

## Studies in Italian Cyperaceae. 2. Miscellaneous notes

FILIP VERLOOVE<sup>1</sup>, ADRIANO SOLDANO<sup>2</sup>

<sup>1</sup> National Botanic Garden of Belgium  
Domein van Bouchout, B-1860 Meise, Belgium  
(filip.verloove@br.fgov.be)

<sup>2</sup> Largo Cagliari 6  
I-13100 Vercelli (Italy)  
(adriano.soldano@fastweb.it)

Accepted 16 December 2010

*Studi sulle Cyperaceae Italiane 2: note miscellanee* — *Cyperus dives* (Cyperaceae), una specie originaria dell'Africa subtropicale e di parti dell'Asia, fu segnalata due volte presso Biella (Piemonte), ma confusa con *Cyperus imbricatus*. Sono forniti i caratteri distintivi di queste due specie e di altre ad esse collegate (compreso *Cyperus alopecuroides*). *Cyperus lupulinus* subsp. *lupulinus*, originario dell'America settentrionale, è stato raccolto lungo la strada ferrata a Chivasso (Piemonte) nel 2009 e probabilmente si tratta del primo ritrovamento in Europa; è descritto e confrontato con specie simili, compreso *Cyperus schweinitzii* che si è naturalizzato in Francia. Viene esaminata la presenza in Piemonte della specie americana *Eleocharis flavescens*. I primi reperti di questa specie erano limitati alle risaie (come un'infestante agricola) e riguardavano la var. *olivacea*, entità oggi probabilmente estinta. Gli odierni individui sembrano rappresentare un'introduzione indipendente attraverso truppe militari e vanno riferiti alla var. *flavescens*, distribuendosi in ambienti naturali protetti (calluneti) come infestanti ambientali.

**Key words:** Italy, Cyperaceae, *Cyperus dives*, *Cyperus lupulinus*, *Eleocharis flavescens* var. *flavescens*, xenophytes.

The Cyperaceae family is well represented in Italy. Especially the number of non-native representatives is remarkably high. Celesti-Grapow & al. (2009), for instance, enumerate not less than 12 species of the genus *Cyperus* that are currently accepted as naturalised. However, many genera of the Cyperaceae exhibit a notoriously complex taxonomy and the exact identity of some of these non-native Cyperaceae was only fairly recently assessed (see for instance Galasso & al., 2006 for *Cyperus brevifoloides* Thieret & Delahouss.; Raynal, 1977 for *Cyperus microiria* Steud.).

Surely not all work is done yet: new species have been introduced in the past years and others have been confused with related species. Assessing the exact identity of some taxa also requires additional research.

In a separate paper (Verloove, 2010) *Eleocharis pelucida* is reported as a naturalised, overlooked xenophyte in northwestern Italy. In this paper two species of *Cyperus* (*C. dives* and *C. lupulinus*) are reported from northwestern Italy (probably for the first time in Europe) and the infraspecific variability of *Eleocharis flavescens* in northwestern Italy is discussed.

### **Cyperus dives** Delile

ITALY: Prov. Biella: a valle di Biella, rivoletto che confluisce nel Cervo, 15.10.1989, *A. Soldano* 6777 (priv.herb. A. Soldano); ad ovest di Maghetto di Mongrando, sponda destra dell'Elvo, 09.1993, *A. Soldano* 8983 (priv.herb. A. Soldano).



Fig. 1 – Inflorescence of *Cyperus dives* (scan from herbarium collection A. Soldano 6777).

*Cyperus dives* is a common weed of temporarily wet places in large parts of tropical and subtropical Africa and parts of Asia. It is a member of section *Exaltati* Kunth (Kükenthal, 1935-1936), a complex cluster of five closely related and often confused species<sup>1</sup>. At least four of these are weedy (*Cyperus alopecuroides* Rottb., *C. dives*, *C. exaltatus* Retz. and *C. imbricatus* Retz.; see Bryson & Carter, 2008) and all, except perhaps *C. dives*, have been recorded before in Europe (see for instance Verloove, 2005; Brullo & Sciandrello, 2006; Verloove, 2006), mostly as ephemeral xenophytes.

The two collections here concerned were initially ascribed to *Cyperus imbricatus* (Soldano & Sella, 2000). However, since there was some doubt about the correct identity and the persistence of the species, it was not upheld by Conti & al. (2005). Examination of spikelets demonstrates that both surely represent the same species although the specimen from Maghetto (*A. Soldano* 8983) is less robust. The collection from Biella (*A. Soldano* 6777; Fig. 1) is characterised by 3-fid styles, trigonous achenes and glumes that are distinctly keeled on the back. These features immediately exclude *Cyperus alopecuroides* although, in general appearance, the latter is much reminiscent of the specimen from Biella (compare Fig. 1 with the illustrations in Brullo & Sciandrello, 2006). *Cyperus exaltatus* is much less similar: it has a laxer inflorescence with more patent spikelets that not obscure the rachis

and usually is more slender; it is also readily ruled out. *Cyperus dives* and *C. imbricatus* are much alike and most floras merely distinguish both on robustness, the former being the taller species with culms higher than 100 cm, wider leaf blades and spikes, etc. (see for instance Haines & Lye, 1983; Gordon-Gray, 1995).

Kukkonen (1998) further adds that in *Cyperus dives* secondary inflorescence branches are often produced but this might also be induced by robustness. So, these features are not only impractical; they surely are unreliable when non-native specimens are concerned. The latter are often (like in this case) found in much less favourable climatological circumstances, which prevent full development. A thorough revision of the numerous African collections of both species in the herbarium of the National Botanic Garden of Belgium (BR) yielded some additional useful features. *Cyperus imbricatus* turned out to have much smaller, often greenish glumes with a longer, excurrent mucro. This character renders the spikelets a typical saw-like appearance. It furthermore is, indeed, usually more slender with narrower leaves and spikes on primary inflorescence branches only. *Cyperus dives*, in turn, has larger, often golden brownish glumes with a short mucro that is straight or even incurved. It usually is taller with wider leaves and spikes and secondary inflorescence branches are regularly developed. The main diacritic features for all these critical species are summarised in the key beneath.

- |   |  |                              |
|---|--|------------------------------|
| 1 | Glumes rounded on the back. Styles predominantly 2-fid (often some 3-fid). Achenes mostly biconvex (often some trigonous) .....  | <i>Cyperus alopecuroides</i> |
|   | Glumes keeled on the back. Styles 3-fid. Achenes trigonous .....   | 2                            |
| 2 | Spikelets patent, not closely spaced (hence the inflorescence rather lax) .....  | <i>C. exaltatus</i>          |
|   | Spikelets appressed and imbricate, closely overlapping (hence inflorescence dense and compact) .....   | 3                            |
| 3 | Plant usually less than 100 cm tall. Leaves ca. 4-8 mm wide. Spikes 3-8 mm wide, solely on primary inflorescence branches. Glumes ca. 0.8-1.2 mm long with conspicuous, excurrent mucro (spikelets saw-like in appearance), greenish or pale brown ..... | <i>C. imbricatus</i>         |
|   | Plant often exceeding 100 cm. Leaves usually at least 10 mm wide. Spikes 6-15 mm wide, often also on secondary inflorescence branches. Glumes ca. 1.2-1.8 mm long, with short, straight or incurved mucro, golden to darker brown .....                  | <i>C. dives</i>              |

<sup>1</sup> *Cyperus alopecuroides* Rottb. is sometimes accommodated in a separate section (sect. *Alopecuroides* Cherm.) (see for instance Kern, 1974). It is peculiar in having predominantly 2-fid styles and its nuts are planoconvex but it otherwise has the general habit of the other representatives of sect. *Exaltati*.

On spikelet characters the two collections from the surroundings of Biella unequivocally should be ascribed to *Cyperus dives*: glumes are ca. 1,5 mm long, golden brown with a short slightly incurved mucro. The general habit of the specimen from Biella also perfectly corresponds with this species: widest leaves ca. 10 mm wide, longest spikes up to 40 mm long and 10 mm wide, presence of secondary inflorescence branches, etc.

The origin of these remarkable records is unknown. Both collections were made in the same area but in different riparian zones (of rivers Cervo and Elvo). The closest native occurrences are known from northern Africa and southwest-Asia (Egypt, Lebanon and Syria; see Govaerts & Simpson, 2007). An accidental introduction by migrating water birds is perhaps most likely. In both cases, *Cyperus dives* was only represented by one or two specimens; its persistence could not be confirmed subsequently. For the time being it should be regarded as an ephemeral xenophyte.

### ***Cyperus lupulinus* (Spreng.) Marcks subsp. *lupulinus***

ITALY: Prov. Torino: Chivasso, W of the city, railway yard, bare, gravelly soil, scattered specimens, along with *Euphorbia davidii*, 14.09.2009, F. Verloove 7870 (priv. herb. F. Verloove, dupl. priv. herb. A. Soldano, TO).

*Cyperus lupulinus* is a native of North America (mainly the eastern portion) and has, to our knowledge, not previously been recorded in Europe. It belongs to the taxonomically complex section *Laxiglumi* C.B. Clarke (Kükenthal, 1935-1936; Marcks, 1972; Marcks, 1974). It is a moderately small (10-30(-50) cm tall), caespitose perennial with very distinct cormlike rhizomes and a subdigitate inflorescence with more or less horizontal bracts (Fig. 2). With this combination of characters it does not resemble any of the known native or introduced species of the genus in Italy. One of its closest relatives surely is *Cyperus schweinitzii* Torr., another North American na-

tive that is locally naturalised in parts of France. At present it is known at least from Alès, Lormont (Bordeaux) and Roanne (Bosc & Foirest, 1990; Foirest & al., 1996; Dupain, 2002; Anietsbèhère & Dussaussois, 2003; pers. comm. J.-M. Tison). An older record from Mulhouse (Lizler, 1965) requires confirmation.

*Cyperus lupulinus* is in many respects very reminiscent of *C. schweinitzii* (and of *C. filiculmis* Vahl). All three are more or less widespread weeds of ruderal habitats in North America and likely to occur as aliens beyond their natural distribution range. Distinguishing features of these species are opposed in Table 1.

Out of these *Cyperus lupulinus* mostly looks like *C. filiculmis*. The former was only recently given specific rank (Marcks 1974). It is best distinguished on floral scale colour and anther length. In areas where these species are sympatric they readily hybridise (Marcks 1974). The population from Chivasso has rather large and numerous floral scales (ca. 3 mm on average) and obviously belongs to subsp. *lupulinus*.

In Chivasso *Cyperus lupulinus* grows on bare, gravelly soil in a railway yard, along with other North American taxa viz *Amaranthus albus*, *Ambrosia artemisiifolia*, *Chamaesyce nutans*, *Euphorbia davidii* (syn.: *E. dentata* auct. non Michaux) and *Lepidium virginicum*. In its area of origin *Cyperus lupulinus* grows in similar habitats (well-drained places). Remarkably, all French records of *Cyperus schweinitzii* are also from (often disused) railway yards.

The invasion status of *Cyperus lupulinus* in Chivasso is difficult to assess. In September 2009 it seemed rather well-established and seeds were produced in abundance. However, the railway yard is still in use and the railway tracks and their vicinity are probably regularly cleaned-up. Analogously with *Cyperus schweinitzii* in France a future naturalisation is not unlikely. It should be looked for along railway tracks in the surroundings of Torino.

**Table 1** – Diacritic features of three closely related species of *Cyperus* section *Laxiglumi* (based on Tucker & al., 2002).

	<i>Cyperus lupulinus</i>	<i>C. schweinitzii</i>	<i>C. filiculmis</i>
Culm below inflorescence	Smooth	Usually scabrous	Smooth
Bracts of inflorescence	Horizontal to reflexed	Erect	Horizontal to reflexed
Rays of inflorescence	Usually absent	3-5, up to 8(-15) cm long	Usually absent
Floral scale colour	Off-white, greenish or brown	Greenish or whitish	Yellowish
Floral scale mucro (length)	0,05-0,2 mm	0,3-1 mm	Unknown
Anther length	0,3-0,6 mm	0,8-1,4 mm	0,8-1 mm

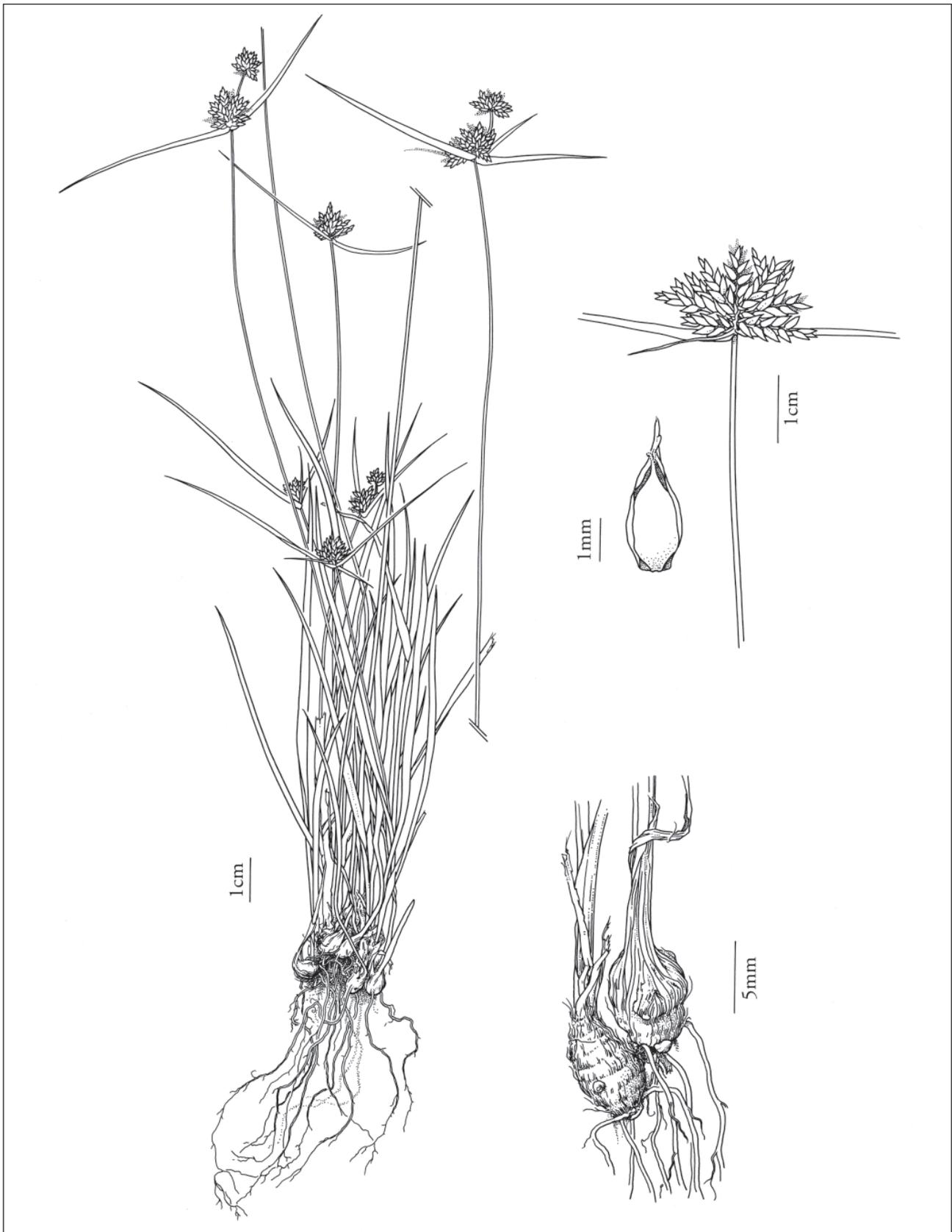


Fig. 2 – *Cyperus lupulinus* subsp. *lupulinus*: general habit and floral details (original drawing Sven Bellanger).

**Eleocharis flavescens** (Poir.) Urban var. **flavescens**

ITALY: Prov. Biella: Torrazzo, Lago Prè (Anfiteatro Morenico di Ivrea), 690m a.s.l., pond margin, 11.10.1995, A. Soldano 10732 (priv. herb. A. Soldano; sub *E. atropurpurea*); Candello, baraggia, heath land, locally abundant, along with *E. obtusa* and *E. pellucida*, 11.09.2009, F. Verloove 7853 (BR, TO). - Prov. Torino: Lombardore, Riserva Naturale Orientata della Vauda, heath land, former military base, 07.09.2009, F. Verloove 7850 (BR, TO). - Prov. Vercelli: Rovasenda, baraggia (E of Cascina San Benedetto, beyond Marchiazza river), 20.10.2008, A. Soldano 14456 (priv. herb. A. Soldano); Rovasenda, baraggia (E of Cascina San Benedetto), heath land, close to military area, locally abundant, 12.09.2009, F. Verloove 7841 (priv. herb. F. Verloove, dupl. BR, LG); Villarboito, Baraggione, heath land, 13.09.2009, F. Verloove 7847 (BR, TO).

*Eleocharis flavescens*, a widespread native species of temperate North America and large parts of South America, is known as a weed of rice in the Italian regions Lombardia and Piemonte (Conti & al., 2005). In Piemonte Abbà (1979) confirms its presence in the provinces of Novara and Vercelli, both known for their extensive rice-growing areas. *Eleocharis flavescens* was not cited from the province of Biella by Soldano & Sella (2000), nor has it been recorded before in the province of Torino (pers. comm. A. Selvaggi 11.2009). Thus it is here apparently first reported from these provinces.

The above records of *Eleocharis flavescens* are further interesting in several respects. Italian populations of this species are exclusively ascribed to var. *olivacea* (Torr.) Gleason (syn.: *E. olivacea* Torr.) (see Koch, 1952; Becherer, 1969; Cook, 1973). This identity was later also confirmed by Raynal in 1978 (specimens of his collections were distributed as n° 10025 by the Soc. Ech. Pl. Vasc. Eur. Occ. Bass. Médit.). This variety is characterised by green to golden-brown achenes

(Tucker et al., 2002). However, all populations of *Eleocharis flavescens* that are referred to in the present paper (including those from the province of Vercelli) have very dark brown achenes<sup>2</sup> and obviously pertain to var. *flavescens*. To our knowledge this variety has not been recorded before in Italy.

There is another striking difference between previous Italian records of *Eleocharis flavescens* (var. *olivacea*) and those dealt with here. So far this species was always and exclusively confined to rice fields (see Pignatti 1982) and thus considered to be an agricultural weed. In all locations cited above *Eleocharis flavescens* (var. *flavescens*) occurs in temporarily wet places (tracks, bomb craters, pond margins, ...) mostly in heath lands, i.e. protected areas ("Baraggia", nature reserves) that have previously been disturbed by man. Most are in or near former and/or actual military training areas and share a remarkable non-native flora, including – among others – *Aristida longespica*, *Dichanthelium acuminatum*, *Digitaria violascens*, *Eleocharis obtusa* and *E. pellucida*, *Hypericum mutilum*, *Sporobolus vaginiflorus*, ... (see also Verloove, 2010).

It seems that *Eleocharis flavescens* var. *olivacea* has nearly (or perhaps completely) disappeared as an agricultural weed of rice fields in Piemonte today (own observations). The same species is now represented by a related taxon (var. *flavescens*) with a totally different invasion history. It was apparently – at least in part – introduced (or at least further dispersed) by military vehicles and is confined to protected natural habitats (as an environmental weed).

**Acknowledgements**

Sven Bellanger (Meise, Belgium) is thankful for preparing the original line drawing for *Cyperus lupulinus*.

## REFERENCES

- ABBÀ G., 1979 – *Flora esotica del Piemonte. Specie coltivate spontaneizzate e specie avventizie*. Atti Soc. Tosc. Sci. Nat. Mem., Serie B 86: 263-302.
- ANIOTSBÈHÈRE J.C. & DUSSAUSSOIS G., 2003 – *Les xénophytes et invasives en Gironde (2<sup>ème</sup> partie)*. Bull. Soc. Linn. Bordeaux 31(3): 127-150.
- BECHERER A., 1969 – *Über die Flora der Reisfelder von Novara und Vercelli (Piemont)*. Bauhinia 4: 117-124.
- BOSC G. & FOIREST C., 1990 – *Le Cyperus schweinitzii Torrey en France*. Le Monde des Plantes 447: 27.

<sup>2</sup> The plants from Torrazzo were initially ascribed to *Eleocharis atropurpurea* by one of us (A.S.), doubtlessly on behalf of their very dark, nearly black achenes.

- BRULLO S. & SCIANDRELLO S., 2006 – *Cyperus alopecuroides* Rottb. (Cyperaceae): typification and first record for Sicily. *Candollea* 61(2): 365-372.
- BRYSON C.T. & CARTER R., 2008 – *The significance of Cyperaceae as weeds*. In: NACZI R.F.C. & FORD B.A. (eds.), *Sedges: uses, diversity, and systematics of Cyperaceae*. Monogr. Syst. Bot. Missouri Bot. Gard. 108: 15-101.
- CELESTI-GRAPPO L., ALESSANDRINI A., ARRIGONI P.V., BANFI E., BERNARDO L., BOVIO M., BRUNDU G., CAGIOTTI M.R., CAMARDA I., CARLI E., CONTI F., FASCETTI S., GALASSO G., GUBELLINI L., LA VALVA V., LUCCHESI F., MARCHIORI S., MAZZOLA P., PECCENINI S., POLDINI L., PRETTO F., PROSSER F., SINISCALCO C., VILLANI M.C., VIEGI L., WILHALM T. & BLASI C., 2009 – *Inventory of the non-native flora of Italy*. *Plant Biosys.* 143: 1-45.
- CONTI F., ABBATE G., ALESSANDRINI A. & BLASI C. (eds.), 2005 – *An annotated checklist of the Italian vascular flora*. Palombi Editori, Roma: 420 p.
- COOK C.D.K., 1973 – *New and noteworthy plants from the northern Italian ricefields*. *Ber. Schweiz. Bot. Ges.* 83: 54-65.
- DUPAIN M., 2002 – *Contributions à la Flore de Gironde*. *Bull. Soc. Linn. Bordeaux* 30(1): 1-7.
- FOIREST C., DUTARTRE G. & DESGOUTTE C., 1996 – *Végétation et flore d'une gare de triage désaffectée à Roanne (Loire, France)*. *Bull. Mens. Soc. Linn. Lyon* 65(4): 153-158.
- GALASSO G., BRUSA G. & BANFI E., 2006 – *Notulae alla checklist della flora vascolare italiana: 1247. Cyperus brevifolioides Thieret & Delahouss.* *Inform. Bot. Ital.* 38(1): 207-208.
- GORDON-GRAY K.D., 1995 – *Cyperaceae in Natal*. *Strelitzia* 2: 218 p.
- GOVAERTS R. & SIMPSON D.A., 2007 – *World checklist of Cyperaceae Sedges*. Royal Botanic Gardens, Kew: XIII + 765 p.
- HAINES R.W. & LYE K.A., 1983 – *The sedges and rushes of East Africa*. East African Natural History Society, Nairobi: 404 p.
- KOCH W., 1952 – *Zur Flora der oberitalienischen Reisfelder*. *Ber. Schweiz. Bot. Ges.* 62: 628-663.
- KERN J.H., 1974 – *Eleocharis*. In: VAN STEENIS C.G.G.J. (ed.), *Flora Malesiana*, I, 7. Noordhoff, Leiden: 522-537.
- KÜKENTHAL G., 1935-1936 – *Cyperaceae*. In: ENGLER H.G.A. (ed.), *Das Pflanzenreich*. Vol. 101 (IV.20) Engelmann, Berlin: 1-671.
- KUKKONEN I., 1998 – *Cyperaceae*. In: Rechinger K.H. (ed.), *Flora Iranica* 173. Akademische Druck- & Verlagsanstalt, Graz: 1-307.
- LITZLER P., 1965 – *Cyperus schweinitzii* Torrey en France. *Bull. Soc. Hist. Nat. Doubs* 67(1): 5-7.
- MARCKS B.G., 1972 – *Population studies of North American Cyperus section Laxiglumi (Cyperaceae)*. Ph.D. thesis, University of Wisconsin.
- MARCKS B.G., 1974 – *Preliminary studies on the flora of Wisconsin, n° 66. Cyperaceae II - Sedge family II. The genus Cyperus - the umbrella sedges*. *Trans. Wisconsin Acad. Sci.* 62: 261-284.
- PIGNATTI S., 1982 – *Flora d'Italia*. Vol. 3. Edagricole, Bologna: 2324 p.
- RAYNAL J., 1977 – *Véritable identité du "Cyperus amuricus" des rizières italiennes*. *Saussurea* 8: 131-134.
- SOLDANO A. & SELLA A., 2000 – *Flora spontanea della provincia di Biella*. Edizioni dell'Orso, Alessandria: XLI + 542 p.
- TUCKER G.C., MARCKS G.C. & CARTER R.J., 2002 – *Cyperus*. In: *Flora of North America* Editorial Committee (ed.), *Flora of North America* 23. Oxford University Press, Oxford: 141-191.
- VERLOOVE F., 2005 – *New records of interesting xenophytes in Spain*. *Lazaroa* 26: 141-148.
- VERLOOVE F., 2006 – *Catalogue of neophytes in Belgium (1800-2005)*. *Scripta Botanica Belgica* 39: 89 p.
- VERLOOVE F., 2010 – *Studies in Italian Cyperaceae. 1. Eleocharis pellucida, new to Europe, naturalised in Piemonte*. *Webbia* 65(1): 133-140.

**Summary:** *Cyperus dives* (Cyperaceae), a native of subtropical Africa and parts of Asia, was recently recorded twice in the surroundings of Biella (Piemonte). It has been confused so far with *Cyperus imbricatus*. Distinguishing features of these and other related species (incl. *Cyperus alopecuroides*) are presented. *Cyperus lupulinus* subsp. *lupulinus*, originating in North America, was recorded on a railway yard in Chivasso (Piemonte) in 2009, probably for the first time in Europe. It is illustrated and compared with some related species (incl. *Cyperus schweinitzii* that is naturalised in France). The presence of the American *Eleocharis flavescens* in Piemonte is discussed. Previous records of this species were confined to rice fields (as an agricultural weed) and belong to var. *olivacea*, a taxon that is now possibly extinct. Present-day records in Piemonte seem to represent an independent introduction (at least in part via military troops). These populations are ascribed to var. *flavescens* and are found in protected, vulnerable natural habitats (heath lands) (as an environmental weed).

