

ARTEMISIA VERLOTORUM LAMOTTE AND ITS OCCURRENCE IN BRITAIN

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INTRODUCTION

The recognition of *Artemisia Verlotorum* Lamotte as a distinct entity in Britain was made independently in 1938-9 by Mr Iolo A. Williams and the late Mr Francis Druce, who had observed it at Ham Pits in Surrey, and by Mr G. M. Ash, who had for some years known a patch of it near Godalming, Surrey. The obvious relationship with *A. vulgaris* L., and the fact that in Britain the two normally grow in company, at first suggested the possibility of *A. Verlotorum* being no more than a very extraordinary sport of common mugwort. Careful investigation has shown that there are numerous and taxonomically important characters separating the two, and I am left in no doubt that our British plant is a perfectly distinct species from *A. vulgaris*, and that it is certainly conspecific with continental *A. Verlotorum*.

Although brief notes have appeared (Lousley, 1946, 1947; Kent, 1947, 1948) on the occurrence of *A. Verlotorum* in Britain, the facts that its history in this country extends back over at least 40 years, and that it is without question a plant here to stay, make desirable a fuller treatment of the taxonomy, distribution, and history of this outstandingly interesting species.

BIBLIOGRAPHY

There must be comparatively few species of plants discovered as recently as 1873 which have in so short a time given rise to so formidable a spate of literature as has *A. Verlotorum*—literature remarkable for its bulk, its controversial content, and its very wide dispersal. I have made the bibliography given at the end of this paper as complete as I could, but even so have little doubt that there are additional references that I have missed.

This is a convenient opportunity of saying how deeply grateful I am to Mr N. Y. Sandwith for numerous bibliographical references that I might otherwise have missed, and who has sent *précis* and excerpts of various papers not available to me. I must also thank Mr A. H. G. Alston, who has kindly verified certain bibliographical references in the library of the British Museum (National History).

TAXONOMIC HISTORY OF *A. VERLOTORUM*

The ravelled taxonomic history has been recounted more than once, in English (Hultén, 1930 A) and in Italian (Pampanini, 1923 A, 1933 A); so that merely a brief outline must suffice here.

In 1873 *A. Verlotorum* was observed in eastern France simultaneously by Verlot at Grenoble and by Lamotte at Clermont-Ferrand. Verlot (1875) provisionally identified his plant with *A. umbrosa* Turcz., but Lamotte, having established the identity of the Clermont and Grenoble

plants, challenged Verlot's determination and described the plant as a new species, *A. Verlotorum*, named in honour of the brothers Verlot (Lamotte, 1876). The next development was that Bonnet (1883), without giving his reasons, sank *A. Verlotorum* as a synonym under *A. selengensis* Turcz. ex Bess. Fiori and Paoletti (1903) were apparently the first to distinguish *A. Verlotorum* in Italy, but described it as a variety of *A. vulgaris* L.—var. *angustisecta*. Béguinot (1917), apparently ignorant of the earlier taxonomic work on the plant, described an Italian gathering as a new variety (var. *suaveolens*) of *A. vulgaris* L., and in the same year Saccardo described it as *A. vulgaris* L. var. *odorata*. The task of straightening out this confusion fell to Pampanini, who in 1923 started his exhaustive series of papers on *Artemisia Verlotorum* Lamotte. To summarise here the contents of these papers would not only take too long but would be out of place, as his researches into *A. Verlotorum* led him to no less than a lengthy and critical revision of the genus *Artemisia* in eastern Asia. In the first paper (1923 A), however, Pampanini discusses the relationship of *A. Verlotorum* both with *A. umbrosa* and with *A. selengensis*, concluding that, after examining authentic material of the two last-named species, *A. Verlotorum* is distinct from both. For a discussion of the distinguishing characters reference should be made to the original paper.

As a personal comment on these conclusions, I have myself examined a specimen of *A. selengensis* in the Fielding Herbarium at Oxford, collected and annotated by Turczaninow himself (" *Artemisia Selengensis* mihi. In insula Selenga ad Selenginsk. 1829. Turcz."), and I cannot help feeling surprised that *A. Verlotorum* should for so long have been misidentified with *A. selengensis*. Turczaninow's specimen, and another from Dahuria which is clearly conspecific, and mounted on the same sheet, differ from *A. Verlotorum* in the following points (among others): stems rapidly becoming quite glabrous; leaf-segments narrower, very finely and remotely denticulate, with non-translucent venation invisible on lower surface; stipuliform leaf-lobes usually absent; upper leaves simple; inflorescence-branches suberect and almost straight, not arcuate-divaricate; capitula subglabrous outside.

Authentic material of *A. umbrosa* at Kew, received from Turczaninow, does not appear to be the same as *A. Verlotorum*, the whole plant being more downy, with the upper leaves all entire and the basal stipuliform lobes lacking.

To sum up, then, there appears to be no reason to doubt that *A. Verlotorum* Lamotte is the correct name for the plant, and that it has been misidentified with *A. umbrosa* and *A. selengensis*. In spite of Pampanini's papers the name *A. selengensis* was in use for *A. Verlotorum* as recently as 1929, by Jaquet.

A citation of *A. Verlotorum*, its synonyms, and the principal taxonomic works and papers in which they have been used, follows:

ARTEMISIA VERLOTORUM Lamotte (1876), Coste (1903), Pampanini (1923 A, 1925, 1926, 1927, 1929, 1930, 1933 A), Gams (1929), Hultén

(1930 A, excluding Kamtchatka plants), Montelucci (1934 A), Chiosi (1937), Cabrera (1941), Vignoli (1945), Fournier (1946).

A. umbrosa [non Turcz.] Verlot (1875).

A. selengensis [non Turcz. ex Bess.] Bonnet (1883), Rouy (1903), Albert et Jahandiez (1908), Defillon (1922), Ducellier & Maire (1923).

A. vulgaris [non L.] Battandier (1888), Parodi (1926).

A. vulgaris L. var. *umbrosa* Verlot ex St. Lager in Cariot (1889).

A. vulgaris L. var. *angustisecta* Fiori & Paoletti (1903), fide Fiori (1927).

A. vulgaris L. var. *Verlоторum* (Lamotte) Battandier & Trabut (1904).

A. vulgaris L. subsp. *selengensis* [non (Turcz. ex Bess.) Thell.] Thellung (1912), Voigt (1920), Schinz et Thellung (1923).

A. vulgaris L. var. *odorata* Saccardo (1917), fide Fiori (1927).

A. vulgaris L. var. *suaveolens* Béguinot (1917).

A. vulgaris L. var. *vulgatissima* [non Bess.] Manganaro (1917).

A. vulgaris L. var. *selengensis* [non (Turcz. ex Bess.) Fiori] Fiori (1921).

A. Verlоторum Lamotte var. *typica* Pampanini (1929, 1933 A).

A. Verlоторum Lamotte var. *typica* Pamp. f. *genuina* Pampanini (1933 A).

The above synonymy is that of the common adventive form of *A. Verlоторum*—var. *typica* Pamp. f. *genuina* Pamp. The f. *genuina* is contrasted with f. *vestita* Pamp. (1933 A), which has the capitula cottony-tomentose at flowering time, and is so far recorded only from Tuscany.

ILLUSTRATIONS

A. Verlоторum: Bonnier (1921, t. 290, fig. 1442b, coloured plate of habit); Fiori (1921, t. 3482 (1) [not seen]); Molfino (1926, t. IX, photograph of herbarium specimen); Gams (1929, pp. 631-2, figs. 342-3, habit and overwintering rosette); Pampanini (1933 A, p. 193, fig. 3*, upper part of inflorescence, p. 194, fig. 4*, lower part of inflorescence, p. 220, fig. 19, median cauline leaves); Cabrera (1941, p. 285, fig. 89, habit drawing, very good).

References to the following illustrations of related species with which *A. Verlоторum* has been confused may be useful:—

A. umbrosa Turcz.: Pampanini (1929, p. 536, figs. 79-80, median cauline leaves; 1933 A, p. 187, fig. 1, authentic herbarium sheet).

A. selengensis Turcz. ex Bess.: Pampanini (1929, p. 532, figs. 26-30, median cauline leaves; 1933 A, p. 188, fig. 2, authentic herbarium sheet).

A. unalaskensis Rydb. (*A. opulenta* Pamp., *A. Verlоторum* [non Lamotte] Hultén): Hultén (1930 A, pp. 498-503, figs. 2-5, photograph of specimen, drawings of subterranean parts, leaves and flowers).

A. vulgaris L.: Hultén (1930 A, p. 497, fig. 1, subterranean parts).

*Figs. 3 and 4 are duplicated in Pampanini (1926) as figs. I and II.

THE NATIVE COUNTRY OF *A. VERLOTORUM*

To those who accepted *A. Verlotorum* as a synonym of *A. umbrosa* or *A. selengensis* this matter gave no difficulty, since the two last-named species are indigenous to Russia and Manchuria. Gams (1929) mentions that Christ even went so far as to coin for it the vernacular name "Bolschewistenbeifuss"—"Bolshevik Mugwort"! The native country of *A. Verlotorum*, however, was unknown at the time of its discovery and remained so until Pampanini investigated the question. In his second Contribution (1925) he ingeniously argues that the sterility of the achenes, the late flowering, the strong smell, and the continuance of vegetative growth through winter are against its being a northern plant brought into a milder climate, and postulates a possible American origin, finding possible allies in Mexico, New Mexico and Arizona, especially *A. Ghiesbreghtii* Rydb. of Mexico. A theory of introduction during the Franco-Mexican war of 1862-1867 follows.

However, in the third Contribution (1926) further consideration of the climatic requirements of *A. Verlotorum* lead him to search for its native home in temperate regions with maximal rainfall in summer (thus not in America), and he looks favourably upon southern and eastern Asia as likely areas. His revision of the Asiatic species in this (1926) and the two following Contributions (1927; 1929) revealed various close relatives of *A. Verlotorum*, especially from China, and in the fifth Contribution (1929) he fits in *A. Verlotorum* among the Asiatic species, distinguishing three varieties var. *a typica* Pamp. (our European plant), and two others confined to China. No specimens of typical *A. Verlotorum* were at that time known from China.

While the fifth Contribution was in the press, Hultén (1930 A) announced that he had discovered the long-sought native home of *A. Verlotorum* in Kamtchatka, where it was alleged to be abundant, extending along the Pacific shore of Asia from the Commander Islands and northern Kamtchatka southwards at least to northern Japan (Hokkaido) and probably also in Saghalin. This paper called forth a rapid reply by Pampanini (1930), to whom Hultén had sent specimens from Kamtchatka. After a lengthy discussion Pampanini concludes that Hultén's *Artemisia*, although a close ally of *A. Verlotorum*, is not that but *A. opulenta* Pamp. Hultén (1937) accepted Pampanini's verdict but sank *A. opulenta* Pamp. under *A. unalaskensis* Rydb. The native home of *A. Verlotorum* was thus as doubtful as before.

The final triumph for Pampanini's theories came when he was able, in his seventh (and last) Contribution (1933 A), to announce that among herbarium material sent to him for naming from Berlin he had found a specimen of *A. Verlotorum* var. *typica* from Ta-tsien-lu in the Province of Si-kang in S.W. China collected by J. A. Soulié in 1894.

To sum up the present position, typical *A. Verlotorum* is known from the above locality in S.W. China, while varieties occur in Hu-peh, northern Shen-si and Sze-chwan in central and south-central China.

For conjectures about how *A. Verlotorum* may have been introduced into France during the French military operations in China between 1856 and 1873, see Pampanini (1933 A).

INTRODUCTION AND SPREAD OF *A. VERLOTORUM* IN COUNTRIES OTHER THAN ENGLAND

Although *A. Verlotorum* as a native plant seems to have a relatively restricted distribution, yet as an introduction it has become remarkably widespread, now occurring in three continents in addition to its native Asia.

To keep this account within reasonable limits only brief notes and references to literature will be given.

(a) *Europe*

(1) FRANCE. First recorded in 1873 at Clermont-Ferrand (Puy de Dôme) and Grenoble (Isère). By 1903 it extended from Paris to the Mediterranean and was spreading rapidly. Now extends from Ille et Vilaine, Somme, Yonne and Haute Saône to Alpes Maritimes, Var, Bouches du Rhône, Hérault and Pyrénées Orientales, and is still spreading. Jovet (1941) says that *A. Verlotorum* is now much more abundant in the south-west than *A. vulgaris*. See Verlot (1875), Lamotte (1876), Revel (1885), Parmentier (1895), Cariot & Saint Lager (1897), Rouy (1903), Coste (1906), Albert & Jahandiez (1908), Thellung (1912), Héri- baud-Joseph (1915), Jovet (1940, 1941), Braun-Blanquet (1945), Fournier (1946), Nehou (1948).

(2) GERMANY. Only known from the shores of the Bodensee (Lake of Constance) (Gams, 1929).

(3) SWITZERLAND. Recorded from Cantons Waadt, Freiburg, Bern Genf, and Tessin, also doubtfully from Canton Zürich. See Thellung (1907, first records for Switzerland), Voigt (1920), La Nicca (1922), Schinz & Thellung (1923), Gams (1929), Jaquet (1929), Becherer (1947).

(4) ITALY. Recorded from Piedmont, Lombardy, Tirol, Venetia, Emilia, Tuscany, Marche and Latium. See Béguinot & Mazza (1916), Béguinot (1917), Saccardo (1917), Fiori (1921), Cozzi (1922), Ugolini (1923), Pampanini (1923 B, 1924, 1934, 1936), Gams (1929), Montelucci (1934 A, 1934 B, 1935), Chiosi (1937), Cobau (1940).

(5) SARDINIA. Recorded by Pampanini (1933 B).

(6) RUSSIA. According to Gams (1929) only known as a weed in the Nikita Garden in the Crimea.

(b) *North Africa*

(7) ALGERIA. A patch noted at Boufarick in 1879. By 1904 abundant and spreading in the Mitidja area. See Battandier (1888, 1904), Battandier & Trabut (1904).

(c) *North America*

[(8) U.S.A. Recorded from Oregon (Rydberg, 1916), but in error (Hall & Clements, 1923; Pampanini, 1925).]

(d) *South America*

(9) ARGENTINA. First recorded in 1917 near Buenos Aires, and by 1928 had spread all over the warm temperate region of the country, extending from Salta, Tucumán and Mendoza to Pampa and the Rio Negro. See Manganaro (1917), Hauman (1925), Molfino (1926, 1928), Parodi (1926, 1930), Cabrera (1941).

(10) URUGUAY. Recorded from Dept. of Canelones (Molfino, 1928; Herter, 1930).

DESCRIPTION OF *A. VERLOTORUM*

The following description has been drawn up entirely from British specimens. The very few points in which Continental material differs will be mentioned after the description.

ARTEMISIA VERLOTORUM Lamotte. *Perennial herb*, aromatic, spreading extensively by rhizomes from which arise barren stems bearing leaves alone and taller fertile stems bearing both leaves and inflorescences. *Fertile stems* up to 2 m. high, generally about 1-1.5 m. high, up to 7 mm. in diameter, profusely but shortly branched above in the region of the inflorescence, otherwise subsimple, strictly erect, rigid, conspicuously sulcate-angled and deeply so when young, solid, at first densely and shortly pubescent with simple flexuous grey hairs among which numerous minute short cylindrical or subclavate glands are mixed, pubescence later becoming thinner but always \pm persistent; pith small, central, white; cortex and connecting tissue relatively broad and green; epidermis deep dull purple at least on the exposed side. *Leaves* alternate, lower ones broadly oval to subcircular in outline, up to about 14 cm. long and wide, sessile, simply or bi-pinnatifid; segments opposite, in 4-6 pairs, the lower ones small, entire, with the lowermost 1-2 pairs inserted at the base of the "petiole", very small and stipuliform, the upper segments much larger, linear to linear-lanceolate, up to about 9 cm. long and 1.3 cm. wide but usually smaller and about $4-5 \times 0.5-0.8$ cm., gradually tapering to an acute apex, obscurely and slightly repand, entire or sometimes with 1 (-2) pairs of shorter secondary segments which are entire or sometimes with a single tooth; margins narrowly revolute; surface above deep green and glabrous or subglabrous except on the impressed midrib, beneath densely and shortly grey-white-tomentellous all over except for the greenish midrib; lateral nerves about 10-12 (-15) on each side, somewhat impressed above, slightly prominent beneath; midrib and veins translucent; median and upper (inflorescencé) leaves gradually becoming smaller and less divided, with elongate-linear and always entire segments; the uppermost leaves trifid or quite simple, small or very small. *Inflorescence* profuse, ample, very leafy, narrowly pyramidal, up to about 58 cm. long and 20 cm. wide, with many arcuate-divaricate primary lateral branches, not clearly separated from the lower primary lateral branches which produce secondary more reduced inflorescences towards their ends; upper primary lateral branches up to about 20 cm. long, very leafy, bearing axillary capitula mostly one per axil and sessile or sub-

sessile, or (especially on the lower branches) few (about 2-5) together and basipetally arranged on very abbreviated secondary lateral branches; occasionally (? on weak shoots) whole inflorescence subsimple and racemiform. *Capitula* congested towards branch-apices, more spaced below, mostly secund, subtended by and exceeded by (even near the branch-apices) the trifold or simple uppermost leaves (bracts), ellipsoid, 3.5-5 mm. long, 2.5-3 mm. wide, heterogamous with 9-12 outer ♀ florets, 2-6 inner ♂ florets, and 6-11 (or possibly more) central apparently abortive ± rudimentary florets; flowering takes place in centripetal succession; occasionally all the ♂ and part of the ♀ florets apparently abortive. *Phyllaries* 13-19, in 3-4 ill-marked series, all thinly arachnoid-pubescent outside; outer ones ± convex, triangular to ovate, acute, 1.25-2.5 mm. long and 0.8-2 mm. wide, with green central part and relatively narrow hyaline margins; inner grading to elliptic or elliptic-obovate, obtuse or rounded, very convex, to about 4 mm. long and 1.5-2 mm. wide, green about the midrib and with broad hyaline or sometimes red-purple-tinged minutely erose margins which have a beautiful metallic ± golden lustre. ♀ *florets* small, tubular, 1.5 mm. long, about 0.3 mm. in diameter, greenish-white or red-purplish above, with sessile glands outside and very short lobes about 0.1-0.2 mm. long; anthers 0; style exceeding the corolla, filiform, glabrous, 2 mm. long, divided at apex into 2 yellowish-white filiform or slightly flattened segments 1.25 mm. long; ovary slightly curved, glabrous, 0.75-1 mm. long and 0.3-0.4 mm. wide. ♂ *florets* larger, infundibuliform, 2.5 mm. long, 0.4-0.5 mm. in diameter at base, gradually enlarging upwards to 0.9 mm. diameter towards apex, basal part with numerous sessile glands, upper part eglandular or almost so except on lobes, shining and bright red-purple, passing through a narrow yellowish zone to the green basal part; stamens with glabrous filaments, 0.6 mm. long, and yellow anthers, 1.5 mm. long in all and 0.4 mm. wide, the connective produced at apex into a hyaline triangular subacute appendage 0.5 mm. long, its top on a level with the ends of the corolla-lobes; style as in ♀ florets but not exceeding the corolla and with segments 0.75 mm. long; ovary as in ♀ florets. *Rudimentary florets* minute, pale. *Achenes* not as yet seen in Britain.

Study of Italian and Swiss specimens in the Fielding Herbarium at Oxford enables the above description to be extended in the few following points:—Secondary segments of lower leaves sometimes with a pair of teeth. *Capitula* towards ends of primary lateral branches of the inflorescence occasionally not exceeded by the bracts, when mature ± ellipsoid or shortly oblong-hemispherical and up to 4 mm. wide. Inner phyllaries up to 4.25 mm. long. Style branches of ♀ florets up to 1.5 mm. long. ♂ florets up to 10-11. Abortive florets sometimes fewer. So far I have not seen any Continental specimens with achenes.

Most of the above points can be attributed to the milder climate of the Mediterranean region, allowing fuller development of the capitula than I have so far seen in this country.

COMPARISON OF *A. VERLOTORUM* WITH *A. VULGARIS**Artemisia vulgaris*

Flowering season early (July-September), only an occasional straggler remaining in flower later.

Plant caespitose or with short underground shoots.

Young stems sulcate.

Stems usually glabrescent or with a very sparse persistent pubescence.

Stem in section showing a large, white, central pith and a narrow, green zone of connecting tissue + cortex.

Upper primary segments of lower and median cauline leaves on flowering stems with 2-4 pairs of serrate or lobate secondary segments.

Midribs and lateral nerves of leaves usually translucent by transmitted light; smaller veins obscure (in living and dried plants).

Segments of upper leaves usually comparatively short, lanceolate to oblong or linear.

Inflorescence usually sparsely leafy except towards base.

Inflorescence-branches strict, straight or nearly so.

Bracts mostly shorter than the capitula except in lower part of inflorescence-branches.

Primary lateral branches of the inflorescence bearing for the most part ± abbreviated secondary lateral branches upon each of which about 2-20 capitula are aggregated; capitula only borne singly near extreme ends of primary lateral branches.

Capitula mostly campanulate or slightly narrowed above, rarely ellipsoid, 3-4 mm. long, 2.25-(3.5) mm. wide.

Phyllaries ± densely arachnoid-pubescent outside.

Tube of ♀ florets about 0.2 mm. in diameter.

5-22 ♂ florets per capitulum, rarely only 2-3; abortive central florets 0-10.

Tube of ♂ florets about 0.25 mm. in diameter at base.

Plant fruiting freely.

Plant with normal "mugwort" smell.

Artemisia Verlotorum

Flowering season late (October-November-?), often curtailed by frost.

Plant with long rhizomes.

Young stems more deeply so.

Stems usually with a denser persistent pubescence.

Stem in section showing a small, central pith and a relatively broad zone of connecting tissue + cortex.

Upper primary segments of lower and median cauline leaves on flowering stems linear or linear-lanceolate, entire or with a single secondary segment or at most 1-(2) pairs of secondary segments which are entire or sometimes with a single tooth (rarely a pair of teeth in Continental specimens).

Smaller veins, as well as midribs and lateral nerves beautifully and clearly translucent by transmitted light (in living and dried plants).

Segments of upper leaves conspicuously elongate linear-lanceolate to linear.

Inflorescence very leafy in all parts.

Inflorescence-branches arcuate-divaricate.

Bracts distinctly exceeding the capitula even near ends of branches (in one Continental specimen capitula not exceeded by bracts towards branch ends).

Primary lateral branches of the inflorescence bearing for the most part solitary, axillary capitula; occasionally, towards base of primary lateral branches, usually very abbreviated secondary lateral branches, bearing few (about 2-5) capitula, may be produced.

Capitula ellipsoid (rarely oblong-hemispherical), 3.5-5 mm. long, 2.5-3(-4) mm. wide.

Phyllaries thinly arachnoid-pubescent outside.

Tube of ♀ florets slightly wider, about 0.3 mm. in diameter.

(0-)2-6-(11) ♂ florets per capitulum, usually fewer than in *A. vulgaris*; abortive central florets 4-11, mostly more numerous than is usual in *A. vulgaris*.

Tube of ♂ florets about 0.4-0.5 mm. in diameter at base.

Plant very rarely maturing achenes (none yet seen in England).

Plant with stronger and more pleasantly aromatic smell.

The above comparative table requires certain comments.

The character of the translucence or non-translucence of the venation appears to be constant in *A. Verlotorum* and in British *A. vulgaris*, but I have seen certain Continental specimens of *A. vulgaris* (*Fl. Exsicc. Austro-Hungarica*, No. 3781, leg. Wettstein, and *Fl. Bello-nensis* comm. Caruel, 1884), in which the venation is partially translucent, although not so regularly and completely so as in *A. Verlotorum*.

In addition to the above characters, Defillon (1922) has adduced the presence of secretory channels near the outside of the endodermis of the stems as distinguishing *A. Verlotorum* from *A. vulgaris*.

Certain other characters, not mentioned in the above table, have been alleged to distinguish these two species. Stress has been laid (e.g. by Rouy, 1903; Béguinot, 1917; Pampanini, 1925) on the absence of glands on the florets. Hultén (1930) recognised that this was incorrect, but implied that the glands are more scattered in *A. Verlotorum*. Glands are certainly present on the corollas of *A. Verlotorum*, and I can see no difference either in their density or distribution to separate *A. Verlotorum* from *A. vulgaris*.

Schinz & Thellung (1923) contrast the phyllaries of *A. Verlotorum*, described as all ovate and blunt, with those of *A. vulgaris*, described as lanceolate to linear and acute. This appears to be quite imaginary; in both species I find a transition from outer acute to inner rounded phyllaries.

Rouy (1903) contrasts the brownish-red florets of *A. Verlotorum* with the creamy-yellow ones of *A. vulgaris*. But, as every field-botanist in this country knows, it is very rare for our common mugwort to have other than brownish-red florets! It is perhaps worth noting here that Pampanini (1925) records yellowish florets in colonies of *A. Verlotorum* at Florence, though this must be very rare.

Mention should be made also of a character to which attention was first drawn, I believe, by Montelucci (1934 A)—the revolution of the margins of the upper leaves. He emphatically maintains that this is very evident in *A. Verlotorum* but not marked in *A. vulgaris*, and that it has helped him to recognise dried flowering stems of *A. Verlotorum* in the field, when green portions were lacking. I have been unable to convince myself that this character is a satisfactory one, at least as far as England is concerned, and have therefore omitted it from the comparative table; I find that the upper leaves of *A. vulgaris* in this country have frequently markedly revolute margins, but this may not apply perhaps in Italy.

For Pampanini's discussion of the differences between *A. Verlotorum* and *A. vulgaris* see his second Contribution (1925).

BIOLOGY

It should be clear from the preceding portions of this paper that *A. Verlotorum* is a plant of unusual interest in its life-history and reproduction. I have therefore endeavoured to bring together here the

available information, though there are several points that are still doubtful or in need of further study.

Throughout its introduced range *A. Verlotorum* seems to have a very markedly close association with ground disturbed by human activities. In England it is characteristic of sides of roads and paths, railway banks and disturbed waste ground. A similar range of habitat is indicated for France (Jovet, 1940), Italy (Montelucci, 1934 A) and Argentina (Molfino, 1928). Parmentier (1895) notes its occurrence in vineyards, and Battandier (1904) in orange-orchards, gardens, etc. Montelucci (1934 A) has a most interesting and philosophical discussion, based on his experience of *A. Verlotorum* in the field, of the situations that it prefers, laying especial emphasis on the railways, and the strong predilection that he observed for the neighbourhood of the stations. From this and from a previous note by Cozzi remarking particularly the plant's invasion of cemeteries, Montelucci deduces that it requires especially ground rich in organic matter, broken up and allowing thus room for the spread of the rhizomes. At Ham Pits in Surrey I have seen *A. Verlotorum* growing abundantly and luxuriantly on the steep sides of old gravel-pit workings where the ground is unstable and unlikely to be especially rich in organic matter, and I believe that the first requisite for the establishment of the plant is, as Montelucci states, broken soil supporting a still "open" community of plants. Like so many other aliens, *A. Verlotorum* does not seem, in general, to spread into already closed communities, even though these may be seral. As a further comment on its occurrence in open communities we may note Molfino's (1928) remarks on its being detrimental to lucerne crops in the Argentine, and even being regarded as a pest by the cultivators.

A point which Thellung (1912) has noted is that *A. Verlotorum* is frequently accompanied by *A. vulgaris*. This is especially noticeable along the Thames in Surrey, stems of the two species being sometimes mingled in the same clump.

As we have already noted, one of the most striking features of *A. Verlotorum* is its very late flowering season. The statement by Parmentier (1895) that it flowers near Besançon from June to August is unquestionably an error. Montelucci (1934 A) remarks that at Rome it started to flower on September 28th and was practically over by the end of November, and numerous other writers in France, Switzerland and Italy agree in giving the period September-November or a part of it. Schinz & Thellung (1923) extend it to December. In England, although detailed phenological studies have not been made, the onset of flowering appears to be about a month later than at Rome. In October 1942, Thames-side plants were in bud on the 12th, and were just flowering on the 24th, and in subsequent years I have not seen flowers before the latter half of October. It will be obvious that the flowering season and severe frosts frequently coincide; Gams (1929) states that in 1923 and 1924 it failed to reach flowering condition either north or south of the Alps. In England it seems normal for the completion

of flowering to be prevented by frost and I have never seen achenes. *A. Verlotorum* would be an interesting subject for further phenological study, especially its behaviour in exceptionally mild seasons.

The rarity of achenes in *A. Verlotorum* has been repeatedly noted, and the matter is discussed by Pampanini (1925), who remarks that Béguinot had cultivated the plant from seed, but that only a very small number of achenes matured; Molfino (1928) also mentions its propagation by achenes. Whatever the cause of this partial infertility—and the indications are that it is probably climatic—we may safely prophesy that the conditions in England will rarely, if ever, permit *A. Verlotorum* to ripen any achenes.

We are, therefore, faced with the apparent paradox of a plant, very rarely maturing achenes, and unequipped for long-distance dispersal, that has spread with astonishing rapidity over much of Europe. It is not easy to explain this fully, but it seems certain that it owes its presence in many places to portions of the rhizome being brought in with earth or ballast; its wide distribution along railways and roads is thus no doubt largely explained. There is no evidence that it has extended its area in England other than by vegetative reproduction, and this will explain its absence from many suitable localities. For further notes on the great ease with which detached portions of the rhizome root, see Vignoli (1945).

Vignoli (1945) has recently discussed the cytology of *A. Verlotorum*. The basic number of chromosomes in *Artemisia* is 9 and Tischler has established that *A. vulgaris* is a diploid ($2n = 18$). Vignoli studied both mitosis and meiosis in *A. Verlotorum* and found $2n = 54$ and $n = 27$. *A. Verlotorum* is thus a hexaploid, and Vignoli makes various suggestions about its possible origin. The observation of apparently normal meioses seems to show that *A. Verlotorum* is a balanced polyploid without the irregular pairing and disjunction that would be expected in an autopolyploid.

OCCURRENCE AND DISTRIBUTION OF *A. VERLOTORUM* IN BRITAIN

Since its discovery our knowledge of the area occupied by this species has grown rapidly, and we can probably now define it with tolerable accuracy. That this is so is largely owing to the enthusiastic studies of Messrs D. H. Kent and J. E. Lousley in Middlesex and Surrey respectively; they have kindly placed their records at my disposal in drawing up this section of the paper, and I am most grateful. I must also acknowledge help over certain Surrey localities from Mr E. C. Wallace.

A. Verlotorum is at present known in the vice-counties of Surrey, Middlesex and Hertfordshire, its main area being a wide arc round the western side of London, from Watford and Whetstone in the north to Chertsey and Kingston in the south. In addition, there are four apparently isolated outlying stations in Surrey, to the south and west

of the main area—Ewell, Ripley, Worplesdon and Godalming. I have heard (1949) from Mr D. H. Kent that he has discovered *A. Verlotorum* in two areas of waste ground in Canterbury, E. Kent (v.-c. 15). In one of them it is in company with *Medicago arabica*, *Trifolium minus*, *Arctium minus*, *Dipsacus fullonum* and *Cardaria (Lepidium) Draba*, and it was in fair quantity in both. This not only adds a new county to its range, but is the most outlying locality from its main London area. How it got to Canterbury is not obvious. One of its habitats here is a bombed site, and it looks as if the *Artemisia* is a comparatively recent arrival at Canterbury.

So far it is unknown from Essex, but it may well spread there in time; also, according to Mr D. H. Kent, it is almost certain to be found in the Iver-Slough area of Buckinghamshire, since it grows within a few yards of the county boundary at Yiewsley. At present it is not possible to know with any accuracy where *A. Verlotorum* started in England, but its great abundance about the Thames on the western edge of London make it very likely that it originated in the Chiswick-Brentford-Hounslow-Twickenham-Richmond area; the oldest known English specimen (1908) is from Hounslow.

A more detailed enumeration of localities and specimens, arranged under vice-counties, follows. (K) denotes that I have seen a specimen in the Kew Herbarium.

v.-c. 15, E. Kent

Two areas of waste ground in Canterbury, 1949, D. H. Kent.

v.-c. 17, Surrey. [See Lousley (1946, 1947)]

Districts according to C. E. Salmon, 1931, *Fl. Surrey*

- IIIa. New bathing pool, Godalming, 9 Nov. 1946, G. M. Ash (K, Herb. Brenan).
- IV. Ripley, 28 Oct. 1945, N. Y. Sandwith 3180 (K). A clump on roadside verge, Bullswater Common, near Worplesdon, 14 Sept. 1947, E. C. Wallace & N. Y. Sandwith.
- VII. Locally abundant at Kew and thence along the Thames to Mortlake, 3 Nov. 1942, N. Y. Sandwith 3179 (K), 2 Oct. 1944, E. J. Salisbury (K), 24 Oct. 1945, N. Y. Sandwith & J. P. M. Brenan (Herb. Brenan No. 7235), 3 Nov. 1945, J. E. Lousley (K), 16 Feb. 1946, J. E. Lousley (K), 15 Jan. 1948, A. H. G. Alston (K). Richmond, 1942-1948! Locally abundant between Ham and Teddington, 12 Oct. 1942, N. Y. Sandwith & J. P. M. Brenan (Herb. Brenan No. 6806), 8 Nov. 1942, N. Y. Sandwith 3178 (K). Between Ham and Kingston, 1942! Large patches on Wimbledon Common, 9 Nov. 1946, N. Y. Sandwith (K); also by several roads to the south of the common, near Copse Hill, Mrs Welch, J. E. Lousley. Wayside, Howell Hill, Ewell, 16 Aug. 1947, E. C. Wallace 6022 (K)—specimen very immature.

v.-c. 20, Hertfordshire

Waste ground between Bushey Heath and Watford, 1947, *D. H. Kent*.

v.-c. 21, Middlesex

[See Kent (1947; 1948), Lousley (1946), Clifton College (1947 ?)]

Districts according to Trimen and Dyer, 1869, *Fl. Middlesex*

- I. Between Brockley Hill and Elstree, 1946, *D. H. Kent*. Yiewsley, 5 Oct. 1930, *R. Melville* (K), still there in 1948, *D. H. Kent*.
- II. Abundant by the Thames near Chertsey Bridge, 1946, *D. H. Kent*. Roadside near Sunbury Clock Tower, 1947, *Mrs Welch*. R. Thames between Sunbury and Halliford, 1947, *D. H. Kent*. Hampton Court, 1947, *Mrs Welch*. Abundant about Fulwell Golf Course, 1948, *D. H. Kent*.
- III. Rough ground near Hounslow, 7 Sept. 1908, *C. G. Green* (Herb. Druce at Oxford, ex Herb. A. Loydell!). Roadside between Bedfont and Hounslow, 1947, *Mrs Welch*. Hounslow Heath and adjoining waste land, 1947, *D. H. Kent*. Railway bank between St Margaret's and Twickenham, 1947, *Mrs Welch*. Near Hayes railway station, 1948, *D. H. Kent*.
- IV. Cool Oak Lane, Kingsbury, 1946, *D. H. Kent*. Near Brent railway station, *Clifton College 1945-6 Report*. Bombed site, Church Lane, Willesden, 1948, *D. H. Kent*.
- V. Roadside, Perivale, 1947, *D. H. Kent*. Canal-bank, Norwood Green, 1948, *D. H. Kent*. Tip at Hanwell and waste ground, Windmill Lane near Hanwell, 1946, *Mrs Welch & D. H. Kent*. Ealing Common, 1946, *D. H. Kent*. Brentford, 1945, *Mrs Welch*. Gunnersbury station! Hartington Road, Chiswick, 1945, *Mrs Welch*.
- VI. Whetstone, 1948, *D. H. Kent*. East Finchley, 1947, *J. E. Lousley*.

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