side is a series of six strong angular bars or chevrons of a dark chocolate-brown colour, and pretty distinctly defined, though, when examined closely, broken in parts.

The intervening spaces between the angular bars and the sides have a few irregular markings of a similar colour; and they are connected by a longitudinal central line of the same hue running through their apices.

The abdomen is very sparingly clothed with hairs and fine bristles; the superior pair of spinners are strong; those of the inferior pair very small and short.

Examples of this fine and very distinct spider were found at Bordeaux in simple unbranched tubes, covered with a wafer-lid, running down very deep into the earth, in some cases as much as fifteen inches into an exceedingly hard soil, making it a work of great labour and care to get them out without injury.

This species can scarcely be confused with any other yet known; its short robust form, short legs,

more elevated caput, general dark colour, distinct angular bars on the abdomen, and almost contiguous lateral eyes, as well as the form of the nest, will readily distinguish it.

It is with great pleasure that I connect with this spider the name of my most kind friend and brother arachnologist, Monsieur Eugène Simon, to whom I am so greatly indebted for much information and numerous examples of rare spiders.

I must not conclude these descriptions without expressing my sense of obligation to Mr. Moggridge for so kindly allowing me to add them to the far more popular, and more interesting, portion of this volume, in which the *habits* of these spiders are recorded.

Descriptions of *colour*, *form*, and *structure* are but dry details, though very necessary for the determination of species; and in the present case it is very important as well as interesting to be able to conclude with some certainty that differences of type in the tubular nests of the spiders Mr. Moggridge has observed so closely and accurately, are joined to well-marked specific differences obtained from those other characters above mentioned, and which it has been my endeavour to detail as fully and faithfully as possible.

INDEX TO SUPPLEMENT.

PART I.—HARVESTING ANTS.

- ALYSSOCARPUS, seeds of, collected by ants, 175
AMPHIBIENA, found in nests of *Lauba* ants, 177
André (M. Ernest), on number of species of ants found in Europe, 160
(note)
Arabia, custom in, relative to ants, 176
ATA, species of, found in Europe, 160 (note); *barbara*, 158; found in
Palestine, 165; *megacephala*, 160; *structor*, 158; experiment with,
172; found harvesting at Cadenabbia, 159
Cadenabbia, harvesting ants at, 159
CAMPONOTUS *sylvatica*, 178
CICENDELA, capturing ants, 164
COLUCERA *atte*, found in ants' nests, 177
Cricket (*GRYLLUS myrmecophilus*), found in ants' nests, 178
England, do ants harvest in, 159 (note)
Formic acid, experiments with, 173
FORMICA *erratica*, 164; *nigra*, collecting violet seeds, 159 (note)
GRYLLUS *myrmecophilus*, found in ants' nests, 178
Hindoos, custom of scattering rice for ants, 176
India, observations in, 175
Insects found in ants' nests, 177
Jews, laws treating of rights over ants' stores, 165
King (Dr.), observations in India, 175
Lizards capturing ants, 162
Misna, allusion to harvesting ants in, 165
Montpellier, harvesting ants at, 160
Nests, quantity of seeds contained in, 170
Palestine, harvesting ants in, 165

- PHEIDOLE megacephala*, 160
PTEROCLES exustus, feeding on seeds collected by ants, 175
Robin eating ants, 163 (note)
Seed-stores of ants, Jewish laws about, 165
Seeds, intervention of ants necessary to prevent germination of, 172 ;
 non-germination of in granaries, 171
Wakefield (Mr.), on ants collecting violet seeds, 159 (note)

PART II.—TRAP-DOOR SPIDERS.

- Ants* form a large part of food of trap-door spiders, 237
ATYPUS bleodonticus (Sim.), 183 (note) ; *piceus* (Sulzer), nests of, 182-3,
 248 ; species of in England, 181, 185
Australia, nest of wafer type from, 217
Bates (Mr. H. W.), on the nest of *Theraphosa Blondii*, 188
Beetle (*CHRYSOMELA Banksii*) rejected by trap-door spider, 241
Blackwall (Mr. J.), on the poison of spiders, 201
Bordeaux, new type of nest at, 211
Brown (Mr. Joshua), discovery of *Atypus* in England, 185
California, trap-door spider from, 198-9 ; habits of in captivity, 203,
 &c. ; indifference to sounds, 206
Captive spiders, habits of, 203, 218, 242-6
Caterpillar (larva of *CUCULLIA verbasci*), eaten by trap-door spider, 239
Cell and tube made by *N. Eleanora*, 218 ; hygrometricity of, 220
Chrysomela Banksii, distasteful to trap-door spider, 241
Cork nest, 193 ; structure of door of, 193
CTENIZA californica (Camb.), 198, 202, 248 ; description of, 260 ; eggs
 laid by, 203 ; habits of in captivity, 203, &c. ; indifference to
 sounds, 206 ; mode of excavating, 208 ; *fodiens* (Walck.), 195, 248,
 259 ; *ionica*, 210 ; *Moggridgii* (Camb.), 196 ; description of, 254 ;
 habits of in captivity, 243, 246
CUCULLIA verbasci, larva of, eaten by trap-door spider, 239
CYRTAUCHENIUS elongatus (Sim.), nest of, 189, 248
Diagrams representing different types of nest, 193
Earwig (*Forficula*) eaten by trap-door spiders, 238
Eggs of *CTENIZA californica*, 203
Enemies of spiders, 200, 205
Enlargement of nests, 245
Excavation of trap-door nests, 208, 243-4

- Food of trap-door spiders, 237-9, 241; mode of procuring, 238
- Funnel type of nest, constructed by *Cyrtuchenius elongatus*, 189
- Geographical distribution, 247-9, 250
- Hyères double-door, branched wafer type, 223
- IDIOTIS *helva* (L. Koch), nest of, 217
- Koch (Dr. L.), on nest of *Idiopsis helva* from Australia, 217
- Lanzwert (Dr.), on trap-door spiders in California, 199
- Latreille (P. A.), on the nest of *LYCOSA tarentula*, 236
- LYCOSA *tarentula*, nests of at Cannes, 233; nests closed in the winter, 235
- Montpellier, NEMESIA *cementaria* at, 196, 198; *N. suffusa* at, 215
- NEMESIA *cementaria* (Latr.), 195-6, 249; description of, 264; congener (Camb.), 224, 249; description of, 292; *dubia* (Camb.), description of, 280; *Eleanora* (Camb.), 218, 249, 272; *incerta* (Camb.), description of, 276; *Mandersjermæ* (Auss.), 226, 249; description of, 283; *meridionalis* (Costa), 227, 250; description of, 289; *Moggridgii* (Camb.), 197-8, 249; description of, 273; *Simoni* (Camb.), 211, 249; description of, 297; *suffusa* (Camb.), 215, 249; description of, 295
- Nests enlarged, not deserted, 245
- Nocturnal habits of trap-door spiders, 249
- Oniscus* (wood-louse) eaten by trap-door spider, 241
- Poison of spiders, 200-1
- Simon (M. E.), on *Atypus piccus* (Sulzer), 182; on *CYRTUCHENIUS elongatus* (Sim.), 189
- Tarantula*, 233, 235
- Theraphosa Blondii*, nest of, 188
- Wafer nests of single-door unbranched type, 193 (note), 211; of single-door branched type, 193, 214; of double-door unbranched type, 193, 218; of Hyères double-door branched type, 193, 223; of double-door branched cavity type, 193, 228
- Wood-louse (ONISCUS) eaten by trap-door spider, 241
- Worms the food of *Atypus*, 182, 186

LIST OF WORKS

PUBLISHED BY

L. REEVE & CO.,

5, Henrietta Street, Covent Garden, W.C.

NEW SERIES OF NATURAL HISTORY FOR BEGINNERS.

. A good introductory series of books on Natural History for the use of students and amateurs is still a *desideratum*. Those at present in use have been too much compiled from antiquated sources; whilst the figures, copied in many instances from sources equally antiquated, are far from accurate, the colouring of them having become degenerated through the adoption, for the sake of cheapness, of mechanical processes.

The present series will be entirely the result of original research carried to its most advanced point; and the figures, which will be chiefly engraved on steel, by the artist most highly renowned in each department for his technical knowledge of the subjects, will in all cases be drawn from actual specimens, and coloured separately by hand.

Each work will treat of a department of Natural History sufficiently limited in extent to admit of a satisfactory degree of completeness.

The following are now ready:—

British Insects; a Familiar Description of the Form, Structure, Habits, and Transformations of Insects. By E. F. STAVELEY. Crown 8vo, 16 Coloured Steel Plates, engraved from Natural Specimens expressly for the work by E. W. ROBINSON, and numerous Wood-Engravings by E. C. RYE, 14s.

British Butterflies and Moths; an Introduction to the Study of our Native LEPIDOPTERA. By H. T. STAINTON. Crown 8vo, 16 Coloured Steel Plates, containing Figures of 100 Species, engraved from Natural Specimens expressly for the work by E. W. ROBINSON, and Wood-Engravings, 10s. 6d.

British Beetles; an Introduction to the Study
of our Indigenous COLEOPTERA. By E. C. RYE. Crown 8vo, 16 Coloured Steel Plates, comprising Figures of nearly 100 Species, engraved from Natural Specimens, expressly for the work, by E. W. ROBINSON, and 11 Wood-Engravings of Dissections by the Author, 10s. 6d.

British Bees; an Introduction to the Study of
the Natural History and Economy of the Bees indigenous to the British Isles. By W. E. SHUCKARD. Crown 8vo, 16 Coloured Steel Plates, containing nearly 100 Figures, engraved from Natural Specimens, expressly for the work, by E. W. ROBINSON, and Woodcuts of Dissections, 10s. 6d.

British Spiders; an Introduction to the Study
of the ARANEIDÆ found in Great Britain and Ireland. By E. F. STAVELEY. Crown 8vo, 16 Plates, containing Coloured Figures of nearly 100 Species, and 40 Diagrams, showing the number and position of the eyes in various Genera, drawn expressly for the work by TUFFEN WEST, and 44 Wood-Engravings, 10s. 6d.

British Grasses; an Introduction to the Study
of the Grasses found in the British Isles. By M. PLUES. Crown 8vo, 16 Coloured Plates, drawn expressly for the work by W. FITCH, and 100 Wood-Engravings, 10s. 6d.

British Ferns; an Introduction to the Study
of the FERNS, LYCOPODS, and EQUISETA indigenous to the British Isles. With Chapters on the Structure, Propagation, Cultivation, Diseases, Uses, Preservation, and Distribution of Ferns. By M. PLUES. Crown 8vo, 16 Coloured Plates, drawn expressly for the work by W. FITCH, and 55 Wood-Engravings, 10s. 6d.

British Seaweeds; an Introduction to the Study
of the Marine ALGÆ of Great Britain, Ireland, and the Channel Islands. By S. O. GRAY. Crown 8vo, 16 Coloured Plates, drawn expressly for the work by W. FITCH, 10s. 6d.

Other Works in preparation.

BOTANY.

The Young Collector's Handybook of Botany.

By the Rev. H. P. DUNSTER, M.A. 66 Wood-Engravings, 3s. 6d.

The Natural History of Plants. By H.

BAILLON, President of the Linnæan Society of Paris, Professor of Medical Natural History and Director of the Botanical Garden of the Faculty of Medicine of Paris. Translated by MARCUS M. HARTOG, B. Sc. Lond., Scholar of Trinity College, Cambridge. Super-royal 8vo. Vols. I. to III., with 1300 Wood-Engravings, 25s. each.

Domestic Botany; an Exposition of the

Structure and Classification of Plants, and of their uses for Food, Clothing, Medicine, and Manufacturing Purposes. By JOHN SMITH, A.L.S., ex-Curator of the Royal Botanic Gardens, Kew. Crown 8vo, 16 Coloured Plates and Wood-Engravings, 16s.

Handbook of the British Flora; a Description

of the Flowering Plants and Ferns indigenous to, or naturalized in, the British Isles. For the Use of Beginners and Amateurs. By GEORGE BENTHAM, F.R.S., President of the Linnæan Society. New Edition, Crown 8vo, 12s.

The Illustrated British Flora, a Description

(with a Wood-Engraving, including dissections, of each species) of the Flowering Plants and Ferns indigenous to, or naturalized in, the British Isles. By GEORGE BENTHAM, F.R.S., President of the Linnæan Society. Demy 8vo, 2 vols., 1295 Wood-Engravings, from Original Drawings by W. FITCH, 35s. 70/-

British Wild Flowers, Familiarly Described

in the Four Seasons. A New Edition of "The Field Botanist's Companion." By THOMAS MOORE, F.L.S. Demy 8vo, 24 Coloured Plates, by W. FITCH, 16s.

Outlines of Elementary Botany, as Introduc-

tory to Local Floras. By GEORGE BENTHAM, F.R.S., President of the Linnæan Society. Second Edition, 2s. 6d.

British Grasses ; an Introduction to the Study of the Gramineæ of Great Britain and Ireland. By M. PLUES. Crown 8vo, with 16 Coloured Plates by W. FITCH, and 100 Wood-Engravings, 10s. 6d.

The Botanical Magazine : Figures and Descriptions of New and Rare Plants of Interest to the Botanical Student, and suitable for the Garden, Stove, or Greenhouse. By Dr. J. D. HOOKER, C.B., F.R.S., Director of the Royal Gardens, Kew. Royal 8vo. Published Monthly, with 6 Plates, 3s. 6d. coloured. Annual Subscription, 42s. Re-issue of the Third Series in monthly vols., 42s. each ; to Subscribers for the entire series, 36s. each.

The Floral Magazine New Series, enlarged to Royal 4to. Figures and Descriptions of the choicest New Flowers for the Garden, Stove, or Conservatory. Monthly, with 4 beautifully Coloured Plates, 3s. 6d. Annual Subscription, 42s. First Series complete in 10 vols., with 560 beautifully Coloured Plates, £18 7s. 6d.

Laws of Botanical Nomenclature adopted by the International Botanical Congress, with an Historical Introduction and a Commentary. By ALPHONSE DE CANDOLLE. 2s. 6d.

The Tourist's Flora ; a Descriptive Catalogue of the Flowering Plants and Ferns of the British Islands, France, Germany, Switzerland, Italy, and the Italian Islands. By JOSEPH WOODS, F.L.S. Demy 8vo, 18s.

Contributions to the Flora of Mentone, and to a Winter Flora of the Riviera, including the Coast from Marseilles to Genoa. By J. TRAHERNE MCGRIDGE, F.L.S. Royal 8vo. In 4 parts, each, with 25 Coloured Plates, 15s., or complete in one vol., 63s.

Flora Vitiensis ; a Description of the Plants of the Viti or Fiji Islands, with an Account of their History, Uses, and Properties. By Dr. BERTHOLD SEEMAN, F.L.S. Royal 4to, Parts I. to IX. each, 10 Coloured Plates, 15s. Part X., 25s., or complete in one thick vol., cloth, £8 5s.

Flora of British India. By Dr. J. D. HOOKER, C.B., F.R.S., &c.; assisted by various Botanists. Parts I. and II., each 10s. 6d. Published under the Authority of the Secretary of State for India in Council.

Flora of Tropical Africa. By DANIEL OLIVER, F.R.S., F.L.S. Vols I. and II., 20s. each. Published under the authority of the First Commissioner of Her Majesty's Works.

Handbook of the New Zealand Flora; a Systematic Description of the Native Plants of New Zealand, and the Chatham, Kermadec's, Lord Auckland's, Campbell's, and Macquarrie's Islands. By Dr. J. D. HOOKER, F.R.S. Complete in one vol., 30s. Published under the auspices of the Government of that colony.

Flora Australiensis; a Description of the Plants of the Australian Territory. By GEORGE BENTHAM, F.R.S., President of the Linnæan Society, assisted by FERDINAND MUELLER, F.R.S., Government Botanist, Melbourne, Victoria. Vols. I. to VI., 20s. each. Published under the auspices of the several Governments of Australia.

Flora of the British West Indian Islands. By Dr. GRISEBACH, F.L.S. 37s. 6d. Published under the auspices of the Secretary of State for the Colonies.

Flora Hongkongensis; a Description of the Flowering Plants and Ferns of the Island of Hongkong. By GEORGE BENTHAM, P.L.S. With a Map of the Island, and a Supplement by Dr. HANCE. 18s. Published under the authority of Her Majesty's Secretary of State for the Colonies. The Supplement separately, 2s. 6d.

Flora Capensis: a Systematic Description of the Plants of the Cape Colony, Caffraria, and Port Natal. By WILLIAM H. HARVEY, M.D., F.R.S., Professor of Botany in the University of Dublin, and OTTO WILHEM SONDER, Ph.D. Vols. I and II., 12s. each. Vol. III., 18s.

Flora of Tasmania. By Dr. J. D. HOOKER, F.R.S. 2 vols. Royal 4to. 200 Plates, £17 10s., coloured. Published under the authority of the Lords Commissioners of the Admiralty.

On the Flora of Australia, its Origin, Affinities, and Distribution; being an Introductory Essay to the "Flora of Tasmania." By Dr. J. D. HOOKER, F.R.S., 10s.

Genera Plantarum, ad Exemplaria imprimis in Herbariis Kewensibus servata definita. By GEORGE BENTHAM, F.R.S., President of the Linnæan Society, and Dr. J. D. HOOKER, F.R.S., Director of the Royal Gardens, Kew. Vol. I. Part I. Royal 8vo, 21s. Part II., 14s.; Part III., 15s.; or Vol. I. complete, 50s. Part IV. (being Vol. II. Part I.) 24s.

Illustrations of the Genus Carex. By FRANCIS BOOTT, M.D. Folio, 600 Plates. Part I., 10l. Parts II. and III., each 5l. Part IV., 10l.

Illustrations of the Nueva Quinologia of Pavon, with Observations on the Barks described. By J. E. HOWARD, F.L.S. With 27 coloured Plates by W. FITCH. Imperial folio, half-morocco, gilt edges, 6l. 6s.

The Quinology of the East Indian Plantations. By J. E. HOWARD, F.L.S. Folio, 3 Coloured Plates, 21s.

Revision of the Natural Order Hederaceæ, being a reprint, with numerous additions and corrections, of a series of papers published in the "Journal of Botany, British and Foreign." By BERTHOLD SEEMANN, Ph.D., F.L.S. 7 Plates, 10s. 6d.

Icones Plantarum. Figures, with Brief Descriptive Characters and Remarks, of New and Rare Plants, selected from the Author's Herbarium. By Sir W. J. HOOKER, F.R.S. New Series, Vol. V. 100 Plates, 31s. 6d.

Orchids : and How to Grow them in India and other Tropical Climates. By SAMUEL JENNINGS, F.L.S., F.R.H.S., late Vice-President of the Agri-Horticultural Society of India. Royal 4to. In Monthly Parts, with 4 Coloured Plates, 5s. each.

A Second Century of Orchidaceous Plants, selected from the Subjects published in Curtis's "Botanical Magazine" since the issue of the "First Century." Edited by JAMES BATEMAN, Esq., F.R.S. Complete in 1 Vol. royal 4to, 100 Coloured Plates, 5l. 5s.

Monograph of *Odontoglossum*, a Genus of the Vandeous Section of Orchidaceous Plants. By JAMES BATEMAN, Esq., F.R.S. Imperial folio, complete in 6 Parts, each with 5 Coloured Plates, and occasional Wood-Engravings, 21s., or in one vol., half morocco, gilt edges, 7l. 7s.

Select Orchidaceous Plants. By ROBERT WARNER, F.R.H.S. With Notes on Culture by B. S. WILLIAMS. Folio, cloth gilt, 6l. 6s.
Second Series, Parts I. to X., each, with 3 Coloured Plates, 10s. 6d.

The Rhododendrons of Sikkim-Himalaya; being an Account, Botanical and Geographical, of the Rhododendrons recently discovered in the Mountains of Eastern Himalaya, by Dr. J. D. Hooker, F.R.S. By Sir W. J. HOOKER, F.R.S. Folio, 30 Coloured Plates, 4l. 14s. 6d.

FERNS.

British Ferns; an Introduction to the Study of the FERNS, LYCOPODS, and EQUISETA indigenous to the British Isles. With Chapters on the Structure, Propagation, Cultivation, Diseases, Uses, Preservation, and Distribution of Ferns. By M. PLUES. Crown 8vo, with 16 Coloured Plates by W. FITCH, and 55 Wood-Engravings, 10s. 6d.

The British Ferns; Coloured Figures and Descriptions, with Analysis of the Fructification and Venation of the Ferns of Great Britain and Ireland. By Sir W. J. HOOKER, F.R.S. Royal 8vo, 66 Coloured Plates, 2l. 2s.

Garden Ferns; Coloured Figures and Descriptions, with Analysis of the Fructification and Venation, of a Selection of Exotic Ferns, adapted for Cultivation in the Garden, Hothouse, and Conservatory. By Sir W. J. HOOKER, F.R.S. Royal 8vo, 64 Coloured Plates, 2*l.* 2*s.*

Filices Exoticæ; Coloured Figures and Description of Exotic Ferns. By Sir W. J. HOOKER, F.R.S. Royal 4to, 100 Coloured Plates, 6*l.* 11*s.*

Ferry Combes; a Ramble after Ferns in the Glens and Valleys of Devonshire. By CHARLOTTE CHANTER. *Third Edition.* Fcap. 8vo, 8 Coloured Plates by FITCH, and a Map of the County, 5*s.*

MOSSES.

Handbook of British Mosses, containing all that are known to be natives of the British Isles. By the Rev. M. J. BERKELEY, M.A., F.L.S. Demy 8vo, 24 Coloured Plates, 21*s.*

Synopsis of British Mosses, containing Descriptions of all the Genera and Species (with localities of the rarer ones) found in Great Britain and Ireland. By CHARLES P. HOBKIRK, President of the Huddersfield Naturalist's Society. Crown 8vo, 7*s.* 6*d.*

SEAWEEEDS.

British Seaweeds; an Introduction to the Study of the Marine ALGÆ of Great Britain, Ireland, and the Channel Islands. By S. O. GRAY. Crown 8vo, with 16 Coloured Plates, drawn expressly for the work by W. FITCH, 10*s.* 6*d.*

Phycologia Britannica; or, History of British Seaweeds, containing Coloured Figures, Generic and Specific Characters, Synonyms and Descriptions of all the Species of Algæ inhabiting the Shores of the British Islands. By Dr. W. H. HARVEY, F.R.S. New Edition. Royal 8vo, 4 vols. 360 Coloured Plates, 7*l.* 10*s.*

Phycologia Australica: a History of Australian Seaweeds, comprising Coloured Figures and Descriptions of the more characteristic Marine Algæ of New South Wales, Victoria, Tasmania, South Australia and Western Australia, and a Synopsis of all known Australian Algæ. By Dr. HARVEY, F.R.S. Royal 8vo, 5 vols., 300 Coloured Plates, 7l. 13s.

Nereis Australis; or, Algæ of the Southern Ocean, being Figures and Descriptions of Marine Plants collected on the Shores of the Cape of Good Hope, the extra-tropical Australian Colonies, Tasmania, New Zealand, and the Antarctic Regions. By Dr. HARVEY, F.R.S. Imperial 8vo, 50 Coloured Plates, 2l. 2s.

FUNGI.

Outlines of British Fungology, containing Characters of above a Thousand Species of Fungi, and a Complete List of all that have been described as Natives of the British Isles. By the Rev. M. J. BERKELEY, M.A., F.L.S. Demy 8vo, 24 Coloured Plates, 30s.

The Esculent Funguses of England. Containing an Account of their Classical History, Uses, Characters, Development, Structure, Nutritious Properties, Modes of Cooking and Preserving, &c. By C. D. BADHAM, M.D. Second Edition. Edited by F. CUBBEY, F.R.S. Demy 8vo, 12 Coloured Plates, 12s.

Illustrations of British Mycology, comprising Figures and Descriptions of the Funguses of interest and novelty indigenous to Britain. By Mrs. T. J. HUSSEY. Royal 4to. Second Series, 50 Coloured Plates, £4 10s.

Clavis Agaricinorum: an Analytical Key to the British Agaricini, with Characters of the Genera and Subgenera. By WORTHINGTON G. SMITH, F.L.S. Six Plates. 2s. 6d.

SHELLS 'AND MOLLUSKS.

Elements of Conchology; an Introduction to the Natural History of Shells, and of the Animals which form them. By **LOVELL REEVE**, F.L.S. Royal 8vo, 2 vols. 62 Coloured Plates, £2 16s.

Conchologia Iconica; or, Figures and Descriptions of the Shells of Mollusks, with remarks on their Affinities, Synonymy, and Geographical Distribution. By **LOVELL REEVE**, F.L.S. Demy 4to, in double Parts, with 16 Coloured Plates. 20s.
A detailed list of Monographs and Volumes published may be had.

Conchologia Indica; Illustrations of the Land and Freshwater Shells of British India. Edited by **SYLVANUS HANLEY**, F.L.S., and **WILLIAM THEOBALD**, of the Geological Survey of India. 4to, Parts I. to VI., each with 20 Coloured Plates, 20s.

The Edible Mollusks of Great Britain and Ireland, with the Modes of Cooking them. By **M. S. LOVELL**. Crown 8vo, with 12 Coloured Plates, 8s. 6d.

INSECTS.

Harvesting Ants and Trap-door Spiders; Notes and Observations on their Habits and Dwellings. By **J. T. MOGGRIDGE**, F.L.S. Coloured Plates, 10s. 6d.

British Insects. A Familiar Description of the Form, Structure, Habits, and Transformations of Insects. By **E. F. STAVELEY**, Author of "British Spiders." Crown 8vo, with 16 beautifully Coloured Steel Plates and numerous Wood-Engravings, 14s.

British Beetles; an Introduction to the Study of our Indigenous COLEOPTERA. By **E. C. RYE**. Crown 8vo, 16 Coloured Steel Plates, comprising Figures of nearly 100 Species, engraved from Natural Specimens, expressly for the work, by **E. W. ROBINSON**, and 11 Wood-Engravings of Dissections by the Author, 10s. 6d.

British Bees; an Introduction to the Study of the Natural History and Economy of the Bees Indigenous to the British Isles. By W. E. SHUCKARD. Crown 8vo, 16 Coloured Steel Plates, containing nearly 100 Figures, engraved from Natural Specimens, expressly for the work, by E. W. ROBINSON, and Woodcuts of Dissections, 10s. 6d.

British Butterflies and Moths; an Introduction to the Study of our Native LEPIDOPTERA. By H. T. STANTON. Crown 8vo, 16 Coloured Steel Plates, containing Figures of 100 Species, engraved from Natural Specimens expressly for the work by E. W. ROBINSON, and Wood-Engravings, 10s. 6d.

British Spiders; an Introduction to the Study of the ARANEIDÆ found in Great Britain and Ireland. By E. F. STAVELEY. Crown 8vo, 16 Plates, containing Coloured Figures of nearly 100 Species, and 40 Diagrams, showing the number and position of the eyes in various Genera, drawn expressly for the work by TUFFEN WEST, and 44 Wood-Engravings, 10s. 6d.

Curtis's British Entomology. Illustrations and Descriptions of the Genera of Insects found in Great Britain and Ireland, containing Coloured Figures, from Nature, of the most rare and beautiful Species, and, in many instances, upon the plants on which they are found. 8 vols. Royal 8vo, 770 Coloured Plates, £28.

Or in separate Monographs.

Orders.	Plates.	£ s. d.	Orders.	Plates.	£ s. d.
APHANIPTERA	2	0 2 0	HYMENOPTERA	125	6 5 0
COLEOPTERA	256	12 16 0	LEPIDOPTERA	193	9 13 0
DERMAPTERA	1	0 1 0	NEUROPTERA	13	0 13 0
DICTYOPTERA	1	0 1 0	OMALOPTERA	6	0 6 0
DIPTERA	103	5 3 0	ORTHOPTERA	5	0 5 0
HEMIPTERA	32	1 12 0	STREPSIPTERA	3	0 3 0
HOMOPTERA	21	1 1 0	TRICHOPTERA	9	0 9 0

“Curtis's Entomology,” which Cuvier pronounced to have “reached the ultimatum of perfection,” is still the standard work on the Genera of British Insects. The Figures executed by the author himself, with wonderful minuteness and accuracy, have never been surpassed, even if equalled. The price at which the work was originally published was £43 16s.

Insecta Britannica; Vol. III., Diptera. By
FRANCIS WALKER, F.L.S. 8vo, with 10 Plates, 25s.

ANTIQUARIAN.

Bewick's Woodcuts. Impressions of Upwards
of 2000 Woodblocks, engraved, for the most part, by THOMAS and JOHN BEWICK; including Illustrations of various kinds for Books, Pamphlets, and Broadsides; Cuts for Private Gentlemen, Public Companies, Clubs, &c.; Exhibitions, Races, Newspapers, Shop Cards, Invoice Heads, Bar Bills, &c. With an Introduction, a Descriptive Catalogue of the Blocks, and a List of the Books and Pamphlets illustrated. By the Rev. T. HUGO, M.A., F.R.S.L., F.S.A. In one large volume, imperial 4to, gilt top, with full-length steel Portrait of Thomas Bewick. £6 6s.

The Bewick Collector and Supplement. A
Descriptive Catalogue of the Works of THOMAS and JOHN BEWICK, including Cuts, in various states, for Books and Pamphlets, Private Gentlemen, Public Companies, Exhibitions, Races, Newspapers, Shop Cards, Invoice Heads, Bar Bills, Coal Certificates, Broadsides, and other miscellaneous purposes, and Wood Blocks. With an Appendix of Portraits, Autographs, Works of Pupils, &c. 292 Cuts from Bewick's own Blocks. By the Rev. THOMAS HUGO, M.A., F.S.A. 2 vols. demy 8vo, price 42s.; imperial 8vo (limited to 100 copies), with a fine Steel Engraving of Thomas Bewick, £4 4s. The SUPPLEMENT, with 180 Cuts, may be had separately; price, small paper, 21s.; large paper, 42s.

Sacred Archæology; a Popular Dictionary of
Ecclesiastical Art and Institutions, from Primitive to Modern Times. Comprising Architecture, Music, Vestments, Furniture Arrangement, Offices, Customs, Ritual Symbolism, Ceremonial Traditions, Religious Orders, &c., of the Church Catholic in all Ages. By MACKENZIE E. C. WALCOTT, B.D. Oxon., F.S.A., Præcentor and Prebendary of Chichester Cathedral. Demy 8vo, 18s.

A Manual of British Archæology. By
CHARLES BOUTELL, M.A. 20 Coloured Plates, 10s. 6d.

Man's Age in the World according to Holy
Scripture and Science. By AN ESSEX RECTOR. 8s. 6d.

The Antiquity of Man; an Examination of
Sir Charles Lyell's recent Work. By S. R. PATTISON, F.G.S.
Second Edition. 8vo, 1s.

MISCELLANEOUS.

International Series of Elementary Text Books on Natural Science.

Zoology. By ADRIAN J. EBELL, Ph.B., M.D.
Part I. : Structural Distinctions, Functions, and Classification
of the Orders of Animals, 1s.

Lahore to Yarkand. Incidents of the Route
and Natural History of the Countries traversed by the Expedi-
tion of 1870, under T. D. FORSYTH, Esq., C.B. By GEORGE
HENDERSON, M.D., F.L.S., F.R.G.S., and ALLAN O. HUME,
Esq., C.B., F.Z.S. With 32 Coloured Plates of Birds,
6 of Plants, 26 Photographic Views, Map, and Geological
Sections, 42s.

On Intelligence. By H. TAINE, D.C.L. Oxon.
Translated from the French by T. D. HAYE, and revised, with
additions, by the Author. Part I. 8s. 6d. Part II. 10s., or,
complete in One Volume, 18s.

The Young Collector's Handy Book of Recrea-
tive Science. By the Rev. H. P. DUNSTER, M.A. Cuts.
3s. 6d.

The Gladiolus: its History, Cultivation, and
Exhibition. By the Rev. H. HONYWOOD DOMBRAIN, B.A. 1s.

The Birds of Sherwood Forest; with Observations on their Nesting, Habits, and Migrations. By W. J. STERLAND. Crown 8vo, 4 Plates. 7s. 6d. coloured.

The Naturalist in Norway; or, Notes on the Wild Animals, Birds, Fishes, and Plants of that Country, with some account of the principal Salmon Rivers. By the Rev. J. BOWDEN, LL.D. Crown 8vo, 8 Coloured Plates. 10s. 6d.

The Zoology of the Voyage of H.M.S. *Samarang*, under the command of Captain Sir Edward Belcher, C.B., during the Years 1843-46. By Professor OWEN, Dr. J. E. GRAY, Sir J. RICHARDSON, A. ADAMS, L. REEVE, and A. WHITE. Edited by ARTHUR ADAMS, F.L.S. Royal 4to, 55 Plates, mostly coloured, £3 10s.

A Survey of the Early Geography of Western Europe, as connected with the First Inhabitants of Britain, their Origin, Language, Religious Rites, and Edifices. By HENRY LAWES LONG, Esq. 8vo, 6s.

The Geologist. A Magazine of Geology, Palæontology, and Mineralogy. Illustrated with highly-finished Wood Engravings. Edited by S. J. MACKIE, F.G.S., F.S.A. Vols. V. and VI., each, with numerous Wood-Engravings, 18s. Vol. VII. 9s.

The Stereoscopic Magazine. A Gallery for the Stereoscope of Landscape Scenery, Architecture, Antiquities, Natural History, Rustic Character, &c. With Descriptions. 5 vols., each complete in itself and containing 50 Stereographs, £2 2s.

Everybody's Weather-Guide. The Use of Meteorological Instruments clearly Explained, with Directions for Securing at any time a probable Prognostic of the Weather. By A. STEINMETZ, Esq., Author of "Sunshine and Showers," &c. 1s.

Sunshine and Showers: their Influences throughout Creation. A Compendium of Popular Meteorology. By ANDREW STEINMETZ, Esq. Crown 8vo, Wood-Engravings, 7s. 6d.

The Reasoning Power in Animals. By the Rev. J. S. WATSON, M.A. Crown 8vo, 9s.

Manual of Chemical Analysis, Qualitative and Quantitative; for the Use of Students. By Dr. HENRY M. NOAD, F.R.S. New Edition. Crown 8vo. 109 Wood-Engravings, 16s. Or, separately, Part I., 'QUALITATIVE,' New Edition, new Notation, 6s.; Part II., 'QUANTITATIVE,' 10s. 6d.

Phosphorescence; or, the Emission of Light by Minerals, Plants, and Animals. By Dr. T. L. PHIPSON, F.C.S. Small 8vo, 30 Wood-Engravings and Coloured Frontispiece, 5s.

Meteors, Aerolites, and Falling Stars. By Dr. T. L. PHIPSON, F.C.S. Crown 8vo, 25 Woodcuts and Lithographic Frontispiece, 6s.

The Artificial Production of Fish. By PISCARIUS. Third Edition. 1s.

Live Coals; or, Faces from the Fire. By L. M. BUDGEN, "Acheta," Author of 'Episodes of Insect Life,' etc. Dedicated, by Special Permission, to H.R.H. Field-Marshal the Duke of Cambridge. Royal 4to, 35 Original Sketches printed in colours, 21s.

Caliphs and Sultans; being Tales omitted in the ordinary English Version of "The Arabian Nights' Entertainments," freely rewritten and rearranged. By S. HANLEY, F.L.S. 6s.

SERIALS.

The Botanical Magazine. Figures and Descriptions of New and Rare Plants of interest to the Botanical Student, and suitable for the Garden, Stove, or Greenhouse. By Dr. J. D. HOOKER, F.R.S. Monthly, with 6 Coloured Plates, 3s. 6d. Annual Subscription, post free, 42s.

Re-issue of the Third Series in monthly vols., 42s. each; to Subscribers for the entire Series, 36s. each.

The Floral Magazine. New Series, enlarged to Royal 4to. Figures and Descriptions of Select New Flowers for the Garden, Stove, or Conservatory. Monthly, with 4 Coloured Plates, 3s. 6d. Annual Subscription, post free, 42s.

Orchids: and How to Grow them in India and other Tropical Climates. By SAMUEL JENNINGS, F.L.S., F.R.H.S., late Vice-President of the Agri-Horticultural Society of India. In Monthly Parts, with 4 Coloured Plates, 5s. each Part.

Select Orchidaceous Plants. By ROBERT WARNER. 3 Coloured Plates, 10s. 6d.

Conchologia Iconica. By LOVELL REEVE, F.L.S., and G. B. SOWERBY, F.L.S. In Double Parts, with 16 Coloured Plates, 20s.

Conchologia Indica. The Land and Fresh-water Shells of British India. In Parts, with 20 Coloured Plates, 20s.

FORTHCOMING WORKS.

St. Helena. A Physical, Historical, and Topographical Description of the Island, including its Geology, Fauna, Flora, and Meteorology. By J. C. MELLISS, C.E., F.G.S., F.L.S.

Genera Plantarum. By BENTHAM and HOOKER. Vol. II.

Flora of India. By Dr. HOOKER and others.

Natural History of Plants. By Prof. BAILLON.

Flora Australiensis. By G. BENTHAM. Vol. VII.

Flora of Tropical Africa. By Prof. OLIVER.

Flora Capensis.

LONDON: L. REEVE & CO., 5, HENRIETTA ST., COVENT GARDEN.

