

CYTOGEOGRAPHY AND CYTOTAXONOMY OF SOME TARAXACUM SECTIONS IN BELGIUM AND NORTHERN FRANCE

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SUMMARY

The cytogeography of *Taraxacum* sect. *Taraxacum*, *Hamata* and *Erythrosperma* has been established for Belgium and northern France. On the basis of collections of samples from field populations and from herbaria the following patterns emerged: in the most north-western parts of France and the central zone of Belgium (Tournai/Gent–Liège) diploid, sexual specimens are of fairly common occurrence; diploids are rare or absent in the coastal and northern parts of Belgium as well in the southern Ardennes and in a region from Le Mans-Orléans-Strasbourg to the north: there is an as yet not fully explained disjunction in the distribution pattern of the diploids. In the studied areas no diploids are found belonging to the sections *Hamata* and *Erythrosperma*.

From the herbarium specimens and from the literature it became clear that in the Belgian *Taraxacum* flora, which phytogeographically belongs to the north-west European one, many species of the sect. *Taraxacum* are both present as diploids and triploids: about 30% of the species studied (± 75). In the discussion attention has been paid to the evolutionary dynamics of this section and to the obviously growing need to reconsider the (micro-)systematics of the group.

1. INTRODUCTION

This study is sequential to the cytogeographical studies carried out in Central Europe (DEN NIJS & STERK 1980), The Netherlands (STERK et al. 1982) and especially in France (DEN NIJS & STERK 1984). A similar, more detailed study of selected regions of The Netherlands is forthcoming.

In the already published studies the wide distribution of sexual diploid specimens mainly belonging to the section *Taraxacum* came to light: in Switzerland, large areas in Austria and the GFR, the whole of France south of the line Le Mans-Tours-Strasbourg. Although, going to the north from the line Le Mans-Strasbourg, the relative frequency of the diploids rapidly declines in France, the suggestion was put forward in the foregoing study that there might be a link between this southern region and the Dutch South Limburg diploids. If also in the intervening region (northern France and Belgium) diploids occur, a continuous geographical area with diploids would be evident. If this is indeed the case, the dynamic evolutionary process resulting from the co-occurrence of sexual and asexual reproduction also may take place in this area, and this particularly would have far-reaching consequences for the systematic taraxacology.

A survey of the distributional areas of a series of north-west European micro-species of *Taraxacum* renders it obvious that most of them have a range comprising (greater or smaller) parts of N.-W. Europe with supposed southern limits that for the greater part roughly coincide in northern France (VAN SOEST 1956, 1961; HAGENDIJK et al. 1982).

These roughly coinciding areas of distribution patterns have been said to be indicative of the existence of a north-western species group. One must bear in mind that the greater part of France (and Germany) has far less extensively been studied than the Low Countries and Belgium (not to mention Scandinavia). The southern distributional limits could, therefore, turn out to be more or less erroneous. Nevertheless there could be some kind of a chorologically transitional zone in the region concerned, because many species from southern and Central France do not extend as far to the north as Belgium. This pattern can be demonstrated by the records from France and Switzerland (DEN NIJS & STERK 1984): of the 37 species of section *Taraxacum* studied, only 5 have also been recorded from The Netherlands (HAGENDIJK et al. 1982). Three of the latter group of species consist (at least partly) of diploids (*T. aeruginiceps*, *T. aurosulum* and *T. polyodon*), which also clearly points at the necessity to extend studies and discussions concerning the geographical aspects of the incidence of diploidy and of hybridisation to include the areas to the north of Central France (and Central Europe).

The above-mentioned results and the ensuing reasoning instigated this present study with the following goals:

- the clarification of the range of distribution of diploid sexual individuals in northern France and Belgium, to which end a series of population samples from field surveys and in addition several herbarium collections were analysed.
- to obtain a more exact phytogeographical picture of the transitional zone in western Europe in which the sexual reproduction by outcrossing in the populations is being replaced by agamospermy
- to gain a better insight into the process of micro-evolution and the taxonomical diversification of the section *Taraxacum* in Europe. The crucial point is that the occurrence of diploids on a broader scale in the “north-west European” species group implies that also this species group of the section *Taraxacum* is in a state of dynamic evolution, which may sincerely hamper the conventional (micro-)taxonomic treatment of the group.

2. MATERIALS

2.1. Herbarium specimens

An extensive collection of 2400 sheets of which \pm 2050 originate from Belgium was kindly put at our disposal by the Nationale Plantentuin, Meise-Brussels (BR: loan 3208/82). Of this collection about 1500 specimens had been identified by the late J. L. van Soest, the remainder must be regarded as indeterminata. The greater part of this collection also formed the base for the taxonomic treat-

ment of the *Taraxacum* flora of Belgium by VAN SOEST (1956, 1961). Most of the specimens had been collected before 1960.

From the Herbarium Generale (BR) a selection from northern France and the south of The Netherlands has also been studied.

From the collections, sheets were selected with sufficient capitula for the assessment of the pollen size regularity and preferably hailing from grassland biotopes: about 700 sheets in all, representing 92 species in three sections.

In addition also a collection from the Musée National d'Histoire Naturelle, Paris (P) came to hand. From this consignment a series of 12 species was selected. Most of these species were also represented in the BR collection.

2.2. Population samples from natural stands

In the spring of the years 1981–1983 five series of population samples were collected along north-south oriented transects through the northernmost part of France, east Belgium and the adjacent part of Germany. Each sample consisted of at least 30 capitula. To the south the transects joined the previously discovered area with diploid-containing populations (DEN NIJS & STERK 1980, 1984), to the north they extended into Belgium and the Dutch Zuid Limburg area (STERK et al. 1982).

The situation of the transects was, from west to east, as follows (compare fig. 8): Lille-Le Mans, Maubeuge-Tours, Maastricht-Dinant-Nancy (the Meuse valley), Aachen-Luxemburg-Metz, and Verviers-Saarbrücken.

The collections are coded TPH 1–26, THL 111–131, THS 1–39 and TMT 25–32, the total number of population samples was 92; the sample series are enumerated in Chapter 5.

From a selected number of sampling sites also living taproots were collected for chromosome counts.

Through the kind aid of Prof. A. Lawalrée (Brussels) it was possible to revisit two sampling sites from which specimens are represented in the herbarium collection (sampling year: 1958). These locations are the "Chaussée de Wavre", Brussels (THA 1) and Mont-St. Aubert near Tournai (THA 2); taproots for chromosome counts were collected there.

3. METHODS

As a routine procedure the ploidy levels of the specimens were primarily determined on the basis of an assessment of the mode of variability of the pollen diameter, as in preceding studies (TSCHERMAK-WOESS 1949, DEN NIJS & STERK 1980, STERK et al. 1982). Chromosome counts were carried out by means of phase contrast microscopy after a usual staining with basic fuchsin.

The populations were collected at set distances by travelling along the transect, keeping in mind the desirability of a broad ecological range being represented in the collection. Capitula were collected by a representative, but not ad random scheme, as employed earlier (DEN NIJS & STERK 1984).

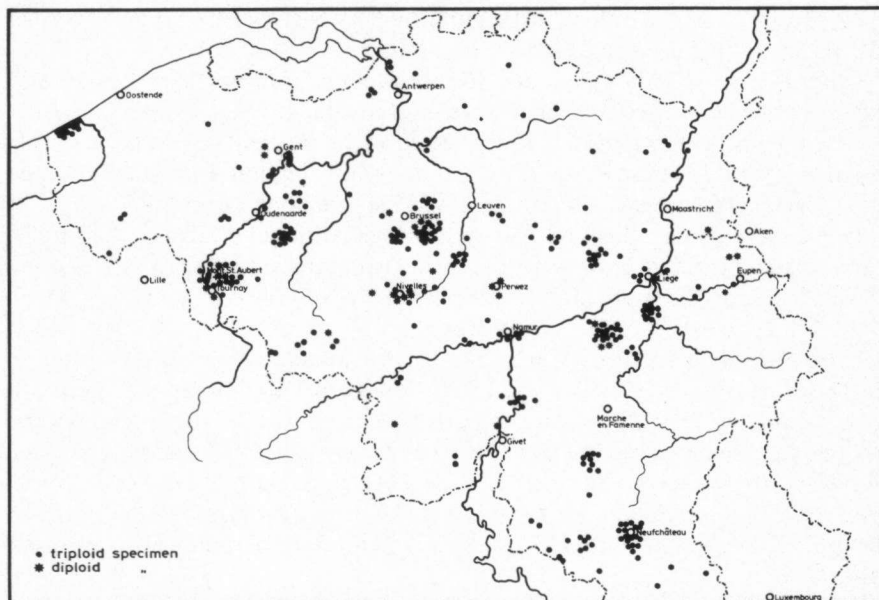


Fig. 1. Distribution of about 350 herbarium specimens (BR) of the section *Taraxacum*. The diploids are indicated with asterisks. From some sites a range of specimens was present; the data on the map are clustered irrespective of their precise topographic position (see for example the surroundings of Mt.-St-Aubert). Also included are two diploid specimens from the herbarium of Gent (GENT).

4. RESULTS OF THE HERBARIUM STUDY

4.1. Nationale Plantentuin Herbarium Meise (BR): Summary

The individuals studied mostly came from Belgian localities, a minority from northern France and the southern part of The Netherlands.

Altogether about 700 specimens were studied of which 40 individuals, all hailing from Belgium, appeared to be almost certainly diploids.

Sequentially arranged section-wise the results can be summarized as follows:

Sectio *Taraxacum*

75 species studied (\pm 350 specimens). Diploid individuals were found in 15 microspecies of which 12 were represented by both diploid and triploid individuals. In fig. 1 the localities of all occurrences of diploids and of most of the triploids are indicated by asterisks and black dots, respectively. The fairly wide distribution of the diploids throughout the greater part of Central Belgium is striking and in sharp contrast to the absence in the coastal area and the southern Ardennes.

Sectio *Hamata*

7 species studied represented by about 70 specimens, of which the greater part (46) belong to the species *T. marklundii* (incl. *T. subhamatum*). No diploids were found.

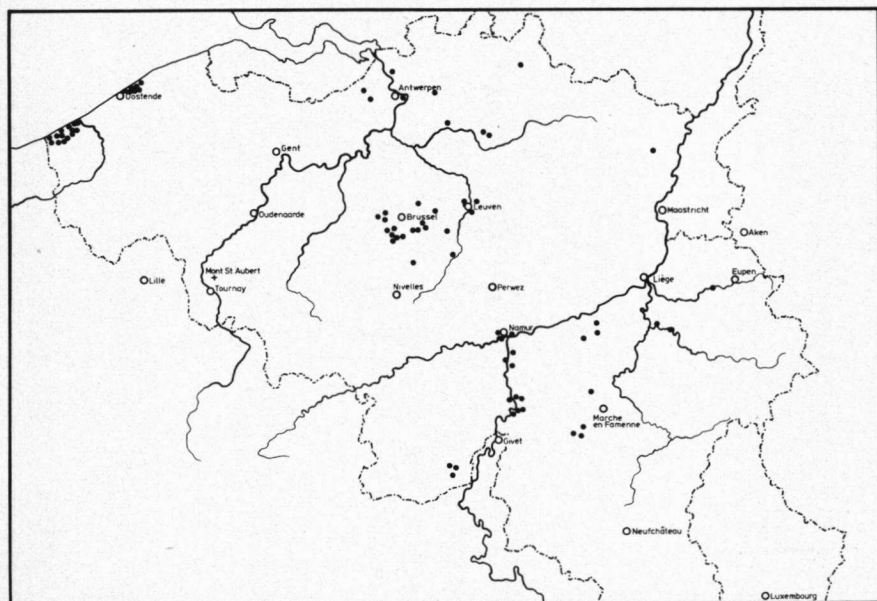


Fig. 2. Distribution of about 80 herbarium species (BR) of the section *Erythrosperma*.

Section Erythrosperma

10 species studied, represented by about 100 specimens. No diploids were encountered. The localities are indicated in *fig. 2*.

Indeterminata

Out of the \pm 550 unnamed sheets a selection of some 135 specimens was studied of which 11 proved to be diploid. The localities of these individuals are incorporated in *fig. 1*.

The percentage of diploid individuals within the group of indeterminata is about as high as it is in the named microspecies (from sections *Taraxacum* and *Hamata* only): 11 out of 135 i.e. 8%, as against 30 out of 420 i.e. 7%.

4.2. Annotated enumeration of the BR-sheets studied

The following enumeration presents per section and per species (in alphabetical order) the BR-specimens examined. The ploidy assessments and relevant literature references and in a few cases some notes are included. The code numbers are those of the above mentioned loan (3208 AMD 82) as indicated on the sheets. The nomenclatural data are according to VAN SOEST (1956, 1961) with some nomenclatural alterations conform RICHARDS & SELL (1976) and HAGENDIJK et al. (1982).

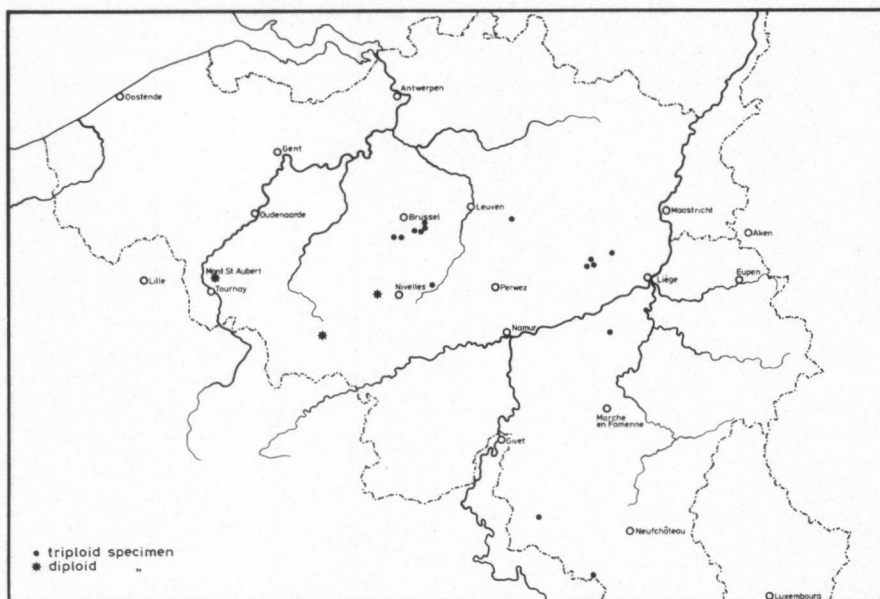


Fig. 3. Distribution of the sampling localities of *T. acutangulum* Markl. as present in BR (see the annotated list of studied specimens).

SECTIO TARAXACUM

T. acutangulum Markl.

Diploid: Maisières, 394; Mont-St. Aubert, 414; Ronquières, 518.

Triploid: Auderghem, 350, 376–378; Bleret, 351–353; Boncelles, 370; Bothey, 363; Bousval, 390; Chassepierre, 391; La Hage, 398; Lantremange, 412; Neervelp, 364; Petit Fays, 348; Terwagne, 369; Ukkel, 349, 354.

Note: Fig. 3 shows these locations, the diploids are distributed to the south-west of Brussels. According to VAN SOEST (1961) the species is also found elsewhere in northwestern Europe and in France, Switzerland and Spain. As a matter of fact more diploids may be expected to be present in the populations from the latter areas.

T. acutifidum Chr.

Diploid: mt.-St.-Aubert, 414.

Note: Van Soest mentions on the attached label that the specimen is not-identical to the type and qualified the species as a critical one. Distribution area: Denmark, Netherlands (HAGENDIJK et al. 1982). Triploid specimens are recorded from The Netherlands (STERK et al. 1982).

T. adamii Claire

Triploid: Assenois 424; Ekeren-Wilmansdonk, 22; St.-Gorgon, Vosges, Fr. 1; Ingoogiem, 426; Ploegsteert, 428; Saventhem, 427.

T. aequilobum Dt.

Triploid: Ebby, 446; Mirwart, 443; Neufchateau, 440, 441; Nosseghem, 450; Saventhem, 438.

T. aequisectum Chr.

Triploid: Mirwart, 462; Tohogne, 465.

T. alatum Lb.f.

Triploid: Auderghem, 471; Boncelles, 467, 469, 470; Cugnon-St-Midarol, 473; Ebby, 484; Hamipré, 482; St. Idesbald, 486; Laiche, 487; De Panne, 485.

Note: Diploidy was registered in the Dutch South Limburg area (STERK et al. 1982). The distribu-

tion area includes northern France (VAN SOEST 1961).

T. ancistrolobum Dt.

Triploid: Clavier, 504; Laiche, 497; St.-Medard, 498; Nederbrakel, 496, 499; Vrasene, 493.

T. angustisquameum Dt.

Triploid: Bleret, 515; Waremmes, 517.

Note: STERK et al. (1982) found a diploid specimen in South Limburg, thus more diploids may be expected.

T. ardisodon Dt. (*T. polyodon* Dt.)

Diploid: Ronquières, 518.

Note: DEN NUS & STERK (1984) record triploids from the French department Yverlines (Paris-Banlieu).

T. arrhenii Palmgr.

Triploid: Montinsart, 520.

T. aurosulum Lb. f.

Triploid: Jognolle, 536; Monceau-en-Ardenne, 541; Ukkel, 542, 543; Vierset-Barse, 538.

Note: STERK et al. (1982): triploids in The Netherlands; DEN NUS & STERK (1980): 2x and 3x in dépt. Seine-et-Oise (Fr.). VAN SOEST (1961) does not mention the occurrence in northern France.

T. brevipyramidale Rail.

Triploid: Ceffonds, Hte-Marne, Fr., 42.

T. calochroum Hgd., v.S. and Z.b.

Triploid: Ellezelles, 561; Mt.-St.-Aubert, 563; Moritèreuil-sur-Epte, Val-d'Oise, Fr., 43; Nederbrakel, 566; Watermaal, 560; Zillebeke, 565.

T. canoviride Lb. f.

Triploid: Everberg, 573; Herbeumont, 571, 570.

T. caudatulum Dt.

Triploid: Auderghem, 588, 594, 621, 622; Beernem, 615; Bourg-et-Comin, Aisne, Fr., 48; Champion, 602; Fontainebleau, Seine-et-Marne, Fr., 49; St. Idesbald, 590; Mons, 596; Namur, 611; Nederbrakel, 580; Pailhe, 592, 593; Saventhem, 604, 605, 607.

T. cordatum Palmgr.

Triploid: Edelaere, 638; Elzendamme, 637; Mt.-St.-Aubert, 643, 642, 641.

Note: VAN SOEST (1961) gives as parts of the distribution area N. France and Spain; diploidy may occur there.

T. croceiflorum Dt.

Diploid: Elene, 681; Nivelles, 674.

Triploid: Edelaere, 662, 663; Hoeilaart, 671.

Note: STERK et al. (1982): diploids from the Central and Northern part of The Netherlands. VAN SOEST (1961) distribution: N.-W. Europe including N. France and England.

T. cyanolepiforme v.S.

Triploid: Eclaron, Hte-Marne, Fr., 65.

T. cyanolepis Dt.

Triploid: St. Idesbald, 683.

T. dahlstedtii Lb. f.

Diploid: Anderlecht, 715; Bressoux, 850; Nivelles, 714, 730.

Triploid: Vrasene, 709; Denderhoutem, 704; Monampsteuil, Aisne, Fr., 66; De Panne, 689; Ukkel, 707; Vailly, Aube, Fr., 68.

Note: See figures 4.1 and 4.2. RICHARDS (1969): 3x from Great Britain; DEN NUS & STERK (1982): 3x from The Netherlands. VAN SOEST (1961): distributed in e.g. England, Canada, Wales (Gr. Brit.). HAGENDIJK et al. (1982): the species is rather variable in The Netherlands; there may occur chromosomal deviations ($2n = 23$) of the type SØRENSEN & GUDJONSSON (1946) discovered. The species sometimes resembles *T. polyodon*.

T. dilaceratum Chr.

Triploid: Dase, 732.

T. dilatatum Lb. f.

Triploid: Chèvremont, 739; Clavier, 735; Elzendamme, 748; Ressoins-sur-Matz, Oise, Fr., 76.

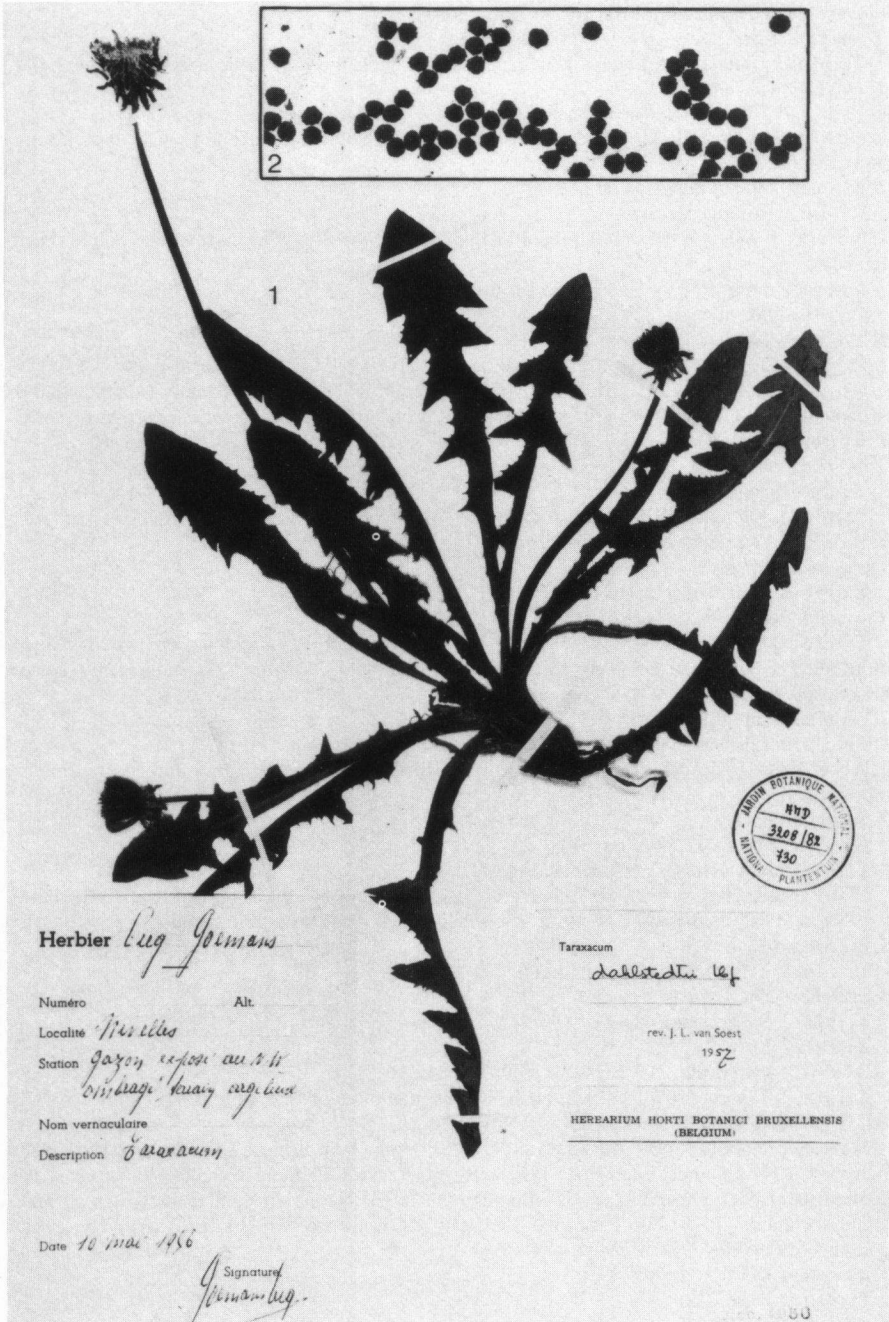


Fig. 4. *T. dahlstedtii* Lb. f. l. Specimen no. 730 from BR, hailing from Nivelles, "gazon". Diploid
2. Pollen slide showing the uniformity of the pollen diameter as an indication of the diploid status.

T. duplidens Lb. f. (*T. ostenfeldii* Raunk.)

Triploid: St. Idesbald, 709; De Panne, 767.

T. duplidentifrons Dt. (*T. raunkiaeri* Winnst. ex. Raunk).

Triploid: Heusden (Lb), 785; Oud Turnhout, 788; Poulseur, 786; Ukkel, 779; Villers-Cotterets, Aisne, Fr., 111.

Note: Distribution area: temperate N. Europa, to the south of England, Central France and W. Switzerland (HAGENDIJK et al. 1982).

T. ekmanii Dt.

Triploid: Hamipré, 840; Landen, 795; Mt.-St.-Aubert, 848; Nederbrakel, 796; Petit, 813; Sény, 835; Wasmes, 834.

Note: Distribution: N.-W. Europe and France, N. Spain and N. Portugal (VAN SOEST 1961).

T. euranum v.S.

Triploid: Jaudrais, Eure-et-Loire, Fr., 116.

T. excellens Dt.

Diploid: Bressoux, 850, 849.

Note: HAGENDIJK et al. (1982): distribution mainly in Belgium, Luxemburg and The Netherlands; in the latter region the species shows some variability with intermediates between the morphs.

T. exiguum v.S.

Triploid: Villers-en-Arthies, Val-d'Oise, Fr., 118.

T. fennorodiae Hagl.

Triploid: Clavier, 857; Waremmé, 858.

T. geminatum Hagl.

Triploid: Esneux, 864.

T. glaucovirens Hagl.

Triploid: Auderghem, 871, 874.

T. haematicum Hagl.

Triploid: Monceau-en-Ardenne, 879; Deinze, 882.

T. hastatum Markl.

Triploid: Beuzet, 951; Bierbeek, 954; Bleret, 949; Chèvremont, 950.

T. insigne Ekm.

Diploid: Elene, 986; Nivelles, 989.

Triploid: Chèvremont, 987; Terwagne, 983.

Note: VAN SOEST (1961) mentions as the distribution area N.-W. Europe including Wales. RICHARDS (1972) records from Durham Co., Gr. Brit., some variation in the chromosome number: $2n = 25$.

T. interoenieus Hagl.

Triploid: Fouches, Arlon, 992.

T. kjelmanii Dt.

Triploid: Esneux, 995, 994; Mirwart, 999; Villance (Ard.), 998.

T. lacerabile Dt.

Triploid: Clavier, 1004; Grupont, 1002.

T. laceratum (Brenn.) Brenn. (*T. parvuliceps* Lb. f.).

Triploid: Namur, 1008.

Note: VAN SOEST (1961) suggests the occurrence of this species in France, the main area being N.-W. Europe.

T. lacerifolium Hagl.

Triploid: Assenois, 1009; Boncelles, 1017; Heffen, 1010; Laiche, 1012; Ways, 1015.

T. laeticolor Dt.

Triploid: Boussu, 1233; Elzendamme, 1231; Grupont, 1234; Heure, 1236; Namur, 1228.

T. lawalreei v.S.

Diploid: Auderghem, 1239; Cérourx 1241.

Triploid: Edelaere, 1242.

Note: According to the attached labels specimen 1239 is the type of the species; as this individual does not have fruits, Van Soest has qualified specimen number 1241 as the *cotypus fruct.*

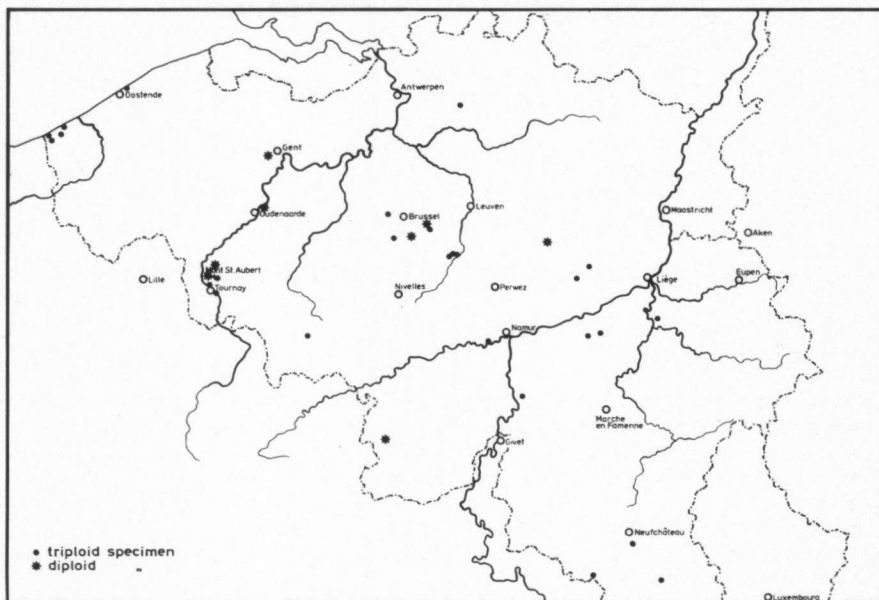


Fig. 5. Distribution of the sampling localities of *T. polyodon* Dt. as present in BR (see the annotated list of studied specimens).

T. limburgense v.S.

Diploid: Kain, 1253; Nivelles, 1254.

Note: Other diploid records originate from South Limburg, Netherlands (STERK et al. 1982). So far only diploid specimens are known of this species. The limitation of the distribution area to The Netherlands (HAGENDIJK et al. 1982) is no longer justified.

T. linguatum Dt.

Triploid: Dinant, 1278; Nederbrakel, 1274, 1275; Oeilley, Aisne, 198; Olloy, 1276; Vierset-Barse, 1272; Walem, 1279; Watermaal, 1277.

T. lucidiforme Hgd., v.S. & Zb.

Triploid: Elzendamme, 1170, 1169; Sart-Dames-Aveline, 1167.

T. lucidum Dt.

Triploid: Elzendamme, 1299; Lantremange, 1292; Mt.-St.-Aubert, 1296; Nederbrakel, 1290; Thin (Liège), 1308; Tournai, 1294.

T. melanthoides Dt.

Triploid: Esemaal, 1136; Hamipré, 1127; Hoeilaart, 1133; Laiche, 1131; Modave, 1132; Mol, 1138; Monceau-en-Ardenne, 1140; Nederbrakel, 1130.

T. mimulum Dt.

Triploid: Bressoux, 1147; Grupont, 1143; Schuurhoven, 1142.

Note: MULLER (1972) found diploids in Switzerland; the distribution area must be much more extensive than VAN SOEST (1961) suggests (: N.-W. Europe, including The Netherlands and Belgium).

T. obliquilobum Dt.

Diploid: Vierset-Barse, 1313.

Triploid: Assenois, 1318; Clavier, 1312; Lillo, 1316; Wavre, 1311.

Note: HAGENDIJK et al. (1982): the typical northern European form seems to be absent in The Netherlands, where it is replaced by morphologically variable and critical specimens.

T. oblongatum Dt.

Diploid: Auderghem, 1324.

Triploid: Gozée, 1322, 1323.

Note: DEN NIJS & STERK (1982) counted $2n = 24$ in The Netherlands.

T. obtusilobum Dt.

Triploid: Wizernes, Pas-de-Calais, Fr., 241.

Note: GUSTAFSSON (1937) already mentions a diploid population from S. Sweden, which according to ROUSSE (1983, in litt.) died out recently by human activities. Distribution (VAN SOEST 1961): S. Sweden, Belgium and France.

T. pallescens Dt.

Triploid: St. Medard, 1355; Pailhe, 1353.

Note: DEN NIJS & STERK (1980) recorded diploidy from the dépt. Seine-Maritime, Fr.

T. pannucium Dt.

Triploid: Bleret, 1363; Elene, 1370; Esneux, 1362; Grupont, 1360; Landen, 1363; Nederbrakel, 1369.

T. pannulatifforme Hagl.

Triploid: Bleret, 1374.

T. pannulatum Dt.

Diploid: Edelaere, 1386.

Triploid: Dinant, 1387; Suvy, 1379; Tournai, 1385; Watermaal, 1382.

Note: VAN SOEST (1961): distributed in N.-W. Europe, including N. France.

T. paucidentatum v.S.

Triploid: Eclaron, Hte-Marne, Fr., 253.

T. pectinatiforme Lb. f.

Triploid: Bouillon, 1392; Laiche, 1390; Neerlanden, 1394; Sommière, 1393.

T. piceatum Dt.

Triploid: Bleret, 1402; Nivelles, 1407.

Note: VAN SOEST (1961): distributed in N.-W. Europe, France and Spain.

T. polyodon Dt.

Diploid: Auderghem, 1458; Drongen, 1429; Edelaere, 1424; Froidchapelle, 1427; Landen, 1438; Mt.-St.-Aubert, 1464, 1463, 1465; Watermaal, 1423.

Triploid: Assenois, 1432; Bleret, 1475; Breedene, 1418; Chassepierre, 1428; Chèvremont, 1461, 1460, 1459; Clavier, 1413; Dilbeek, 1449; Dinant, 1409; Etalle, 1430; Fontenay-sous-Bois, Seine, Fr., 260; Ghlin, 1433; St. Idesbald, 1466; Kain, 1477; Lantremange, 1446; Modave, 1416; Mont-Violette, 1421; De Panne, 1420, 1470, 1471; Poulseur, 1434; Putte, 1455; Saint-Germain, Seine-et-Oise, Fr., 258; Soye, 1450; Tournai, 1425; Ukkel, 1452; Vrasene, 1417; Wavre, 1469, 1468, 1467.

Note: Fig. 5 shows the distribution of the material studied. For an illustration, see fig. 6. There exist apparently populations built up of both ploidy levels. The diploids have a fairly wide distribution throughout Central Belgium. Earlier chromosome counts: RICHARDS (1969): $2n = 24$ from Denmark and Great Britain; RICHARDS & SELL (1976): $2n = 21$ up to 48 from Great Britain; DOLL (1982): $2n = 17$ up to 48 from not mentioned localities; DEN NIJS & STERK (1982): $2n = 24$ from The Netherlands; DEN NIJS & STERK (1984): diploids from the French dept. Seine-Maritime. The species shows regionally a considerable chromosomal variation, i.e. an unbalanced inconstancy. As early as 1946 SØRENSEN & GUDJONSSON studied triploid Scandinavian populations intensively: there occur chromosomal aberrations (e.g. $2n = 23$) resulting in morphologically discernable morphs and sometimes in a partial restauration of sexuality (by a normalization of the meiotic processes). The morphological deviations may also occur in The Netherlands (HAGENDIJK et al. 1982).

One may assume that the partial sexuality of these "species" caused the cytologically complicated structure by hybridizations and that diploids may have arisen from reduced ♀ gametic cells from triploids.

T. procerum Hagl.

Triploid: Tohogne, 1502.

T. pycnolobum Dt.

Triploid: Alken, 1538; Assenois, 1539; Quiévrain, 1536; Wavre, 1534.

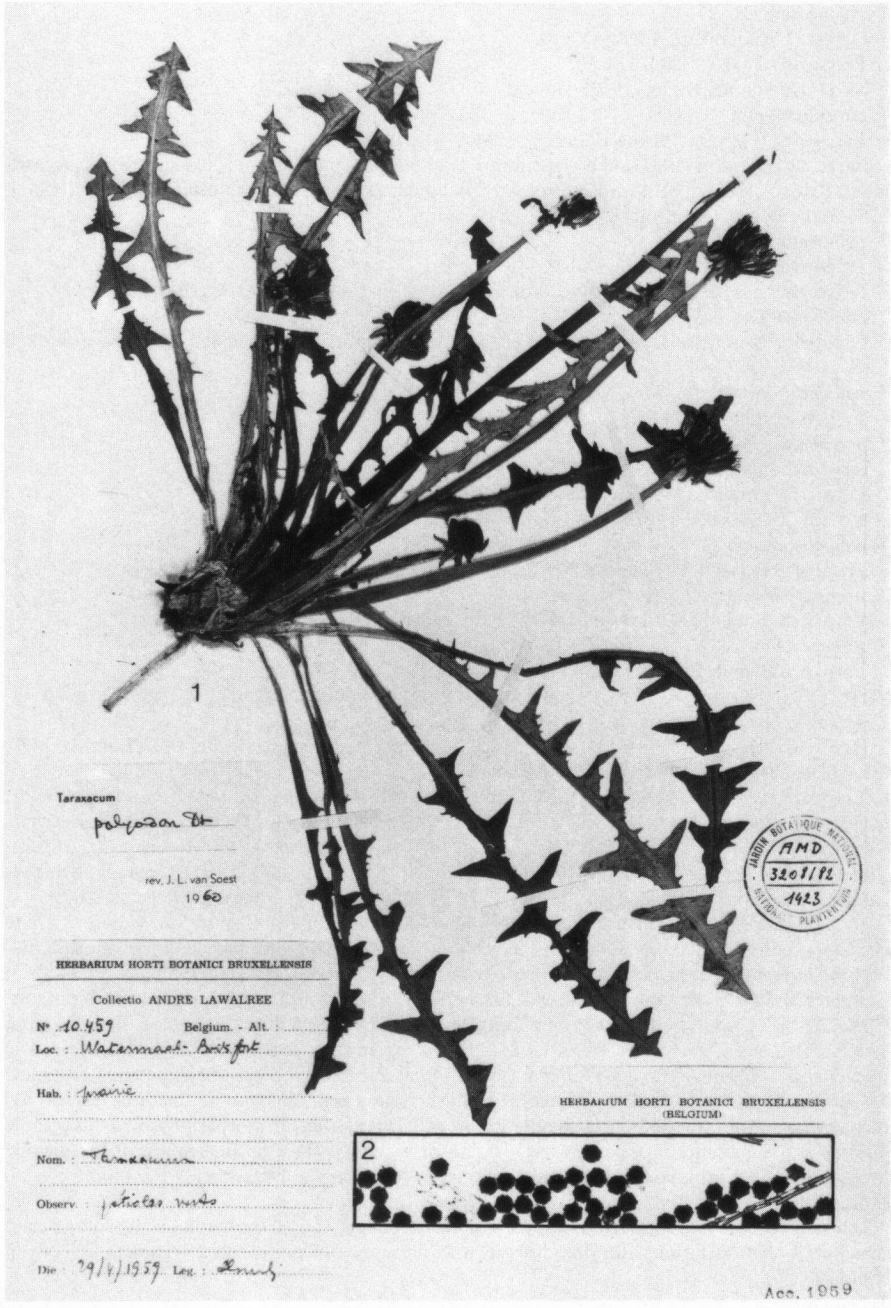


Fig. 6. *T. polyodon* Dt. 1. Specimen no. 1423 in BR, hailing from Watermael-Boitsfort, "prairie". Diploid. 2. Pollen slide showing the uniformity of the pollen diameter as an indication of the diploid status.

T. reseolepis, v.S.

Triploid: Villers-en-Arthies, Val-d'Oise, Fr., 274.

T. retroflexum Lb. f.

Triploid: Arville, 1543; Dinant, 1541.

T. rhodopodon Dt.

Triploid: Zillebeke, 1352.

T. rubrisquameum Chr.

Triploid: Habay, 1577.

T. sellandii Dt.

Triploid: Ukkel, 1608.

T. sinuatum Dt.

Triploid: Mt.-St.-Aubert, 1613, 1614.

T. splendidum Hagl.

Triploid: Goë, 1617; Neufchateau, 1616.

T. stereodes Elem.

Triploid: Ukkel, 1621.

T. subcyanolepis Chr.

Diploid: Kain, 1633; Lemberg, 1626.

Triploid: Auderghem, 1632, 1634; Bierbeek, 1630; Chiorres, 1625; Dorinnes, 1628; Esemael, 1623; St. Idesbald, 1635; Pépinster, 1627; Schaerbeek, 1636; Velaines, 1624.

Note: RICHARDS (1969) found $2n = 16$ and $2n = 24$ individuals in Durham Co., Gr. Brit. Distribution area: N.W. Europe, N. and C. France and Ireland (VAN SOEST 1961).

T. sublatissimum Dt.

Triploid: Pailhe, 1640.

T. tarachodum Hgd., v.S. et Zb.

Triploid: Assenois, 1676.

T. trilobatum Palmgr.

Triploid: Auderghem, 1799; Elzendamme, 1761; Esneux, 1798, 1774; Hamipré, 1777; Linkebeek, 1784; St. Medard, 1782; Millen, 1766; Moha-Huccorgne, 1751; Muno, 1772; Nederbrakel, 1750; Neufchateau, 1779, 1778, 1760; Quiévrain, 1771; Saventhem, 1757; Schelde-windeke, 1767; Tohogne, 1797; Wavre, 1781.

Note: Distribution: N.-W. Europe and France (VAN SOEST 1961).

T. undulatifforme Dt.

Diploid: Perwez Br., 2174; Tournai, 1850.

Triploid: Bleret, 1817, 1816; Elzendamme, 1822; Esneux, 1852; Froid-chapelle, 1827; Holton, 1826; Landen, 1856; Lillo, 1813; Luttre, 1846; Marlière, 1851; Mirwart, 1857, 1818; Mons, 1845; Nederbrakel, 1838, 1837, 1836, 1835, 1823, 1820; Onhay, 1831; Pailhe, 1854; St.-Servais, 1855; Straimont, 1828; Tervuren, 1865; Tohogne, 1814; Vierset-Barse, 1853; Wavre, 1821.

Note: Fig. 7 shows the distribution of the sampling localities. Distribution: N.-W. Europe and N. France (VAN SOEST 1961).

T. undulatum Lb. f.

Triploid: Clavier, 1869; Waterloo, 1864.

T. vastisectum Markl.

Triploid: Nivelles, 1873.

SECTIO HAMATA

T. atrovirens Dt. (*T. hamiferum* Dt.)

Triploid: Elzendamme, 526; Froidchapelle, 531; St. Idesbald, 524, 525.

T. boekmanii Borg.

Triploid: Paris '75, 29.

T. bracteatum Dt.

Triploid: St. Idesbald, 557, 558; Zillebeke, 556.

T. hamtifforme Dt.

Triploid: Auderghem, 893; Elene, 903, 906; Hamipré, 905; Ierskamp, 884; Mons, 923; Oorbeek, 919; De Panne, 909; Quiévrain, 931; Tournai, 916, 928; Zillebeke, 910.

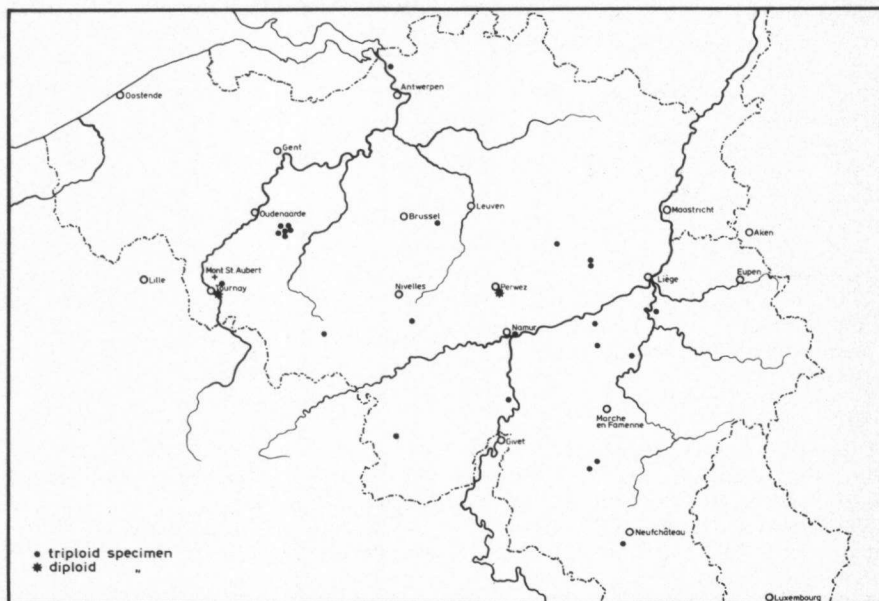


Fig. 7. Distribution of the sampling localities of *T. undulatifforme* Dt. as present in BR (see the annotated list of studied specimens).

T. hamatum Raunk.

Triploid: Beersel, 947, 943; St. Idesbald, 935; Iscelles, 942; Pépinster, 938.

T. marklundii P. (including *T. subhamatum* Dt.)

Triploid: Auderghem, 1071; Baudour, 1037; Chassepierre, 1045, 1044, 1034, 1056, 1093; Chèvremont, 1123; Edelaere, 1119, 1120; Elene, 1051, 1050; Ellezelles, 1122; Epinois, 1079; Esneux, 1021; Fontainebleau, Seine-et-Marne, 218; Goniregnier, 1094; Grupont, 1076; Hargnies, Ardennes, Fr., 213; Hasselt, 1077; Hornues, 1048; Lac de Monampteuil, Aisne, Fr., 219; Lebbeke, 1035, 1066; Leuven, 1058; Lubbeek, 1089; Mirwart, 1092; Monceau-en-Ard., 1032; Moorsel, 1088, 1986; Neufchateau, 1075; Ophain, 1065; Opoeteren, 1091; Orval, 1027; Quarles, 1087; Saint-Benoit, Yvelines, Fr., 216; Schuurhoven, (Tnht), 1030, 1028; Seltre, 1064; Stembert, 1036; Straimont, 1982; Terwagne, 1022; Winzele, 1080, 1111; Zellebeke, 1046.

Note: The overall distribution area (VAN SOEST (1961): N.-W. Europe and also France, Portugal and N. Spain.

T. quadrans Oelg.

Triploid: Rambouillet, Yvelines, Fr., 273.

SECTIO ERYTHROSPERMA

T. brachyglossum Dt.

Triploid: Auderghem, 546, 547, 548, 549; Cayeux-sur-Mer, Somme, fr., 34; Coxyde-village, 551; Domburg NL, 33; Olloy 550; Oranjezon (Walcheren) NL, 30.

Note: $2n = 24$ by GUSTAFSSON (1935): Sweden; CHUHSANOVA et al. (1968): Latvia; MALECKA (1969) and DOLL (1973): GDR, Poland; DEN NIJS et al. (1978): The Netherlands, here also $2n = 32$ occurs. RICHARDS (1970) discovered sexuality and a great variability in the chromosome number: $2n = 16, 17, 18, 20, 24, 26, 28$.

T. fulviforme DT.

Triploid: Nosseghem, 863.

T. lacistophyllum Dt.

Triploid: Beauchamp, Seine-et-Oise, Fr., 174; Breedene, 1184; Chanyolle, 1197; Coxyde, 1174; Dieghem, 1218; St. Idesbald, 1172, 1174; Lambermont, 1199; Leuven, 1193; Marhave, 1195; Ste. Marie, 1217; Montagne-aux-Buis, 1215; De Panne, 1173, 1176, 1177; Rambouillet, Seine-et-Oise, Fr., 169; Remouchamps, 1194; Tongerlo, 1206, 1207; Ukkel, 1219, 1220, 1222; Valenciennes, Nord, Fr., 177.

T. oxoniense Dt.

Triploid: De Panne, 1344.

T. polyschistum Dt.

Triploid: Archennes, 1483; Bourg-et-Comin, Aisne, Fr., 265; Cermay-la-Ville, Seine-et-Oise, Fr., 263; Eoyis, 1484; Fontainebleau, Seine-et-Marne, Fr., 264; Lys-Chantilly, Oise, Fr., 266; Namur, 1493; Ophain, 1485.

T. pseudolacistophyllum v.S.

Triploid: Jognolle, 1510; Lustin, 1508; Seny, 1509.

T. rubicundum Dt.

Triploid: Anseremme, 1569, 1570, 1568; Cayoux-sur-Mer, Somme, Fr., 275, 276; Champalle, 1573; Dinant, 1552; Dourbes, 1558; St. Idesbald, 1555; Maisse, Seine-et-Oise, Fr., 279; Olloy, 1554.

Note: DOLL (1972) mentions diploids from S. Europe, without giving topographical details; other literature data: RICHARDS (1969): triploids in Gr. Britain; MALECKA (1969): triploids and hexaploids in the DDR; DOLL (1973): $2n = 24$ and 25 in the GDR.

T. scanicum Dt.

Triploid: Anderlecht, 1580, 1582, 1583; Antwerpen, 1593; Jamoigne, 1595; Oud Turnhout, 1590; Rochefort 1592; Wavre, 1594.

T. silesiacum Dt.

Triploid: Modave, 1609.

Note: DOLL (1973) counted $2n = 24$ in the GDR, whereas DEN NIJS et al. (1978) record the occurrence of $2n = 24$ and $2n = 32$ in populations from the Dutch dune area.

T. tortilobum Fl.

Triploid: Arlon, 1744; Bredene, 1682, 1681, 1679, 1729; Chèvremont, 1712, 1711; Dave, 1714; Dinant, 1709, 1689; Fontainebleau, Seine-et-Marne, Fr., 316; Guignicourt, Aisne, Fr. 317; St. Idesbald, 1708; Juvincourt, Laonnais, Aisne, Fr., 340, 341, 342, 343, 339; Lier, 1705; Leuven, 1703; Meerdonk, 1683; Modave, 1710; Montignies, 1741; Niel/As, 1716; Namur, 1713, 1701; Olloy, 1688; De Panne, 1707, 1726; Petit-Landou, Hte-Rhin, Fr., 311; Rochefort, 1697; Rouvieux, 1694; Vallée s. l'Heure, 1690; Vrasene, 1685; Wijnegem 1692; Wilmarsdonkse dijk, 1687.

4.3. Species from northern France (Herb. P.)

From the materials of the Musée National d'Histoire Naturelle a selection was made of specimens named by qualified *Taraxacum* taxonomists (mainly Van Soest and Sahlin) confirming to the attached labels. Species belonging to the section *Taraxacum* were studied only.

T. dahlstedtii Lb. f.

Triploid: Le Vesinet, Seine-et-Oise, 13788.

T. linguatum Dt.

Triploid: Oeuilly, Aisne, 41470 A.

T. melanocethrum Sahl.

Triploid: Nanterre, Hts-de-Seine, 16163.

T. mimulum Dt.

Triploid: Bléville, Seine-Mtme., 12989.

T. oblongatum Dt.

Triploid: Suresnes, Hts-de-Seine, 16389; Marchais, Yvelines, 16232.

T. polyodon Dt.

Triploid: Fontenay-sous-Bois, Seine, 31.

T. pseudoleptodon v.S.

Triploid: Limay, Yvelines, 16367; Vellennes, Seine-et-Oise, 13354; Colombes, Hts-de-Seine, 16, 149; Nanterre, Hts-de-Seine, 16172; Médan, Seine-et-Oise, 13362.

T. retroflexum Lb. f.

Diploid: Suresnes, Hts-de-Seine, 16390.

Note: JENNISKENS (1984) also found diploids in S.-W. Germany.

T. tenuiceps v.S.

Triploid: Colombes, 16337; Nanterre, 16164, 16168; Hts-de-Seine; St.-Germain, Yvelines, 16174; Le Vesinet, Seine-et-Oise, 13795.

T. triangularidentatum v.S. (*T. subundulatum* Dt.)

Triploid: Villennes, Seine-et-Oise, 13351.

T. trilobatum Palmgr.

Triploid: Chanteloup, Yvelines, 16295; Colombes, Hts-de-Seine, 16334, 16338.

T. undulatum Lb. f.

Triploid: Orsay, 1837 Cosson.

5. Results from the field-transects

The results of the analyses from the populations are tabulated in the following lists, the samples grouped in the 5 transects. The percentages of diploid individuals and the doubtful diagnoses are reported. The latter category corresponds with the pollentype PT as distinguished in STERK et al. (1982). When no percentage is given, 100% of the capitula proved to be triploid. In the lists very concise habitat typifications are added; the exclamation notes indicate a high level of the factor in question. For the French localities the number of the magisterial department is given.

Transect 1: Lille-Le Mans (15 population samples)

TPH1 Strazele, 59, Fr: grazed! fertilized! pasture: 64% *diploids*; TPH2 Burbure, 62, Fr: Alfalfa crop rotation; TPH3 St.-Pol-s.-Ternoise, 62, Fr: fertilized meadow: 12% *diploids*, PT: 3%; TPH4 Clairys-Saulchoix, 80, Fr: grazed!, fertilized pasture; TPH5 Poix-de-Picardie, 80, Fr: ext. grazed, fertilized pasture; TPH6 Equennes, 80, Fr: fertile river meadow: TPH7 Marseille-en-Beauvaisis, 60, Fr: fertilized! pasture; TPH8 Gournay-en-Bray, 76, Fr: fertilized pasture; TPH9 Les Andelys, 27, Fr: fertilized meadow: 12% *diploids*; TPH10 Conches-en-Ouche, 27, Fr: orchard meadow; TPH11 Neaufles-Auvergny, 27, FR: orchard meadow, poor in species: 82% *diploids*, PT: 3%; TPH12 Montagne-au-Perche, 61, Fr: pasture: 3% *diploids*; TPH12A Pervenchères, 61, Fr: moist! meadow: 6% *diploids*; TPH13 Ballon, 72, Fr: orchard meadow; TPH14 St.-Denis-d'Orgues, 72, Fr: pasture: 3% *diploids*, PT: 6%; TPH 15 St.-Georges-du-Bois, 72, Fr: grazed, poor pasture: PT: 6%.

Transect 2: Maubeuge-Tours (11 samples)

TPH26 Dourlers, 59, Fr: poor, moist meadow many herbs: 30% *diploids*; TPH25 La Capelle, 02, Fr: meadow: 42% *diploids*; TPH24 Marle, 02, Fr: grazed! pasture: 55% *diploids*; TPH23 Monamp-teuil, 02, Fr: grazed! fertilized pasture; TPH22 Clermont, 60, fr: pasture, dense crop stand; TPH Monneville, 60, Fr: grazed pasture; TPH20 Septeuil, 78, Fr: ext. meadow; TPH19 Maintenon, 28, Fr: grazed, calcareous grassland; TPH18 Chartinvilliers, 28, Fr: river meadow; TPH17 Chateaudun, 28, Fr: river meadow; TPH16 St.-Calais, 72, Fr: pasture.

Transect 3: Maastricht-Dinant-Nancy (22 samples)

TMT23 Vucht, Limb., B: ext. grazed river meadow: 36% *diploids*; TMT28 Montroux, Liège, B: brook meadow; TMT27 Battice, Liège, B: fertilized, grazed pasture; TMT26 Soumagne, Liège, B:

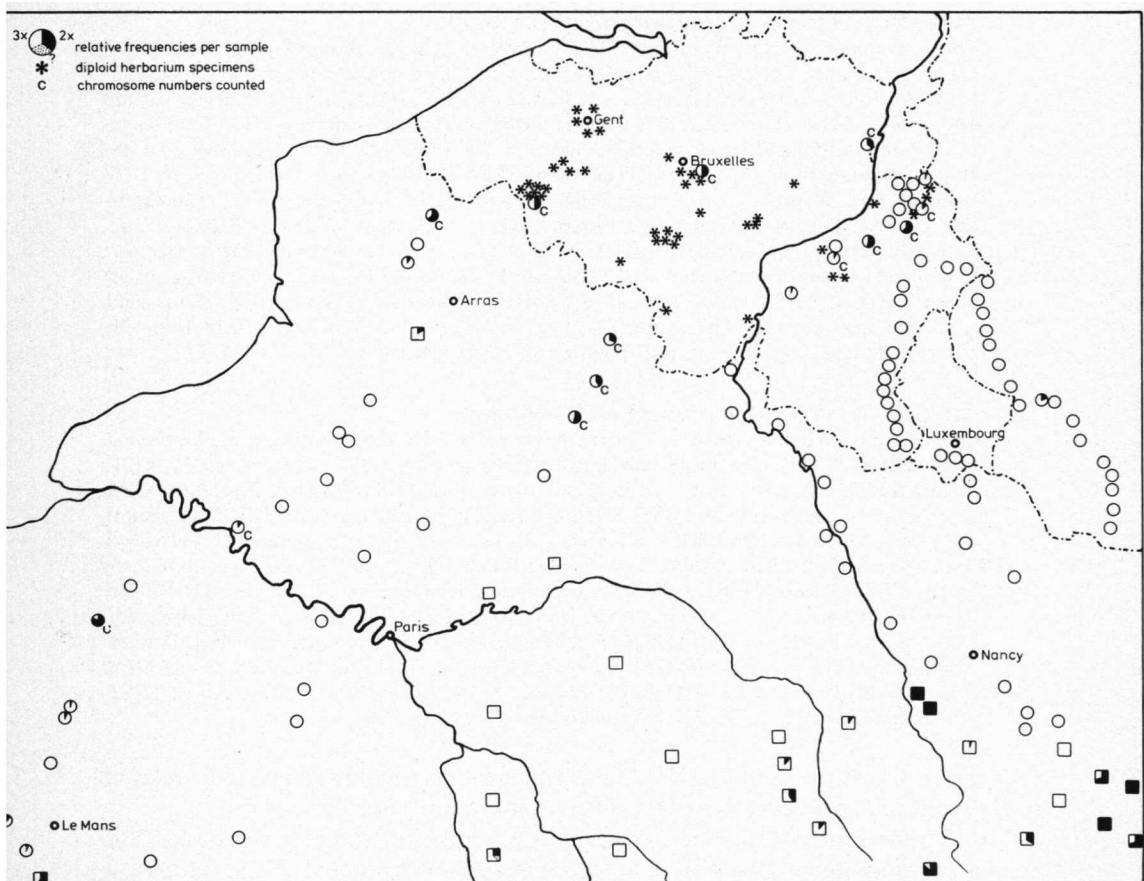


Fig. 8. Distribution of the population samples, arranged according to the 5 N.-S. transects. The relative frequencies of the ploidy levels and the PT category (doubtful cases) are shown by symbols. The circles represent new samples, the squares represent records borrowed from DEN NIS & STERK (1984) and show the diploid area just to the south of the present sampling sites. The putatively diploid herbarium individuals from Belgium are drawn in as asterisks confirming to fig. 1. Populations with known chromosome numbers are indicated by "C".

moist brook meadow; TMT25 Nessonvaux, Liège, B: pasture, south sloping; THL129 Comblain-au-Pont, Liège, B: fertilized! grazed! pasture: 52% *diploids*; THL128 Vierset-Barse north, Liège, B: fertilized pasture; THL127 Vierset-Barse south, Liège, B: fertilized! grazed pasture: 6% *diploids*; THL126 Ciney, Namur, B: fertilized! pasture, many Tar. 3% *diploids*; THL125 Fèpin, 08, Fr: meadow; THL124 Séchéval, 08, Fr: meagre! meadow, many species; THL123 Sedan, 08, Fr: moist! river meadow, per. flooded; THL122 Mouzon, 08, Fr: moist pasture; THL121 Martincourt-s-Meuse, 55, Fr: meagre pasture, many species; THL119 Sivry-s-Meuse, 55, Fr: meagre meadow south sloping; THL118 Briellules-s-Meuse, 55, Fr: meadow; THL117 Charny-s-Meuse, 55, Fr: meagre orchard pasture, bombing holes; THL116 Apremont-la-Forêt, 55, Fr: moist!! meadow; THL115 Toul (D908), 54, Fr: moist; slightly fertilized meadow; THL114 Rosières-aux-Salins, 54, Fr: moist!, extensive meadow, *Palustria*-types; THL113 Gerbéviller, 54, Fr: river meadow, slightly fertilized; THL112 Magnières, 88, Fr: slightly fertilized meadow, flooded, *Palustria*-types; THL111 Baccarat, 54, Fr: slightly fertilized meadow clearing.

Transect 4: *Aachen-Luxembourg-Metz* (24 samples)

TNT32 Plombières, Liège, B: pasture; TMT31 Hergenrath, Liège, B: brook meadow, fertilized, grazed: 3% *diploids*; TMT29 Clermont-s-Berwinne, Liège, B: ext. grazed pasture; TMT30 Dolhain, Liège, B: fertilized, grazed river meadow: 13% *diploids*; THL131 Theux, Liège, B: fertilized! pasture: 62% *diploids*; THS1 Harre, Lux., B: slightly fertilized pasture, many species; THS2 Grandmeuil, Lux., B: moist, fertilized meadow; THS3 Dinez, Lux., B: slightly fertilized, many species; THS4 Houffalize, Lux., B: brook meadow; THS5 Cobru, Lux., B: moist meadow many species; THS6 Bastogne, Lux., B: meadow SW-sloping; THS7 Salvacourt, Lux., B: brook meadow; THS8 Strainchamps, Lux., B: grazed! Pasture; THS9 Martelange, Lux., B: many species; THS10 Post, Lux., B: slightly fertilized, SW-sloping; THS11 Arlon, Lux. B: many species, S-sloping; THS12 Steinfort, L: fertilized meadow, many species; THS13 Mamer, L: slightly fertilized meadow; THS14 Luxembourg, L: pasture; THS15 Hassle, L: meadow, clearing, many species; THS16 Evrange, 57, Fr: slightly fertilized pasture; THS17 Hettange, 57, Fr: moist meadow, many species; THS18 Thionville, 57, Fr: pasture, slightly fertilized; THS19 Varize, 57, Fr: moist meadow.

Transect 5: *Verviers-Saarbrücken* (20 samples)

THS39 Waimers-Arimont, Liège, B: fertilized! pasture; THS38 Butgenbach, Liège, B: moist brook meadow; THS37 Murrange, Liège, B: slightly fertilized, pasture; THS36 Kehr, Rheinl.-Pf., GFR: pasture; THS35 Prüm, Rheinl.-Pf., GFR: species-rich pasture; THS34 Reuland, Rheinl.-Pf., GFR: moist meadow, many species; THS33 Seffern, Rheinl.-Pf., GFR: meadow; THS32 Rittersdorf, Rheinl.-Pf., GFR: meadow; THS31 Idenheim, Rheinl.-Pf., GFR: rich pasture; THS30 Newel, Rheinl.-Pf., GFR: fertilized pasture, south-sloping; THS29 Trier, Rheinl.-Pf., GFR: meadow, many species; THS29 Kasel, Rheinl.-Pf., GFR: brook meadow, many species: 20% *diploids*; THS27 Herl, Rheinl.-Pf., GFR: brook meadow; THS26 Hermeskeil, Rheinl.-Pf., GFR: ruderal, brook side; THS25 Sötern, Saarland, GFR; THS24 Nohfelden-Wolfersweiler, Saarl., GFR: sparsely fertilized pasture; THS23 Eisweiler, Saarl., GFR: brook meadow; THS22 Hofeld-Mausbach, Saarl., GFR: crop rotation (*Trofolium spec.*); THS21 St. Wendel, Saarl., GFR: pasture, many species; THS20 Wiebelskirchen, Saarl., GFR: slightly fertilized pasture, many species.

Fig. 8 shows the sampling localities, with symbols roughly showing the relative frequencies of occurrence of the diverse ploidy levels (see the legend).

To the south of the line Paris-Nancy a number of samples borrowed from a previous study (DEN NIJS & STERK 1984) are incorporated. These data show the rather frequent occurrence of diploids in that region forming the northern limit of the large diploid area in France. On the map also the distribution of the herbarium diploids is drawn in as asterisks (compare the preceding chapter).

From these data the following conclusions may be drawn:

- As a regional concentration there occur remarkably large amounts of diploids in the north-western part of France, which northern populations seem to form a continuum with the area of distribution of diploids in the central part of Belgium, in its turn linking up with the localities in the Dutch South Limburg area.

The southern concentration (TPH11 and further) may be seen as connected with the series of samples from the area around Le Mans (DEN NIJS & STERK 1984). No correlation has been found between the occurrence of diploids and any special type of terrain or agricultural regime.

- Diploids are rare in the sampled part of N.E. France, the southern Ardennes and the Eifel-region, a single isolated locality (THS28) in the neighbourhood of Trier excepted. The concise habitat descriptions indicate that the ecological amplitude of the series of sampling localities is most probably as broad as it is in the more westerly transects.

- Triploids with PT-pollen occur only sporadically.

Table 1. Chromosome numbers in some populations from Belgium and northern France. THA1 and 2 originate from former sampling sites of diploids (collected in 1958 by Dr. Lawalrée, in BR).

Code no.	Location	Chromosome number (2n)		number of individuals studied	
TPH1	Strazeele, Fr.	16		1	2
TPH9	Les Andelys, Fr.	16		2	
TPH11	Neaufles-Auvergny, Fr.	16		3	
TPH24	Marle, Fr.	16		4	
TPH25	La Capelle, Fr.	16	24	3	5
TPH26	Dourlers, Fr.	16	24	2	8
THL131	Theux, B.	16	24	1	4
THL129	Comblain-au-Pont, B.	16	24	3	1
THL127	Vierset-Barse South, B.		24	15	
TMT23	Vucht, B.	16		4	
TMT30	Dolhain, B.	16		1	
THA1	Auderghem-Brux.	16	24	1	1
THA2	Mt.-St. Aubert/Tournai, B.	16	24	4	4

6. CHROMOSOME COUNTS

As a confirmation of the pollen regularity assessments chromosomes were counted of a number of individuals (69) hailing from 12 populations distributed throughout the sampled region. This series also includes the two samples which may be considered to be repeated collections from two of the Belgian locations of diploid herbarium specimens. *Table 1* gives a survey of the results of the chromosome counts; in *fig. 8* the corresponding populations are indicated with "C".

7. DISCUSSION

7.1. Generalities

The extent of the incidence of diploid dandelions in N. France and Belgium has up to now been underestimated. The present set of data renders it obvious that on a regional scale such diploids may be rather abundant to the north of the supposed demarcation line Le Mans-Strasbourg (DEN NIJS & STERK 1984). Nevertheless there is indeed a general decline and in certain regions it seems as if the diploids are absent or at best decidedly rare (for example in N.E. France, the region between the river Seine and Arras). A striking peculiarity is that diploids are represented by relatively high frequencies in the most north western part of France (Depts. Nord and Pas-de-Calais) and in the adjacent region of Belgium (see *fig. 8*).

From the ecological diversity of the sampling sites it is not possible to infer any ecological preference of the diploids. The distribution pattern nevertheless suggests the well known phenomenon of the increasing scarcity of a species in the periphery of its distributional area.

What (master)factors could be limiting in this process or, alternatively, as

a possible functioning of substituting ecological factors might favour such marginal occurrences is as yet unexplained.

The recent ecological study of the microspecies flora of a range of pasture types in The Netherlands by STERK et al. (1983) shows a shift of the microspecies composition correlated with the thoroughness of the pasture management (i.e. mowing, grazing, fertilizing). This study shows quite clear that many microspecies possess specific ecological amplitudes. A number of the newly recorded diploid species also figures (admittedly as supposed triploids) in this survey of an ecological shifting. It is remarkable that these (at least partly and elsewhere diploid) species are scattered across a wide range of pasture types: *T. dahlstedtii* and *T. obtusilobum* are present when the management is extensive (i.e., without or only with a limited amount of grazing, and fertilising light or none), a situation which is "old" in The Netherlands, whereas *T. oblongatum* and *T. excellens* occur in intermediate habitats, and such species as *T. undulatifforme*, *T. croceiflorum* and *T. pannulatum* exclusively occur in the heavily manured and intensively grazed production pastures (an in The Netherlands relatively young type of habitat). Conform the study cited, this situation might lead to the assumption that, as the triploid forms (races), also the diploid ones show a wide ecological amplitude, as had already been concluded from earlier data from Central Europe, where both diploids and triploids are apparently capable of occupying relatively young biotopes as well as older and established ones. In any case this speculation is based on the following assumptions which are still in an increasing need of verification:

1. the identity and the taxonomy of the microspecies is stable and sound within the area studied, and
2. within a single microspecies diploid and triploid races may co-exist (which possibility is not accepted by all taraxacologists).

The herbarium collection as a whole is rather old, the most recently collected specimens dating from 1960, and the majority from between 1940 and 1960. This raises the question whether the result of the analyses could be extrapolated to the present situation in the fields. For this reason the population-samples THA1 and 2 and THL127 and 128 were collected. The THA-sites are some of the exact localities where Dr. Lawalrée collected material in 1958; both the THL-numbers originate from the near vicinity of such a sample site. In three populations in 1983 diploids still appeared to occur. In view of the small size of the aselect, autumn-collected samples, the relative frequency of the diploids in some of these pastures must be quite high.

These records and those from other population samples from (mainly) eastern Belgium warrant the conclusion that the "historical" (herbarium based) condition has to a large extent been maintained.

Section *Erythrosperma*: the absence of diploid specimens of this section is somewhat surprising. RICHARDS (1970) found diploid *T. brachyglossum* specimens in Gr. Britain in County Durham. Records from C. Europe suggest a fairly wide-spread occurrence of diploid *Erythrosperma* individuals in the wider surroundings of Vienna (Austria), see FUERNKRANZ (1960, 1961) and JENNISKENS

et al. (1984), and in the adjacent part of Slovakia (RICHARDS 1970). The supposed micro-evolutionary and geographical parallel in ploidy level and reproductory system between sections *Taraxacum* and *Erythrosperma* apparently does not extend into the parts of Belgium and France studied. This may be partly attributable to the fact that the section *Erythrosperma* prefers more xerothermic habitats than does the section *Taraxacum* and for this reason the diploid *Erythrosperma* morphs do not occur so far to the north as the diploid taxa of the other section.

7.2. Phytogeographical aspects

The fact that single herbarium specimens collected at diverse sites turned out to be diploids strongly suggests that there may be (or may have been) a rather high representation of diploids present among the populations occurring at those sites (see fig. 1: Surroundings of Gent, Oudenaerde, Nivelles, Perwez).

In order to get some insight into the relation between the distribution of diploid dandelions and the current recognition of phytogeographical districts within the area studied, a comparison was made with the "Atlas de Flore Belge et Luxembourgeoise" (VAN ROMPAEY & DELVOSALLE 1978). Fig. 9 shows the grid system as used in the mapping of the flora of Belgium. In this grid system the diploid sampling sites are drawn-in: both the herbarium specimens and the living populations. The figure also gives the phytogeographical districts. It appears that up to now the diploids are almost exclusively found in the Picardian (Fr.), Brabant and Calcaire-Mosan districts (compare for example the distribution of *Euphorbia lathyris*, given as type 31, by VAN ROMPAEY & DELVOSALLE (1978).

There are some deviations: their range extends into the Gent area to the north-west and the northern escarpments of the high Ardennes in the north-east.

A further survey of the various distribution types in the Belgian flora brings to light that the diploid *Taraxaca* behave rather as species correlated with loamy soils. *Ranunculus arvensis*, for example, exhibits a main distribution in the Brabant and Calcaire-Mosans districts, with a much more scattered occurrence in the Flandrian and Lorrain districts (note the presence of diploids near Trier: THS28 in transect 5). Compare the further details VAN ROMPAEY & DELVOSALLE (1978).

In The Netherlands most of the diploids occur in South Limburg, where the soils constitute an extension of the Belgian loaming area. This distribution pattern warrants the supposition that some edaphical and/or microclimatic factor (substrate temperatures?) associated with a loamy soil type favours the occurrence of the diploids in the north-western marginal region of their distributional area, in particular in its western part. How far to the north diploids occur in the populations is still under investigation.

7.3. Taxonomical aspects

The examination of herbarium collections identified by *Taraxacum* specialists renders it clear that the incidence of outbreeding, sexual diploids is to a great extent involved in the taxonomic division into microspecies. Until recently only

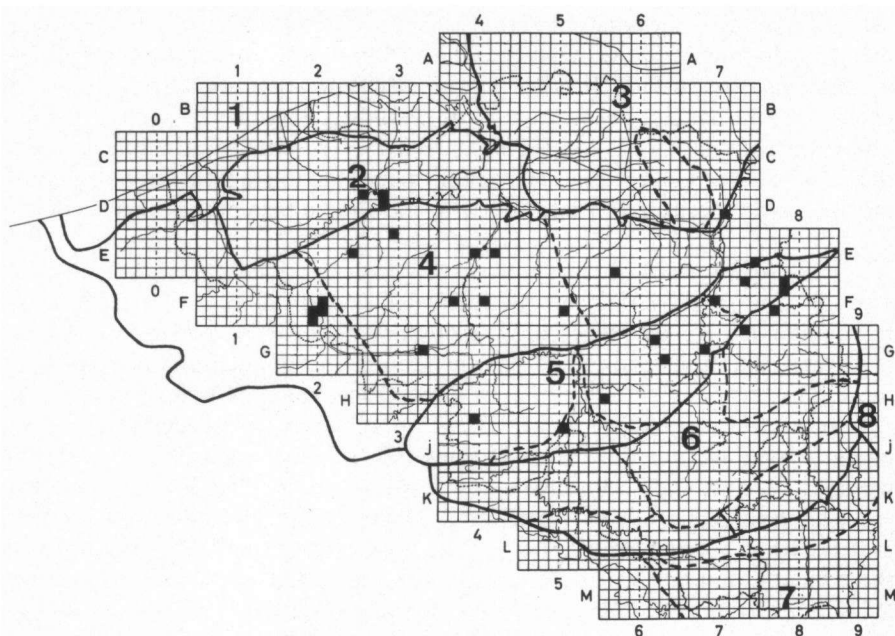


Fig. 9. Distribution of the sampling sites of diploids in their relation to the division in phytogeographical districts. The sites are redrawn according to the official grid system for the mapping of the Belgian flora. No distinction has been made between herbarium specimens and recent population samples.

Coding of the phytogeographical division: 1. the Maritime, 2. the Flandrian, 3. the Campinian, 4. the Brabant, 5. the Meusian-Limestone, 6. the Ardennes, 7. the Lorraine, 8. the Western Eifel, and in the western French-Belgian border region the Picardian district.

a few species of the section *Taraxacum* were known to be (at least partially) diploid (compare the survey by DEN NIJS & STERK 1980: 5 species); this number has since increased appreciably to over 50 species: DEN NIJS & STERK (1984) recorded 28 species with diploidy in France and Switzerland; the present one adds another 16 from Belgium and N. France and an additional 3 from France are being described (SAHLIN, unpublished); JENNISKENS (1984) mentions two diploid species, one from S. France (*T. multifidum*) and one from S.-W. Germany (*T. paradoxachrum*).

There can be very little doubt that further herbarium studies will reveal the incidence of sexual diploidy in many more of the microspecies described. In the light of this evidence the notoriously intricate and difficult systematics of especially the French and Central-European dandelions becomes understandable (SAHLIN, in litt. VAN SOEST, in litt., among others). Hybridisation experiments have shown that there are no clear-cut barriers prohibiting gene flow between different diploid morphs, not even between forms from ecologically very diverse habitats and/or from geographically distant localities (JENNISKENS 1984). The probable occurrence of facultative sexuality in certain triploids and the successful pollination of diploid mother plants with (\pm haploid) pollen from

a triploid pollen donor results in a possible gene flow between diploids and triploids and contribute towards the establishment of a reticulate pattern of close relationships (SØRENSEN & GUDJONSSON 1946, RICHARDS 1970, JENNISKENS et al. 1984, STERK & DEN NIJS in prep.).

In the present study 75 species of the Belgian dandelion flora (section: *Taraxacum* only) have been studied of which 15 appeared to exhibit diploidy. Judging by the list of annotated specimens there are another 7 (in Belgium 3x) species which occur (also) as diploids in other parts of their distributional area. In most cases these species are also found in northern France, e.g., *T. retroflexum* (material in P.). These accumulated data indicate that of the 75 species of sect. *Taraxacum* so far studied, 22 (i.e., 30%) exhibit diploidy, most of which also occur as triploids (and often predominantly so).

The 22 (partially) diploid microspecies all belong to a group of species distributed in north-western Europe albeit that some have a much wider range and are also found in Spain, Portugal and/or some of the alpine countries (consult for details the annotated list). Of these 22 species 18 have also been recorded from The Netherlands. HAGENDIJK et al. (1982) report that in some of these species a remarkable variability, the incidence of different morphs and sometimes even intermediates occur, which had already raised taxonomic problems involving, e.g. *T. dahlstedtii*, *T. excellens*, *T. obliquilobum* and *T. polyodon*. The latter species has a close, diploid relative often treated as a synonym viz., *T. ardisodon*. SØRENSEN & GUDJONSSON (1946) had already noted the great polymorphism and the partial sexuality of this species.

The present authors are of the opinion that up to now only the top of the iceberg has been detected and that further analyses along the lines indicated will yield similar results. It seems as if indeed also in north-western Europe the evolutionary status of at least the section *Taraxacum* with its many hundreds of described (micro)species is a highly dynamic one (cf. DOLL 1982). The authors, therefore, feel a growing necessity to reconsider the microsystematics of this group as it is fundamentally based on an assumed, exclusively agamospermous form of reproduction of the representatives of this group. The old controversy concerning the recognition of broadly defined species of dandelions ("macrospecies") and narrowly defined ones ("microspecies"), initiated by the beginning of the 20th Century as a disagreement between the Austrian monographer Handel-Mazetti and the Scandinavian authors Dahlstedt and others, is still alive. Our increasing cognisance of the incidence of diploidy and sexuality in Central European populations of *Taraxacum* renders the problem much better understandable.

The underlying and essential, biological background, viz., the question what units are the carriers of the micro-evolutionary processes in the section *Taraxacum* requires elucidation. From an evolutionary point of view this section can be described as a complex comprising a (restricted) number of diploid, sexual species, each with a broad spectrum of variation (and ecotypes?) and for the greater part occurring syneic, and through gene-flow connected, with many triploid, agamospermous microspecies with a much smaller range of variation

and with a more or less definable ecology. This holds for southern and Central Europe, whereas in the northern regions the sexuality is almost completely absent and a whole gamut of hundreds of agamospermous and genetically almost completely isolated microspecies is present. Among several other ones, there are two points of particular interest regarding this viewpoint:

– the cytogeographical records strongly suggest that there is a clinal variation pattern as regards the distribution of the sexuality within the section to the north of the area with incidence of diploidy. The transitional zone is relatively broad and extends from the central French-German region, the rate of sexuality petering out towards the north, the northern-most records of diploids being from central England and the south of Scandinavia.

– judging from morphological criteria, a lot of the microspecies is represented by diploid as well as triploid individuals; the questions whether these ploidy levels are connected with a different ecology (per species), whether the diploid or the triploid status is the oldest (poly-diploid cycles; see JENNISKENS et al. 1984) and, finally, whether the relevant race is mono- or poly-phyletic (MARKLUND 1938) all remain speculative for the time being; and relevant points are now being studied.

From a taxonomical point of view one has to solve the question of how to treat the several biologically different evolutionary units. The present authors are preparing a more detailed and better documented discussion concerning this topic.

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