

A synopsis of Jarava Ruiz & Pav. and Nassella E. Desv. (Stipa L. s.l.) (Poaceae : Stipeae) in southwestern Europe

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A synopsis of *Jarava* Ruiz & Pav. and *Nassella* E. Desv. (*Stipa* L. s.l.) (Poaceae: Stipeae) in southwestern Europe

FILIP VERLOOVE

ABSTRACT

VERLOOVE, F. (2005). A synopsis of *Jarava* Ruiz & Pav. and *Nassella* (Trin.) E. Desv. (*Stipa* L. s.l.) (Poaceae: Stipeae) in southwestern Europe. *Candollea* 60: 97-117. In English, English and French abstracts.

A taxonomic revision of the naturalized representatives of the South American genera *Jarava* Ruiz & Pav. and *Nassella* (Trin.) E. Desv. (segregates of *Stipa* L. s.l.) in Europe revealed several interesting data. Eight taxa are currently regarded as, at least locally, naturalized in the Iberian Peninsula, Macaronesia, France (incl. Corsica) and/or Italy: *Jarava ambigua* (Speg.) Peñail., *J. brachychaeta* (Godr.) Peñail., *J. caudata* (Trin.) Peñail. and *J. plumosa* (Spreng.) S. W. L. Jacobs & J. Everett, and *Nassella neesiana* (Trin. & Rupr.) Barkworth, *N. poeppigiana* (Trin. & Rupr.) Barkworth, *N. tenuissima* (Trin.) Barkworth and *N. trichotoma* (Nees) Arechav. *Nassella mucronata* (Kunth) R. W. Pohl has not been confirmed, all actual European populations being definitely ascribable to the closely related *N. neesiana*. Particular attention is paid to the confusion of both taxa in Europe and useful diacritic features for their distinction are discussed. Only two taxa have become more or less widespread to date (*N. neesiana* and *N. trichotoma*), both being present respectively in all or nearly all investigated countries. Two further taxa (*Jarava brachychaeta* and *J. caudata*) also tend to increase. *Jarava ambigua* (confused with *J. brachychaeta* in S-France) is cited for the first time as a naturalized alien in Europe. All taxa but *Nassella tenuissima* (which is an escape from cultivation) are believed to have been introduced unintentionally; all are of American origin. Each taxon is described and a dichotomous key, original line drawings of all species' antheria and further chorological, nomenclatural, taxonomic and ecological data are provided.

RÉSUMÉ

VERLOOVE, F. (2005). Synopsis des genres *Jarava* Ruiz & Pav. et *Nassella* (Trin.) E. Desv. (*Stipa* L. s.l.) (Poaceae: Stipeae) dans le sud-ouest de l'Europe. *Candollea* 60: 97-117. En anglais, résumés anglais et français.

Une révision taxonomique des espèces naturalisées en Europe des genres sud-américains *Jarava* Ruiz & Pav. et *Nassella* (Trin.) E. Desv. (*Stipa* L. s.l.) a fourni des résultats intéressants. Actuellement, huit taxons sont considérés comme naturalisés, au moins localement, dans la péninsule Ibérique, en Macaronésie, en France (incl. la Corse) et/ou en Italie: *Jarava ambigua* (Speg.) Peñail., *J. brachychaeta* (Godr.) Peñail., *J. caudata* (Trin.) Peñail. et *J. plumosa* (Spreng.) S. W. L. Jacobs & J. Everett et *Nassella neesiana* (Trin. & Rupr.) Barkworth, *N. poeppigiana* (Trin. & Rupr.) Barkworth, *N. tenuissima* (Trin.) Barkworth et *N. trichotoma* (Nees) Arechav. *Nassella mucronata* (Kunth) R. W. Pohl n'est pas retenu; toutes les données européennes appartenant en définitive à l'espèce voisine *N. neesiana*. Une attention particulière est accordée à la distinction entre ces deux taxons souvent confondus et leurs caractères différentiels sont discutés. Deux taxons seulement se

sont plus ou moins répandus jusqu'à présent (*N. neesiana* et *N. trichotoma*); ils ont été signalés respectivement dans tous ou presque tous les pays concernés. Deux autres taxons (*Jarava brachychaeta* et *J. caudata*) semblent en voie d'extension. *Jarava ambigua* (confondu avec *J. brachychaeta* dans le Midi de la France) est cité pour la première fois comme naturalisé en Europe. Tous les taxons sauf *Nassella tenuissima* (qui est échappé de cultures) ont été introduits involontairement en Europe et ont tous une origine américaine. Tous les taxons sont décrits et des dessins originaux des lemmes sont fournis. Par ailleurs, une clé dichotomique est proposée et des données chorologiques, nomenclaturales, taxonomiques et écologiques sont également fournies.

KEY-WORDS: POACEAE – *Jarava* – *Nassella* – Europe – chorology – identification – neophytes – taxonomy

Introduction

The representatives of the genus *Stipa* L. s.l. (incl. those taxa currently regarded as belonging to the genera *Jarava* Ruiz & Pav. and *Nassella* (Trin.) E. Desv.) in Europe have been studied recently by various authors. Especially MARTINOVSKY (1980) enlarged the knowledge of the genus in Europe. Local treatments for the studied area are available for the Iberian Peninsula (VÁZQUEZ PARDO & DEvesa, 1996) and Italy (MORALDO, 1986). Although excellent revisions with regard to the autochthonous flora, these authors paid not too much attention to the presence of some recently naturalized taxa. Apart from the ephemeral *Nassella hyalina* (Nees) Barkworth (sub "*Stipa hyalina* Nees"), MARTINOVSKY (1980) only mentions "*Stipa neesiana*" and "*Stipa trichotoma*" for the *Flora Europaea* area, only the latter being included in the identification key.

The present study consequently aims to enlarge the knowledge of some naturalized taxa of *Stipa* s.l. in southwestern Europe (Iberian Peninsula; France, incl. Corsica and Italy; the treated taxa apparently being absent as naturalized neophytes from the rest of Europe) and Macaronesia.

The first attempt of this study was to elucidate the presence of "true" *Nassella mucronata* (Kunth) R. W. Pohl, a taxon of dubious status in Europe and widely confused with *N. neesiana* (Trin. & Rupr.) Barkworth. A subsidiary goal was to obtain an overview of all taxa currently naturalized in Europe, based on literature references, herbarium revision and field records. Taken into account the bad reputation of various *Stipeae* as aggressive invaders, particularly in the warm-temperate regions of the world, a better understanding of the degree of naturalization, the eventual spread and penetration in more or less natural environments, the ecological niches occupied, etc. seems appropriate.

Taxonomic treatment

Following BARKWORTH (1990), JACOBS & al. (1995) and BARKWORTH & TORRES (2001), *Nassella* is treated at generic level in the present revision. The same applies to *Jarava*, following PEÑAILILLO (2002). At present, there is no general agreement upon the circumscription within the *Stipeae* tribe, and all taxa treated here formerly belonged to the genus *Stipa* s.l.

The present paper does not aim to discuss whether the segregation of *Jarava* and *Nassella* is appropriate or not; I have simply opted to apply the most recent taxonomic insights.

The treated representatives of the genera *Jarava* and *Nassella* are differentiated as follows from the European taxa of *Stipa* s.str. (compared each time with *Flora Europaea*; MARTINOVSKY, 1980):

Nassella:

- Easily distinguished by the presence of a usually very distinct, bone-like, often cupuliform corona at the apex of the lemma (consequently excluding all taxa of *Flora Europaea*, with the exception of *Stipa trichotoma* Nees, which belongs to *Nassella* in this synopsis).

Jarava:

- Awn of lemma glabrous to the naked eye (this means glabrous or with hairs not more than 1 mm) (excluding the majority of the taxa of *Flora Europaea*: taxa 1-26 and 28-30).
- Awn geniculate and lemma not bifid at apex (excluding taxon 41: *Stipa bromoides* (L.) Dörf.).
- Callus inconspicuous and awn at most 30 mm (excluding: taxa 31-40).
- Caespitose and perennial (excluding taxon 27: *Stipa capensis* Thunb.).

Below are treated all naturalized taxa of *Jarava* and *Nassella* in Europe. Each taxon is carefully described, based on European material seen, and detailed original line drawings of the lemmas are provided.

Key to the genera:

1. Palea well developed and not concealed by the lemma margins at maturity, often almost as long as the lemma, usually hairy; lemma without a prominent epidermal pattern, apical corona absent **Jarava**
- 1a. Palea soon concealed by the strongly overlapping lemma margins, usually glabrous; lemma with a prominent epidermal pattern (usually conspicuously tuberculate) and always with an apical corona or conical protuberance..... **Nassella**

I. The genus *Jarava*

RUIZ & PAVÓN (1794) created the genus *Jarava*, based on the species *J. ichu* Ruiz & Pav. Soon the genus was included in *Stipa*, often considered as a well-defined subgenus or section (see f.i. CARO & SÁNCHEZ, 1973). Apparently JACOBS & EVERETT (1997) were the first to restore *Jarava* to generic rank, the genus being circumscribed by the awn not plumose, upper part of the lemma bearing long hairs that form an apical pappus, the lemma usually less thickened than in other genera, etc. Subsequently MATTHEI & al. (1998) and ROJAS (1998) plead for a further enlargement of the genus to include *Achnatherum* P. Beauv. *Jarava* having priority over *Achnatherum*, this would imply all combinations in *Achnatherum* be changed in combinations in *Jarava* (including the European type species, *Achnatherum calamagrostis* (L.) P. Beauv., and several other Old World species!). According to BARKWORTH (2003), ITS sequence data support combining *Achnatherum* and *Jarava* but the support is weak and based on a rather small and non-random sample. Either case, PEÑAILILLO (2002) has considerably extended the genus *Jarava* (excl. *Achnatherum*); he recognizes 53 South American species. SORENG & al. (2003) have followed this viewpoint and have included the taxa treated below as members of the genus *Jarava*.

The nomenclature followed here is the one proposed by PEÑAILILLO (2002) and JACOBS & EVERETT (1997).

Key to the naturalized taxa of *Jarava* in Europe

1. Glumes usually shorter than the lemma..... **4. *J. plumosa***
- 1a. Glumes definitely longer than the lemma..... **2**
2. Lemma with apical pappus, i.e. a tuft of long white hairs (up to 3 mm), considerably longer than those of the lemma body **1. *J. ambigua***
- 2a. Lemma without apical pappus, sometimes however with some longer hairs at apex (coma) **3**
3. Lemma hairy all over, sometimes less so between the midrib and the first lateral vein; hairs on palea often reaching beyond apex of palea; caryopsis ca. 1 mm wide, obovoid **2. *J. brachychaeta***

- 3a. Lemma hairy along the midrib and between the outermost lateral veins, more or less glabrous between the midrib and the first lateral vein; hairs of palea not reaching beyond apex of the palea; caryopsis ca. 1,4 mm wide, often more or less gibbous
 **3. *J. caudata***

Jarava ambigua (Speg.) Peñail.in Gayana Bot. 59: 30. 2002.

≡ *Stipa ambigua* Speg. in Revista Argent. Bot. 1: 27. 1925.

Densely caespitose perennial; culm up to 110 cm tall, erect, glabrous; leaf sheaths glabrous but with long hairs confined to the (upper) margins; leaf blades long, involute, appearing setaceous, glabrous or with scattered hairs on the margins; ligule ciliate, less than 0.5 mm. Inflorescence contracted, up to 40 cm, usually partly remaining inserted in the upper leaf. Spikelets 1-flowered, disarticulating above the glumes; glumes 3-nerved, equal, (6-)9 mm, incl. awn 1.5 mm, with broad hyaline margin and apex and purplish back, glabrous or with some sparse hairs confined to the midvein; lemmas lanceolate, ca. 5 mm, hairy all over with whitish antrorse hairs and apical pappus of whitish slightly divergent hairs up to 3 mm, callus inconspicuous, awn present, 25-30 mm, column shorter than the bristle, geniculate; palea present, subequaling the lemma, 3-4 mm, hairy all over, hairs surpassing the apex. Caryopsis fusiform, 2.5-3.5 mm.

Origin. – South America (Argentina, Uruguay).

Iconography. – CARO (1966: Fig. 23, sub “*Stipa dusenii* Hitchc.”)

Flowering. – V-VI.

Local distribution. – France (SALABERT & GASTESOLEIL, 1994; sub “*Stipa brachychaeta* Godr.”).

Specimens examined. – **FRANCE. Dép. Aude:** Ile Sainte-Lucie, introduit, 1990, *M. Gastesoleil s.n.* (LG, sub “*Stipa brachychaeta*”); Port-la-Nouvelle, Ile Sainte-Lucie, near la Cantine, dry calcareous soil, dominated by *Cistus albidus*, numerous specimens, fully naturalized and spreading, 17.V.2003, *F. Verloove 5381* (priv. herb. author, BR, HGI).

ARGENTINA. Prov. La Pampa: El Carancho, ruta 128, 12.XI.1962, *E. Cano & J. Cámara 339* (LG).- **Prov. de Santa Cruz:** Dpto Deseado, Puerta Deseado, camino a la Isla de Leones, 47°00’S, 66°00’W, 26.I.1965, *E. Ancibor & A. Vizinis 4508* (LG).- **Prov. Chubut:** Dpto. Biedma, Peninsula Valdés, al S de Punta Norte, 13.XI.1968, *A. Piccinini et Garcia 1220* (LG).

Notes:

The population of *J. ambigua* at Ile Sainte-Lucie seems to be the only naturalized one in Europe. The species was first discovered there in 1990 and identified by the late M. Kerguelen as “*Stipa brachychaeta*”. This taxon differs from *J. ambigua* by the absence of an apical pappus, the shorter awns and the rather effuse panicle.

The species seems to extend rather fast and at present many hundreds of specimens are present. *Jarava ambigua* penetrates in a natural vegetation dominated by *Cistus albidus* L. and prevails particularly where the vegetation cover has been disturbed; main accompanying species are *Sedum acre* L., *Lobularia maritima* (L.) Desv., *Bellardia trixago* (L.) All., *Pallenis spinosa* (L.) Cass., etc.

To our knowledge, *J. ambigua* was only known so far as a rare ephemeral wool casual in Great-Britain (RYVES & al., 1996). The origin of the present population remains uncertain: the industrial harbour of Port-la-Nouvelle is nearby but it may as well be a remnant of the former wool importation industry in this area.

Stipa dusenii Hitchc. is generally considered as conspecific with *J. ambigua* (e.g. ROSENGURTT & al., 1970: 73; TORRES, 1993; RYVES & al., 1996; etc.). CARO (1966), on the contrary, clearly distinguished both, the former being distinct by its longer, hairy palea (subequal to the lemma) and

the margin of the leaves being pilose. The plants from Ile Sainte-Lucie are obviously ascribable to the “*dusenii*”-type but this particular combination of characters probably does not deserve taxonomic recognition.

Jarava brachychaeta (Godr.) Peñail. in Gayana Bot. 59: 30. 2002.

≡ *Stipa brachychaeta* Godr. in Mém. Sect. Méd. Acad. Sci. Montpellier 1: 450. 1853.

Densely caespitose perennial; culm up to 70-90 cm tall, erect, glabrous; leaf sheaths glabrous below or with multicellular hairs confined to the upper margins; leaf blades long, involute, appearing more or less setaceous, glabrous or with sparse hairs; ligule of dense white hairs, ca. 0.5 mm. Inflorescence at first more or less contracted, becoming an effuse panicle, 20-30 cm; primary branches verticillate, more or less 7 in number, strongly unequal. Spikelets 1-flowered, gapping, disarticulating above the glumes; glumes 3-nerved, subequal, (4-)6-7 mm, incl. awn 1-1.3 mm, with broad hyaline margins and purplish back, glabrous or scabrous on the midvein; lemmas lanceolate, 4.5-5.5 mm, hairy all over with whitish antrorse hairs, callus absent or inconspicuous, awn present 15-20 mm, column somewhat shorter than the bristle, geniculate; palea present, almost equalling the lemma, 3-4 mm, hairy all over, hairs surpassing the apex. Caryopsis ovate, bicuspidate, 2.5-3 mm.

Origin. – South America (Argentina, Peru, Uruguay). Naturalized in Australia (JACOBS & EVERETT, 1993b).

Iconography. – CARO (1966: Fig. 22); BURKART (1969: Fig. 50).

Flowering. – V-VI.

Local distribution. – France, Spain.

Specimens examined. – **FRANCE. Dép. Hérault:** Montpellier, Port Juvénal, before 1875, Grenier s. n. (P); Celles, près du Lac de Salagou, 29.V.2003, R. Portal s.n. (priv. herb. author).

SPAIN. Prov. of Gerona: Gerona, prop de can Montilivi (UTM 31TDG84), 140 m, 5.VI.2001, L. Vilar s.n. (HGI 17409); Gerona, sota el puig d'en Roca (UTM 31TDG84), 75 m, 10.VI.2001, J. Font s.n. (HGI 17410); Gerona, Montilivi (UTM 31TDG84), 140 m, vacant lot in residential area and adjacent grassy hill side, locally abundant, 14.V.2003, F. Verloove 5388 (priv. herb. author, BR, L, LG).

Notes:

Within the outskirts of the city of Gerona (Spain), *J. brachychaeta* has been recorded recently at two separated localities where the species appears to be well-established in abandoned soil and pastures near human settlements (J. Font, pers. comm., III.2003). Especially at Can Montilivi, *J. brachychaeta* seems to thrive very well. Main accompanying species are banal annual ruderals such as *Bromus diandrus* Roth, *Hordeum murinum* L. s.l., *Medicago* spp. L., or biennials and perennials like *Dactylis glomerata* L. s.l., *Gladiolus* spp. L., *Urospermum dalechampii* (L.) F. W. Schmidt, etc. (pers. obs., V.2003). At present, *J. brachychaeta* seems to represent not a single threat to the original vegetation.

Also in NE-Spain, a single specimen of *J. brachychaeta* has been reported in 2003 from Montjuïc in the city of Barcelona (S. Pyke, pers. comm., VII.2003).

In 2003, a new (small) population of *J. brachychaeta* came to light in southern France where the species once occurred as an (ephemeral?) casual. The present locality – near a parking place at the much-frequented Lac de Salagou – counts at least three well-established clumps (R. Portal, pers. comm., VI.2003); its future naturalization needs to be confirmed.

For a detailed discussion of the morphological peculiarities of this taxon and the following, see CARO & SÁNCHEZ (1971). As a matter of fact, both taxa are similar and several key characters from various literature are not reliable. HITCHCOCK (1925) has separated *J. brachychaeta* and

J. caudata (Trin.) Peñail. solely based on the morphology of the leaf blades (respectively “flat or loosely involute” and “involute-filiform, firm”). In fact, both species share leaf blades that are usually strongly involute, almost filiform and firm. There might as well be a minor phenological difference between both species: *J. brachychaeta* starts flowering somewhat later than *J. caudata*, at least in the Gerona-area (*pers. obs.*, V.2003).

Jarava caudata (Trin.) Peñail. in Gayana Bot. 59: 30. 2002.

≡ *Stipa caudata* Trin. in Mém. Acad. Imp. Sci. St.-Pétersbourg, Sér. 6, Sci. Math. 1: 75. 1830.

Densely caespitose perennial; culm up to 70-80(-100) cm tall, erect, glabrous or sparsely hairy, nodes glabrous; leaf sheaths glabrous or with long hairs confined to the margins and the ligule area; leaf blades long, involute or plane, up to 3.5(-7) mm wide, glabrous; ligule ciliate, ca. 0.5 mm. Inflorescence at first more or less contracted, becoming a more effuse panicle, up to 30 cm, usually well exerted from the upper leaf sheath. Spikelets 1-flowered, somewhat gapping, disarticulating above the glumes; glumes 3-nerved, subequal, 8-9(-11) mm, incl. awn ca. 1 mm, with broad hyaline margins and purplish back, glabrous or with antrorse hairs confined to the midvein; lemmas (4-)5.5-6 mm, hairy but with glabrous patches between the principal nerves, callus inconspicuous, ca. 0.5 mm, awn present 15-20(-25) mm, column shorter than the bristle, geniculate; palea present, almost equalling the lemma, 5 mm, hairy all over, hairs not surpassing the apex. Caryopsis more or less pear-shaped, bicuspidate, 3 mm.

Origin. – South America (Argentina, Chile, Uruguay). Naturalized in Australia (JACOBS & EVERETT, 1993b).

Iconography – MATTHEI (1965: Fig. 17); ANZALONE (1982: Fig. 1); PYKE (2003a: 22).

Flowering. – V-VI.

Local distribution. – Italy (ANZALONE, 1982; MORALDO, 1986); Spain (PYKE, 2003a).

Specimens examined. – **ITALY. Roma:** Valle Aurelia (Valle dell’Inferno), su ridosso al centro dell’abitato della borgata, 8.VII.1979, *B. Anzalone s.n.* (RO); Roma, presso Via Lucio Apuleio, incolti, X.1979, *B. Anzalone s.n.* (RO); Roma, Monte Mario a Via Lucilla Domizia, 20.VII.1980, *B. Anzalone s.n.* (RO); Roma, Valle Aurelia, al centro abitato, 20.IX.1980, *B. Anzalone s.n.* (RO); Roma, Monte Mario, presso L. Damiano, Chiesa, V.1982, *B. Anzalone s.n.* (RO).

SPAIN. Prov. of Gerona: Gerona, Castell de Montjuïc (UTM 31TDG84), 175 m, ruderal area inside the ruins of the old castle, few specimens, 14.V.2003, *F. Verloove 5419* (priv. herb. author, BR, HGI, LG). – **Prov. of Barcelona:** Sant Fost de Campsentelles, Can Rovira (UTM 31TDF39), 130 m, stony riverbed of riu Besòs, locally abundant, 16.V.2003, *F. Verloove 5466* (priv. herb. author, BR, LG); Castellbisbal, right bank of riu Llobregat (UTM 31TDG19), gravelly, ± ruderalized winterbed of river, 4 specimens, dispersed N and S of the bridge, 8.IX.2003, *F. Verloove 5477* (BR); Montmelo towards Mollet del Vallès, left bank of riu Besòs (UTM 31TDF39), ± 50 m, dry, stony border of river, locally very common and fully naturalized, 9.IX.2003, *F. Verloove 5552* (MA); Zaragoza, entre Juslibol y San Gregorio (UTM 30TXM7615), 220 m, suelo profundo en laderas secas, 31.V.2004, *S. Pyke s.n.* (priv. herb. author).

GREAT-BRITAIN. Maulden, Bedfordshire (v.c. 30), wool adventive, root collected 17.IX.1968 (21.VII.1970), *J. E. Lousley 3396* (LG; sub “*Stipa spec.*”).

Notes:

In Europe, *J. caudata* was first reported as being naturalized from Italy (NW-Rome). The species was initially detected there around 1966 by ANZALONE (1982) and subsequently confirmed (MORALDO, 1986; CELESTI GRAPOW, 1995). At present, *J. caudata* is still present in the Pineto-area (one of the major nature reserves within the city borders) (L. Celesti, *pers. comm.*, IV.2003). *Jarava caudata* occupies dry, sandy soils (for a phytosociological relevé, see ANZALONE, 1982). The species is believed to have been introduced with timber (ANZALONE, 1982).

Recently, *J. caudata* has been signalized from Spain: the species is considered firmly established, at least since 1993, in the steppe country north of Zaragoza (PYKE, 2003b). *Jarava caudata* inhabits arid road verges and ruderalized steppe. In this area, *J. caudata* more or less behaves like native *Stipa parviflora* Desf. but seems to prefer more nitrophilous and periodically humid soils (PYKE, 2003b). According to the finder the species is probably introduced originally by American military troops. Live stock enables the species to spread rapidly (anthecia easily attach to their coat).

Research in the riu Besòs basin in May 2003 (province of Barcelona, Spain) revealed the presence of numerous patches of *J. caudata* on the stony riverbed, especially north of Montcada. The species penetrates in typical herbaceous communities that largely consists of neophytes (see f.i. PINO, 2000); major accompanying taxa are *Ambrosia coronopifolia* Torr. & A. Gray, *A. tenuifolia* Spreng., *Artemisia annua* L., *Bromus catharticus* Vahl and to a lesser extent *Chenopodium ambrosioides* L., *Coronopus didymus* (L.) Sm., *Cuscuta campestris* Yunck., *Senecio inaequidens* DC. and the native *Lolium perenne* L. and *Piptatherum miliaceum* (L.) Coss. (*pers. obs.*). Additional investigations in the same riverbed in September 2003 confirmed the presence of *Jarava caudata* further stream up: the species has become extremely common between Montmelo and Llagosta (particularly so around Mollet del Vallès where monospecific stands are found). *Jarava caudata* inhabits both sides of the dry, stony winterbed of the riu Besòs, ruderalized road verges, talus of motorways, etc. Main accompanying species are *Ambrosia coronopifolia* and *Foeniculum vulgare* Mill. The origin and time of arrival of the riu Besòs populations of *J. caudata* are obscure. Given its actual abundance, the species must have been introduced a long time ago. A former introduction with wool-waste – as suggested for *J. plumosa* by CASASAYAS I FORNELL & FARRÀS I DE BLÀS (1985) (see below) – is likely: *J. caudata* has been recorded as a casual wool-alien in Great-Britain (cf. RYVES & al., 1996). The area north of Barcelona used to be a famous wool-processing area; unfortunately its wool-alien flora has never been thoroughly investigated. The presence of several remarkable species (*J. caudata* and *J. plumosa*, *Senecio pterophorus* DC., etc.; the latter known as a wool-alien from Belgium, Great-Britain, etc.) could be explained by the former introduction of wool.

Finally, scattered plants of *J. caudata* have also been found in September 2003 on the right bank of the riu Llobregat, NW of Barcelona, in the same conditions as in the riu Besòs-basin. The species surely exists elsewhere in NE-Spain and should be looked for.

Evident invasive behaviour has not been established yet in Europe, even not in Italy where *J. caudata* is present since at least the 1960's. In Australia, the species has recently been reported as a pest-species. In Victoria, *J. caudata* invades riparian vegetation; its seeds are spread by water, particularly after flooding (ANONYMUS, 2003). Given the species massive presence in an identical habitat in the riu Besòs-basin in Spain, its eventual invasiveness possibly deserves to be investigated.

Jarava plumosa (Spreng.) S. W. L. Jacobs & J. Everett in *Telopea* 7: 301. 1997.

≡ *Calamagrostis plumosa* Spreng., *Syst. Veg.* 1: 253. 1824.

Caespitose perennial, culm up to 70 cm tall (usually much smaller), erect, completely glabrous; leaf sheaths glabrous, or with some sparse long hairs confined to the upper margins; leaf blades rather short, most leaves up to 10-15(-25) cm long, involute, appearing more or less setaceous, glabrous; ligule membranous, minute, less than 0.5 mm. Inflorescence at first more or less contracted, becoming more effuse, up to 20 cm, sometimes partly remaining inserted in the upper leaf sheath. Spikelets 1-flowered, disarticulating above the glumes; glumes without obvious nerves, colourless, unequal, the upper larger, 6-8 mm (incl. awn ca. 1-2.5 mm), hyaline, glabrous; lemmas fusiform, 8-9 mm, as long as or slightly longer than the upper glume, scabrous by minute antrorse prickles, apical pappus of whitish, divergent hairs up to 4(-7) mm, callus ca. 1 mm, hidden by short whitish hairs, awn present, up to 30 mm, column much shorter than bristle, geniculate; palea membranous, 1.5-2.5 mm, glabrous. Caryopsis linear, 4-4.5 mm.

Origin. – South America (Argentina, Brazil, Chile, Uruguay). Naturalized in Australia (GARDNER & al., 1996).

Iconography (sub “*Stipa papposa* Nees”). – MATTHEI (1965: Fig. 28); CARO (1966: Fig. 19); BURKART (1969: Fig. 47); CASASAYAS I FORNELL & FARRÀS I DE BLÀS (1985: Fig. B); GARDNER & al. (1996: Fig. 1).

Flowering. – VII-X.

Local distribution. – Spain (CASASAYAS I FORNELL & FARRÀS I DE BLÀS, 1985; CASASAYAS I FORNELL, 1989; VÁZQUEZ PARDO & DEVESA, 1996).

Specimens examined. – **FRANCE. Dép. Hérault**: Montpellier, Port Juvénal, before 1875, *Grenier s.n.*, (P [barcode P00279411]); Montpellier, Port Juvénal, before 1875, *Grenier s.n.*, (P [barcode P00279412]); Port Juvenal, près Montpellier, VI.1857, *s.coll.*, (RO n° H.C.17.IV.3).

SPAIN. Prov. Barcelona: Sabadell (Vallès Occidental), ruderal (UTM 31TDF29), 30.XI.1989, *T. Casasayas s.n.* (BCN 5713); Sabadell, La Creu de Barbera, carrer de Puig i Cadalfach x carrer de J. Blume, talus of roads, weed in plantations, locally common (UTM 31TDF29), 10.IX.2003, *F. Verloove 5483* (BR, MA); Sabadell, NE-side of airport, grassland, weed in plantations, road-verges, locally very common, co-dominant (UTM 31TDF29), 10.IX.2003, *F. Verloove 5484* (priv. herb. author); Barbera del Vallès to Ripollet, poligon industrial Can Salvatella, disturbed road-verge in industrial area, along with *Eragrostis curvula*, few specimens (UTM 31TDF29), 10.IX.2003, *F. Verloove 5487* (MA).

Notes:

The Spanish populations of Sabadell (Vallès Occidental) near Barcelona apparently are the only naturalized ones in Europe. The species was first discovered there in 1983 (CASASAYAS I FORNELL & FARRÀS I DE BLÀS, 1985) and subsequently confirmed (CASASAYAS I FORNELL, 1989; DE BOLÒS, 1998: 986; DE BOLÒS & VIGO, 2001). Although the area has changed considerably in the past decades (*T. Casasayas i Fornell, pers. comm.*), *J. plumosa* still thrives very well, particularly in the area between and north of the airport and the railway station. The species tends to spread and surely exists elsewhere in the surroundings: a small population has been detected in an industrial area halfway between Barbera del Vallès and Ripollet (SE of Sabadell; *pers. obs.*, IX.2003). *Jarava plumosa* usually grows in more or less ruderal, disturbed conditions: periodically disturbed roadverges, as a weed in plantations, parking places, lawns, etc.; typical accompanying species are banal taxa such as *Dittrichia viscosa* (L.) Greuter, *Foeniculum vulgare*, *Hyparrhenia hirta* (L.) Stapf, *Lepidium graminifolium* L., *Medicago sativa* L., etc.

Elsewhere in the Mediterranean Basin (outside Europe, e.g. in Israel – GREUTER & RAUS, 2001), *J. plumosa* is rapidly spreading and behaves more or less like a weed. The species might as well spread to other suitable habitats elsewhere in southern Europe.

In Spain, *J. plumosa* is believed to have been introduced with wool (CASASAYAS I FORNELL & FARRÀS I DE BLÀS, 1985; see also sub *J. caudata*), while in Israel the species seems to be an escape from cultivation (GREUTER & RAUS, 2001).

II. The genus *Nassella*

For a detailed synopsis of the history and the actual delimitation of the genus *Nassella*, one can refer to BARKWORTH (1990) and BARKWORTH & TORRES (2001). At present the genus includes 116 species, all indigenous in the New World (almost exclusively South and Central America), but with several representatives behaving as aggressive invaders outside their original range.

The elevation of *Nassella* to generic level is increasingly becoming accepted and consequently applied here.

Apart from the taxa treated here, several other taxa of this genus have been recorded in Europe, usually as wool adventives (see for instance THELLUNG, 1912; RYVES & al., 1996). None of these have been able to become naturalized. One species however, *N. hyalina* ($\equiv$ *Stipa hyalina* Nees), is one of the more regular introductions (VIEGI & al., 1974; MARTINOVSKY, 1980) and might

possibly naturalize. *Nassella hyalina* is separated from *N. neesiana* and *N. poeppigiana* (Trin. & Rupr.) Barkworth by the smaller lower glumes (<10 mm) and anthercia (<5 mm) (see Fig. 1, 2), by the non gibbous anthercium from *N. trichotoma* (Nees) Arechav. and by the distinct apical corona (0.4-1 mm) and the larger anthercia (>3 mm) from *N. tenuissima* (Trin.) Barkworth (see Fig. 1, 2). Confirmed records exist for W-Turkey (Izmir, VII.1975; distributed by Soc. Ech. n° 11986, cf. herb. GENT) and the species might occur elsewhere in the Mediterranean.

The nomenclature followed here is the one proposed by BARKWORTH (1990). The terminology used to designate morphological features of the *Nassella* florets is the one proposed by JACOBS & al. (1995).

Key to the naturalized taxa of *Nassella* in Europe

1. Anthercium strongly gibbous, ca. 2 mm; awn up to 30 mm..... **4. *N. trichotoma***
- 1a. Anthercium cylindrical to fusiform, always longer; awn usually longer 2
2. Anthercium ca. 3 mm, with indistinct corona **3. *N. tenuissima***
- 2a. Anthercium longer, up to 10 mm, with a distinct apical corona (corona constricted or not at base)..... 3
3. Lemma body glabrous, except for some hairs on the lower half of the veins; apical corona distinct, conspicuously constricted at base..... **1. *N. neesiana***
- 3a. Lemma body with scattered long white hairs, those on the veins (almost) reaching apex; apical corona not constricted at base, continuous with the sides of the lemma **2. *N. poeppigiana***

Nassella neesiana (Trin. & Rupr.) Barkworth in Taxon 39: 611. 1990.

= *Stipa neesiana* Trin. & Rupr. in Mém. Acad. Imp. Sci. St.-Petersbourg, Sér. 6, Sci. Math. 5: 27. 1842.

Densely caespitose perennial; culm ca. 90 cm tall, erect, glabrous, nodes pilose; leaf sheaths usually with scattered long white hairs; leaf blades long, plane or involute, especially the lower with scattered long white hairs; ligule membranous, 1.5-4 mm. Inflorescence a more or less contracted panicle, becoming more effuse with age, up to 25 cm long. Spikelets 1-flowered, disarticulating above the glumes; glumes unequal, the lower longer, up to 20 mm, the lower up to 15 mm, incl. awn up to 8 mm, the lower 5-nerved, the upper 3-nerved, purplish with hyaline apex and margins, hairy on the nerves; anthercium cylindrical, up to 10 mm, diameter ca. 1.2 mm, lemma body conspicuously tuberculate, glabrous, except on the lower half of the veins, callus ca. 4 mm, hidden by tuft of white hairs, corona ca. 1 mm wide and 1 mm high, constricted at base and with denticulate hairs at apex, awn present, (60-)80(-95) mm, column slightly shorter than bristle; palea membranous, glabrous, 1-2.5 mm. Caryopsis 4-5 mm.

Origin. – South America (Argentina, Bolivia, Brazil, Chile, Ecuador, Peru, Uruguay). Naturalized in Australia (JACOBS & EVERETT, 1993a) and South Africa (GIBBS RUSSELL & al., 1991).

Iconography. – BURKART (1969: Fig. 53).

Flowering. – V-VI.

Local distribution. – France, incl. Corsica (BOSC, 1981, 1982; BERNARD & FABRE, 1983; NATALI & JEANMONOD, 1996; BELHACENE, 2003); Italy (PIGNATTI, 1982; MORALDO, 1986; MARTINI & ZAPPA, 1993, sub “*Stipa setigera*”); Portugal, incl. Azores (Madeira) (HANSEN & SUNDING, 1993; COPE, 1994; ALMEIDA, 1999); Spain, incl. Canary Islands (Gran Canaria, La Gomera and Tenerife) (SUÁREZ RODRÍGUEZ & al., 1990; HANSEN & SUNDING, 1993; FONT & al., 2000; OSORIO & al., 2000).

Specimens examined. – **FRANCE. Dép. Hérault:** Port Juvénal, V.1872, *J. Callé s.n.* (BR); Port Juvénal, Montpellier, before 1875, *Grenier s.n.*, (P [barcode P00279413]); Port Juvénal,

Montpellier, before 1875, *Grenier s.n.*, (P [barcode P00279414]); Lodève, anciens séchoirs à laine, 2.VI.1880, *J. Callé s.n.* (BR); Bédarieux, 13.VI.1894, *F. Sennen 1041* (P); Bédarieux, adventice, VI.1911, *Coste s.n.* (BR); Montpellier, naturalisée dans les vieilles pelouses du jardin des plantes, V.1925, *J. Daveau 5074* (P); Domaine de Méric, près du verger conservatoire, 8.VI.2003, *N. Georges s.n.* (priv. herb. author); Domaine de Méric, chemin ombragé, 8.VI.2003, *N. Georges s.n.* (priv. herb. author).- **Dép. Haute-Corse**: à proximité de l'étang de Biguglia (Bastia), 13.VI.1978, *M. Kerguelen s.n.* (LG); environs de Biguglia, prairie au niveau de la halte de Fornacina, à 3 km env. au nord du village de Casatorra, 25.V.1980, *G. Bosc s.n.* (BR, GENT, LG; distr. by Soc. Ech. n° 9985); Furiani, Furnagina (= Fornacina) (plaine littorale au S de Bastia, entre la N 193 et l'extrémité nord de l'étang de Biguglia), bord de la voie ferrée et prairie-friche à hautes herbes, extrêmement abondant, 29.V.1986, *J. Lambinon 86/95* & *J. Deschâtres* (BR, LG).- **Dép. Lozère**: Moissac-Vallée-Française, coteaux silicieux de la rive gauche du Gardon, face à l'entrée du camping G.C.H., sur d'anciennes terrasses en friche (alt. 300 m), 29.V.1981, *C. Bernard & G. Fabre s.n.* (priv. herb. C. Bernard, dupl. priv. herb. author).- **Dép. Pyrénées-Orientales**: La Roca d'Albera, prop del mas Montariol (UTM 31TDH90), 75 m, 26.VI.2000, *J. Font s.n.* (HGI 16836).

ITALY. Liguria: Borzoli, Argine, 19.VI.1909 (RO); Varazze, Invrea, stazione di servizio, 22.V.1993, *A. Soldano 10239* (priv. herb. Soldano).- **Roma**: Villa Ada, 05.VII.1970, *B. Anzalone s.n.* (RO); Villa Ada, 27.V.1973, *B. Anzalone s.n.* (RO).

SPAIN. Tenerife: El Bailadero, Parque Forestal, wegberm, 27.III.1972, *J.E. De Langhe 55/72* (priv. herb. De Langhe).- **Prov. of Gerona**: Vidreres, prop del camp de futbol (UTM 31TDG82), 96 m, 25.V.1998, *X. Viñas s.n.* (HGI 16827; sub "*Nassella mucronata*"); Rabós, al Pla d'Helena (UTM 31TEG09), 100 m, 15.VI.2000, *J. Font s.n.* (HGI 16828); Gerona, al castell de Montjuïc (UTM 31TDG 84), 175 m, 31.V.2001, *J. Font s.n.* (HGI 17408).

MEXICO (sub "*Nassella mucronata*"). **Valley of Mexico**: Federal district, 8.000 ft., 12.X.1896, *C. G. Pringle 6583* (BR); Puebla, Esperanza, 19.XI.1907, *Arsène s.n.* (BR).- **Azcapotzalco**: Federal district, open grassy ground, 29.VII.1910, *A. S. Hitchcock 803* (BR).- **Michoagan**: 2 km al E de Jeráhuaro, camino a Huajumbaro, municipio de Zinapécuaro, 2380 m, orilla de camino, 29.IX.1988, *M. J. Jasso 246*, det. J. Valdés Reyna (BR).

Notes:

Some Corsican populations from the Biguglia-area slightly differ by the presence of unusually large lower glumes (up to 24 mm); other plants from the same area present normally sized glumes. Hence, this aberration probably is of no particular taxonomic value.

Nassella neesiana and *N. mucronata* have been (and still are) widely confused taxonomically in Europe. In most of the concerned countries, references for both exist. In the Iberian Peninsula, "*Stipa setigera*" (= *Nassella mucronata*, according to BARKWORTH & TORRES, 2001) was first cited by GARCIA (1946). He clearly meant *Nassella neesiana* (see synonymy in GARCIA (1946)), the binomial name "*Stipa setigera*" being widely misapplied at that time for *Nassella neesiana*. The misapplication of the binomial name "*Stipa setigera*" for *Nassella neesiana* in Europe is probably due to SPEGAZZINI (1901) and his treatment of the *Stipeae* in Argentina. The (widespread) plant he treats under that binomial name clearly matches the concept of *Nassella neesiana* ("*cum anthropodio et corona 7-10 mm long.*", "*glumis (...) infera 15-18 mm long., 14-15 mm long. (...) parum superante*", etc.), and TORRES (1997) has noted that "true" *Nassella mucronata* was absent from Argentina at that time.

ALMEIDA (1999) renamed the Portuguese plants and only retains *N. neesiana*. On the contrary, VÁZQUEZ PARDO & DEVESE (1996) maintained *N. mucronata* for the Iberian Peninsula (apparently based on two ancient and ephemeral records). For the present study, none of the two voucher specimens of *N. mucronata* cited by VÁZQUEZ PARDO & DEVESE (1996) were examined. Their species description however ("*Glumas (...) superior de 13-17 mm y la inferior de 11-15 mm*", etc.) is not really compatible with the concept of *N. mucronata* and rather matches *N. neesiana*.

Moreover, one of their voucher specimens (*Mas y Guindal s.n.*; MAF), originally labelled as “*Stipa lagascae*”, has been annotated by Vázquez Pardo himself as “*Stipa neesiana*” (xerox of concerned collection kindly provided by Dr. J. Pizaro). Their second herbarium reference is the one of Coimbra, Portugal, meanwhile altered to *N. neesiana* (see ALMEIDA, 1999).

Hence, the records of *N. mucronata* in the Iberian Peninsula remain very doubtful and are considered erroneous. Recently *N. mucronata* has been confirmed in NE-Spain (FONT & al., 2000) but these plants proved to belong to *N. neesiana* too.

In France, the possible presence of *N. mucronata* has been suggested by KERGUÉLEN (1999), but never confirmed; all Corsican and most probably all actual populations of continental France (at least all those examined) definitely belong to *N. neesiana*. In Italy, the binomial name “*Stipa setigera*” has always been (cf. MARTINI & ZAPPA, 1993) misapplied for *N. neesiana*. MORALDO (1986), in his revision of *Stipa* s.l. in Italy, only maintained “*Stipa neesiana* var. *longiaristata* Arechav.”. The latest edition of the checklist of the Italian flora (L. Celesti, pers. comm.) enumerates both *Nassella mucronata* and *N. neesiana*. There is a reasonable chance that old Italian records of “*Stipa setigera*” have been renamed as *Nassella mucronata* (following BARKWORTH & TORRES, 2001) and that more recent Italian records have been correctly referred to *N. neesiana*. Finally, MARTINOVSKY (1980) only mentions “*Stipa neesiana*” for the Mediterranean region. BARKWORTH & TORRES (2001) reference of *Nassella mucronata* for both France and Italy hence remains very doubtful.

The following table aims to clarify and facilitate the delimitation of three closely related and often confused taxa. It is based on numerous voucher specimens seen and various literature references (cf. TOVAR, 1993; BARKWORTH & TORRES, 2001).

Table 1. – Main diacritic features of three closely related taxa of *Nassella*.

	<i>N. mucronata</i>	<i>N. neesiana</i>	<i>N. poeppigiana</i>
Corona of lemma	Long-ciliate (cilia up to 1.5 mm); constricted at base	Ciliate, cilia rather triangular, with broadened base; constricted at base	Ciliate; continuous with the sides of the lemma
Length of antheridium	5-6 mm	7.5-9 mm	7 mm
Length of glumes	7.5-11 mm	15-20 mm	13-14 mm
Glume indumentum	Absent	Present on the nerves and/or margins (scabrous-pubescent)	Present on the nerves and/or margins (scabrous-pubescent)
Lemma indumentum	Some hairs on the veins in upper half	Confined to the lower half of the veins	Veins pubescent almost to apex
Length of awn	Up to 50 mm	Up to 95 mm	Up to 90 mm

A study of numerous herbarium specimens of all three taxa mentioned above proves that especially *N. mucronata* and *N. neesiana* are rather easily distinguished. Apart from the obvious differences in floret dimensions (especially glumes and antheridium length), the particular form of the corona cilia seems a useful characteristic: within *N. mucronata* these cilia are linear in outline (up to 1.5 mm, usually somewhat shorter), while *N. neesiana* has conspicuously triangular cilia and thus with a clearly broadened base.

As a matter of fact, confusion of *N. mucronata* and *N. poeppigiana* is much more likely (as already stated by MATTHEI, 1965), both taxa being characterized by a rather hairy lemma body and a corona with linear cilia.

Not all diacritic features found proved to be useful to distinguish *N. mucronata* and *N. neesiana*, for instance the prominence of the epidermal pattern, the number of nerves or the degree of hairiness of the lemma body (an important distinguishing feature according to HITCHCOCK, 1925), the dimensions of the apical corona, etc.

The infraspecific variability within *N. neesiana* seems to be of little taxonomic value. Nevertheless, numerous varieties have been described (cf. var. *formicarioides* Burkart, var. *gracilior* Burkart, var. *hirsuta* Arechav., var. *longiaristata* Arechav., var. *neesiana* and var. *virescens* Hack.). Italian plants have been referred to var. *longiarista* Arechav. (cf. MORALDO, 1986). The presence or absence of hirsute hairs on the leaf blades, the prominence of the lemma epidermal pattern, etc. should differentiate several varieties. The examination of European herbarium specimens often shows completely glabrous upper leaf blades and densely hirsute lower leaf blades and eventual differences in the lemma epidermal pattern seems to be not reliable and rather depend upon age.

Although usually tolerably well distinguished in Europe, some South American populations appear to be more or less intermediate between *N. mucronata*, *N. neesiana* and/or *N. poeppigiana*, especially where two or more taxa co-exist (for instance some Peruvian collections, viz *Sánchez Vega* 2395, in herb. BR). Moreover, at least some European plants examined (in casu those from the “Jardin des Plantes” in Montpellier, France; see supra for herbarium references) turned out to share the linear cilia of the corona with *N. mucronata*. These plants finally have been referred to *N. neesiana* on account of the dimensions of glumes, antherium and awn but the specific rank of *N. mucronata* could come into question.

Nassella neesiana apparently is the most widespread of the naturalized taxa of *Stipa* s.l. in Europe. The species inhabits a wide range of usually anthropogenic biotopes varying from road-verges, abandoned vineyards, urban parks (as in Montpellier and Rome), more or less ruderalized pastures, etc. Furthermore, at present it seems to be the only species with reported invasiveness in Europe; in the Canary Islands *N. neesiana* recently penetrates into natural, protected areas (for instance in the National Park of Garajonay; GARCÍA CAMACHO & QUINTANAR SÁNCHEZ, 2003) and behaves like an aggressive invader (OSORIO & al., 2000). The species thrives well under *Laurus azorica* (Seub.) Franco and *Castanea sativa* Mill. within the *Pruno-Lauretea azoricae*-community (SUÁREZ RODRÍGUEZ & al., 1990). In France and Italy too, *N. neesiana* has been reported from or nearby natural habitats, especially on rocky, schistous slopes in river-valleys (BERNARD & FABRE, 1983; MARTINI & ZAPPA, 1993). The species is generally found on well drained, sometimes slightly eutrophic soils.

Although sometimes found in restricted number, *N. neesiana* is able to build up dense stands and spread rapidly (as reported from Corsica; cf. BOSC, 1982).

Nassella neesiana seems to be recently spreading in the investigated area and new localities surely will come to light. Apart from those enumerated above (see “Specimens examined”), the species actually exists at Bédarieux-Nissergues and is abundant (P. Jauzein, *pers. comm.*). It is also recorded in the department Hérault, France. Another French population was reported from the Haute-Garonne department: “Vaudreuille (Revel), pastures close to the local airport of ‘Montagne Noire’” (L. Belhacene, *pers. comm.*, V.2003).

The origin of *N. neesiana* in Europe is obscure. According to GARCIA (1946), the species might have been introduced with Argentine cereals. At least (some) French populations might originate from the former local wool importation industry. A large population from southern France (Bédarieux-Nissergues) might have been introduced with railway traffic.

Nassella poeppigiana (Trin. & Rupr.) Barkworth in Taxon 39: 611. 1990.

≡ *Stipa poeppigiana* Trin. & Rupr. in Mém. Acad. Imp. Sci. St.-Petersbourg, Sér. 6, Sci. Math. 5: 29. 1842.

Densely caespitose perennial; culm ca. 90 cm tall, erect, glabrous; leaf sheaths glabrous but with long white hairs along the margin; leaf blades long, plane or more or less folded, glabrous; ligule membranous, inconspicuous, 0.4-0.8 mm. Inflorescence an effuse panicle, often somewhat pendent, up to 30 cm long. Spikelets 1-flowered, disarticulating above the glumes; glumes subequal, the lower slightly longer, (9-)13-14(-17) mm, incl. awn 3-4 mm, purplish with hyaline apex, slightly hairy, the lower 5-nerved, the upper 3-nerved; antheridium cylindrical, ca. 7 mm, diameter 0.8 mm, lemma body slightly tuberculate, more or less glabrous but loosely hairy along the veins, at least some hairs (almost) reaching apex, ca. 7 mm, callus 2.5 mm hidden by tuft of white hairs, corona small, less than 0.5 mm, not constricted at base, continuous with sides of the lemma, awn present, (50-)65(-90) mm, column more or less as long as bristle; palea inconspicuous, hyaline, glabrous, 1.5-2 mm. Caryopsis 4-6 mm.

Origin. – South America (Argentina, Chile, Uruguay).

Iconography. – MATTHEI (1965: Fig. 27); CARO (1966: Fig. 7); VIVANT (1961: Fig. 1, sub “*Stipa setigera*”).

Flowering. – V-VI.

Local distribution. – France (VIVANT, 1961, sub “*Stipa setigera*”; AUQUIER & KERGUÉLEN, 1981).

Specimens examined. – **FRANCE. Dép. Pyrénées-Atlantiques:** Anglet, adventice dans la pinède sublittorale, aux abords de la rive Est du Lac de Chiberta, colonise une allée de 200 m de long et les clairières de la pinède voisine, 3.VI.1959, *J. Jallu* 5329 (LG; distr. by Soc. Ech. n° 3286, sub “*Stipa setigera*”); près de Bayonne, allées sablonneuses autour de l’étang de Chiberta, 10.VII.1972, *J. Vivant s.n.* (BR, GENT, LG; distr. by Soc. Ech. n° 7270, sub “*Stipa neesiana*”); Anglet, bord de route, près du Lac de Chiberta, 19.VII.1975, *H. G. Rabyns* 4640 (BR).

Notes:

Discovered in 1959 by VIVANT (1961), the plant was erroneously identified as “*Stipa setigera* Presl” and was later re-identified as *Stipa poeppigiana* Trin. & Rupr. (AUQUIER & KERGUÉLEN, 1981). Found near Bayonne, it was subsequently confirmed in 1972 and 1975 (cf. herbarium references). The area altered considerably in the last decades (installation of a golf court, tourist infrastructure, etc.) and the populations of *N. poeppigiana* are now included in a private area; their actual status is therefore unclear (J. Vivant, *pers. comm.*, I.2003).

The origin of these populations remains uncertain. The species might have been introduced unintentionally by visitors of the many international high society parties held at that time in the very same area (Chiberta) (J. Vivant, *pers. comm.*, III.2003).

Nassella amethystina (Steud.) Barkworth is usually regarded as a synonym of *N. poeppigiana*. Some recent authors however (for example ZULOAGA & al., 1994) still tend to treat them separately, the former being characterized by shorter glumes (less than 10 mm), a shorter antheridium (3.5-5 mm) and shorter awns (25-48 mm) (CARO, 1966). The populations from SW France clearly belong to *N. poeppigiana* s.str.

Nassella tenuissima (Trin.) Barkworth in Taxon 39: 612. 1990.

≡ *Stipa tenuissima* Trin. in Mém. Acad. Imp. Sci. St.-Petersbourg, Sér. 6, Sci. Math. 2: 36. 1836.

Caespitose perennial; culm up to 70 cm tall, erect, scabrous by minute antrorse prickles, nodes glabrous; leaf sheaths scabrous; leaf blades long, involute, appearing setaceous, <0.5 mm, scabrous; ligule membranous, ca. 0.5-1.5(-4) mm. Inflorescence a more or less contracted panicle, up to 25 cm long. Spikelets 1-flowered, disarticulating above the glumes; glumes 3-nerved, subequal, the lower slightly longer, (5-)7.5-8(-10) mm, incl. awn ca. 3.5 mm, purplish with hyaline apex, glabrous; antheridium lanceolate, (2-)3.5-4 mm, lemma body slightly tuberculate, glabrous, callus

inconspicuous, 0.5 mm, hidden by tuft of white hairs, corona small with some apical cilia, ca. 0.5 mm, awn present, up to 55(-90) mm, column much shorter than the bristle; palea membranous, glabrous, 0.5-1 mm. Caryopsis fusiform, 1.5-2 mm long.

Origin. – South America (Argentina, Chile), further north also in Mexico and USA but doubtfully introduced. Naturalized in Australia (JACOBS & al., 1998).

Iconography. – CARO (1966: Fig. 11); VALDÉS REYNA (1995: 233); VALDÉS REYNA & BARKWORTH (2002: Fig. 3).

Flowering. – V-XII.

Local distribution. – France.

Specimens examined. – **GREAT BRITAIN. Bedfordshire:** Maulden, (v.c. 30), wool adventive, root collected 28.X.1966 (3.VII.1967), *J. E. Lousley 3119* (LG, sub “*Stipa spec.*”); Maulden (v.c. 30), wool adventive, root collected 1966 (09.VII.1967), *J. E. Lousley 3120* (LG, sub “*Stipa spec.*”); Maulden, (v.c. 30), wool adventive, root collected 17.X.1967 (27.VIII.1968), *J. E. Lousley 3257* (LG, sub “*Stipa spec.*”); Maulden, (v.c. 30), wool adventive, root collected 17.X.1967 (6.VII.1968), *J. E. Lousley 3267* (LG, sub “*Stipa spec.*”).

Notes:

Nassella tenuissima, increasingly cultivated for ornament in southern Europe, is recently escaping and several records already exist for France: L’Isle d’Abeau (départ. Isère), Pérols (départ. Hérault) and Rodilhan (départ. Gard) (J. Molina & J.-M. Tison, *pers. comm.*, II.2003). The species is not yet taken into account by WALTERS (1984) who lists five other cultivated taxa of *Stipa* s.l. in Europe. GREENLEE (1992), on the contrary, provides a detailed treatment.

Despite its recent escape, *Nassella tenuissima* already behaves like a potentially aggressive weed, at least in the surroundings of Montpellier (J. Molina & J.-M. Tison, *pers. comm.*, X.2004). The species inhabits more or less ruderalized, rather arid roadverges.

The species is usually taken for the Australian *Stipa tenuifolia* Steud. or the mediterranean *S. tenacissima* L. (and purchased as such) by gardeners (JACOBS & al., 1998; CLEMENT, 2003).

Nassella trichotoma (Nees) Arechav. in Anales Mus. Nac. Montevideo 1: 276., f.19. 1894.

≡ *Stipa trichotoma* Nees, Agrost. Bras.: 375. 1829.

Densely caespitose perennial; culm 30-70 cm tall, erect, scabrous by antrorse prickles; leaf sheaths glabrous; leaf blades long, involute, appearing more or less setaceous, scabrous; ligule membranous, ca. 0.5-1.5 mm. Inflorescence an effuse panicle, often reaching half the culm length, up to 10-25 cm. Spikelets 1-flowered, disarticulating above the glumes; glumes 3-nerved, subequal, the lower slightly longer, 7-8 mm, incl. awn 2-2.5 mm, purplish with hyaline apex, scabrous on the midvein; antheridium gibbous, (1.5-)2(-3) mm, lemma body strongly tuberculate, glabrous, callus inconspicuous, hidden by tuft of white hairs, corona small, ca. 0.5 mm, awn present, eccentric, almost straight, up to 30 mm, column shorter than the bristle; palea inconspicuous, hyaline, glabrous, 0.8-1.4 mm. Caryopsis ovate, 1.2-1.7 mm. The length of the awn of *Nassella trichotoma* reaches, at most, 30 mm (not 30-50 mm as mentioned by MARTINOVSKY, 1980).

Origin. – South America (Argentina, Brazil, Uruguay). Naturalized in Australia (JACOBS & EVERETT, 1993a) and South Africa (GIBBS RUSSELL & al., 1991).

Iconography. – BURKART (1969: Fig. 48); MOGGI (1971: Fig. 2).

Flowering. – V-VI.

Local distribution. – France, incl. Corsica (BOSC, 1981, 1982; SALABERT & GASTESOLEIL, 1994; NATALI & JEANMONOD, 1996; LAMBINON, 1998; BOCK & LÉGER, 1999; VERLOOVE & VAN-

DENBERGHE, 2002); Italy (MOGGI, 1971; VIEGI & CELA RENZONI, 1981; MORALDO, 1986); Portugal, Madeira (HANSEN & SUNDING, 1993); Spain (CARRERAS & al., 1991; apparently overlooked by VÁZQUEZ PARDO & DEVESA, 1996).

Specimens examined. – **FRANCE. Dép. Hérault:** Lodève, VI.1870, *s.coll.* (BR); [cultivé dans mon jardin à Mazières-en-Gâtine, de caryopses récoltés par J. Ayliès à] Cazeviel, prairie au S du village, où cette espèce est naturalisée, 10.VI.1924, *R. de Litardière 3943bis* (P); Vendres, NE de l'étang de Vendres, le long de la RD 64, friche, 16.VI.2002, *F. Verloove 5094* (priv. herb. author, BR). – **Dép. Haute-Corse:** à proximité de l'étang de Biguglia (Bastia), 13.VI.1978, *M. Kerguélien s.n.* (LG); au nord d'Aléria, 18.V.1979, *G. Dutartre s.n.* (LG); environs de Biguglia, prairie au bord du chemin qui longe la voie ferrée, au niveau du pont routier qui relie ce chemin à la N.193, 25.V.1980, *G. Bosc s.n.* (BR, GENT, LG; distr. by Soc. Ech. n° 9989); Furiani, Fornagina (= Fornacina) (plaine littorale au S de Bastia, entre la N 193 et l'extrémité nord de l'étang de Biguglia), bord de la voie ferrée, 29.V.1986, *J. Lambinon 86/96 & J. Deschâtres* (BR, LG); Sisco, route du Bocca di San Giuviani (Col de Saint-Jean) (versant E du Cap Corse), alt. env. 620 m., bord de chemin, dans un maquis, 04.VI.1997, *J. Lambinon 97/163 & G. Van Den Sande* (GENT, LG, priv. herb.; distr. by Soc. Ech. n° 18787).

ITALY. Livorno: Cecina Marina, radure nella pineta, 3-4 m, 20.VI.1984, *B. Moraldo s.n.* (RO n° H.G.92.I.6).

SPAIN. Prov. of Gerona: Serra de Collserola, Collet de l'Espinagosa (UTM 31TDF2584), 265 m, 24.V.1989, *J. Carreras s.n.* (BCN 5711); Serra de Collserola, vora Vallvidrera, prats secs, s.d. (24.V.1989?), *J. Carreras s.n.* (BCN 5712). – **Prov. of Gerona:** Cassà de la Selva, a Sant Vicenç d'Esclet (UTM 31TDG83), en un Thero-Airion, 100 m, 15.V.1990, *X. Viñas & L. Vilar s.n.* (HGI 3712)]

Notes:

Nassella trichotoma doubtlessly was the first species to become naturalized in Europe. It is one of the remnants of the famous adventitious flora related to wool importation in the surroundings of Montpellier, France (THELLUNG, 1912) and was already considered fully naturalized in the beginning of the XXth century ("complètement naturalisé sur les rives de l'Orb"; THELLUNG, 1912). In the very same area (surroundings of Béziers), *N. trichotoma* counts numerous localities at present (cf. SALABERT & GASTESOLEIL, 1994; BOCK & LÉGER, 1999; VERLOOVE & VANDENBERGHE, 2002) and seems to spread slightly (f.i. along road verges and adjacent wastelands in the vicinity of the lake of Vendres (*pers. obs.*, VI.2002). From the riverbanks of the Orb river, *N. trichotoma* apparently disappeared (J.-M. Tison, *pers. comm.*, II.2003).

In Italy too, the species seems to have a rather long tradition and is fully naturalized, at least in Liguria, Toscana and Campania (VIEGI & CELA RENZONI, 1981).

Nassella trichotoma has been found naturalized in various anthropogenic as well as in semi-natural environments: roadverges, more or less ruderalized pastures, wasteland, but also in the margins of coastal pinewoods (as in Italy), maquis (with accompanying genera as *Cistus*, *Erica*, *Genista*, etc. as reported from Corsica), clearing, etc. In Spain, the species penetrates into the *Thero-Brachypodium*-community in which it thrives well: in La Selva, *N. trichotoma* has colonized an area of 4 km², few years after its first appearance (FONT & al., 2000). A phytosociological relevé from an Italian locality has been presented by MOGGI, (1971). *Nassella trichotoma* inhabits well-drained, sandy soils but also more compact, calcareous soils.

Although not yet explicitly cited as such, the species locally seems to behave more and more like an invader in the studied area. ABOUCAYA (1998) already incorporates *N. trichotoma* in a waiting list of potentially invasive xenophytes in mediterranean France.

Generally, *N. trichotoma* is regarded as an introduction from wool. It is one of the worst noxious weeds in Australia (REED, 1977) and a very serious invader in South Africa (GIBBS RUSSELL & al., 1991). The species' entirely disarticulating inflorescence constitutes its main mode of dispersal.

DISCUSSION – CONCLUSION

Now that the exact identity of several non-native members of the genera *Jarava* and *Nassella* in southwestern Europe is elucidated, the ecological consequences of the recent naturalization of these taxa can come into question. Most of the concerned taxa – in fact all but *Jarava ambigua* and *Nassella poeppigiana* – are declared noxious weeds either in their area of origin and/or in their secondary area. Especially *J. brachychaeta*, *J. caudata*, *N. neesiana*, *N. tenuissima* and *N. trichotoma* are worldwide among the most troublesome weeds and their control and eradication are very time-consuming and expensive. They constitute a serious threat for native vegetation.

In southwestern Europe and Macaronesia, all are relatively recent invaders and their exact behaviour, ecological niche and potential distribution require additional research. Up to now, most taxa inhabit disturbed or other man-made habitats and they do not yet generally penetrate into more natural ones (except *N. neesiana* for which invasive behaviour has been reported from the Canary Islands; see above). An expansion can be predicted in a near future taken into account their invasiveness in other parts of the world with similar climatological and geographical circumstances. Early detection of these invaders, followed by their eradication, particularly in valuable and vulnerable habitats, seems to be appropriate. For the time being, *J. caudata* appears to be the most expansive in the concerned area, especially in northeastern Spain where it has become very common locally. Prevention of future introductions of these taxa into Europe is difficult or even impossible; all except *N. tenuissima* have been introduced unintentionally. The introduction as an ornamental of the latter – increasingly mass-planted in numerous cities in the studied area, especially in France – should probably be prohibited.

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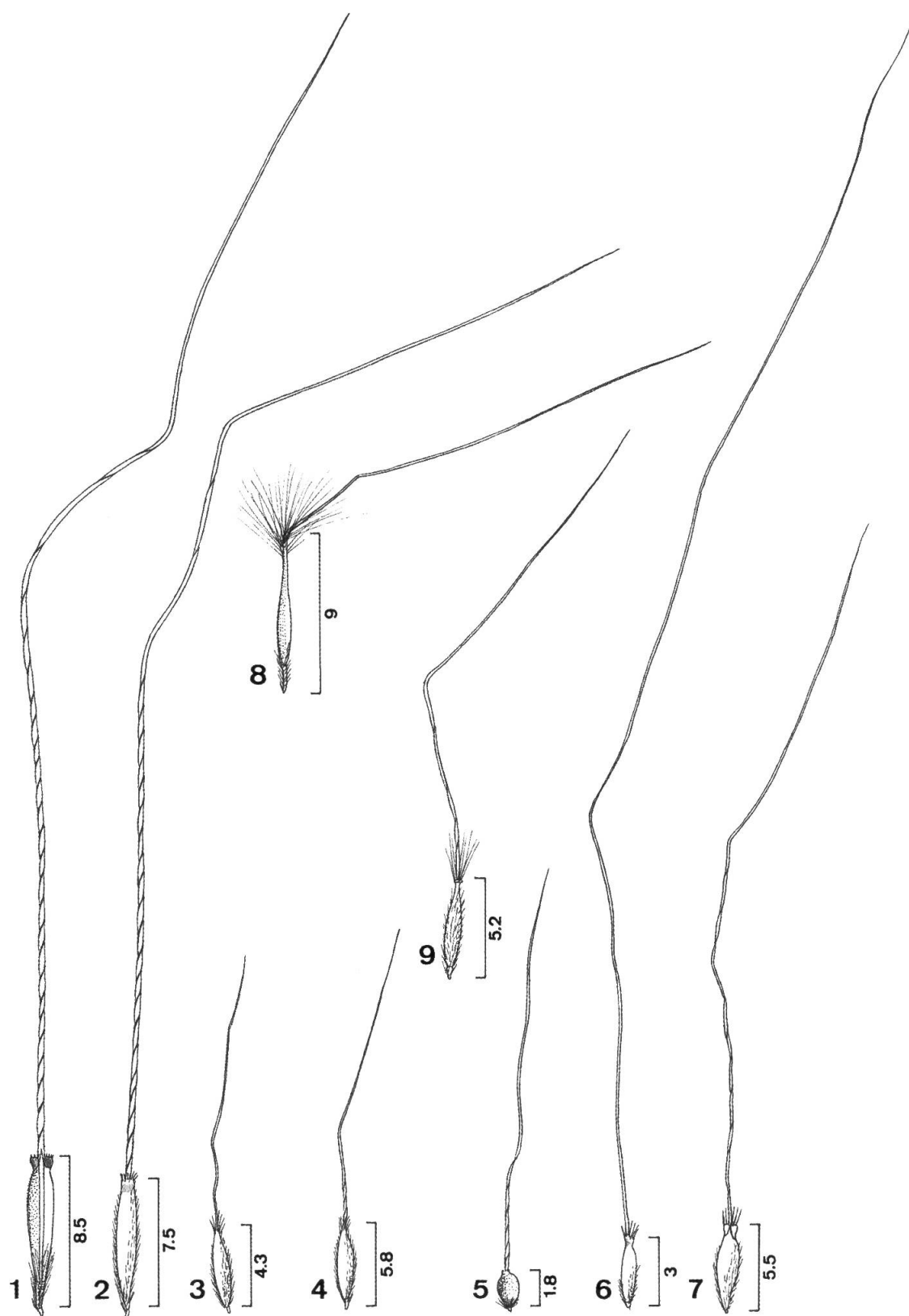


Fig. 1. – Spikelets (glumes removed) of: 1. *Nassella neesiana*. 2. *N. poeppigiana*. 3. *J. brachychaeta*. 4. *J. caudata*. 5. *N. trichotoma*. 6. *N. tenuissima*. 7. *N. mucronata*. 8. *J. plumosa*. 9. *J. ambigua*. [Measurements are in mm]. (Drawn by Robert Portal).

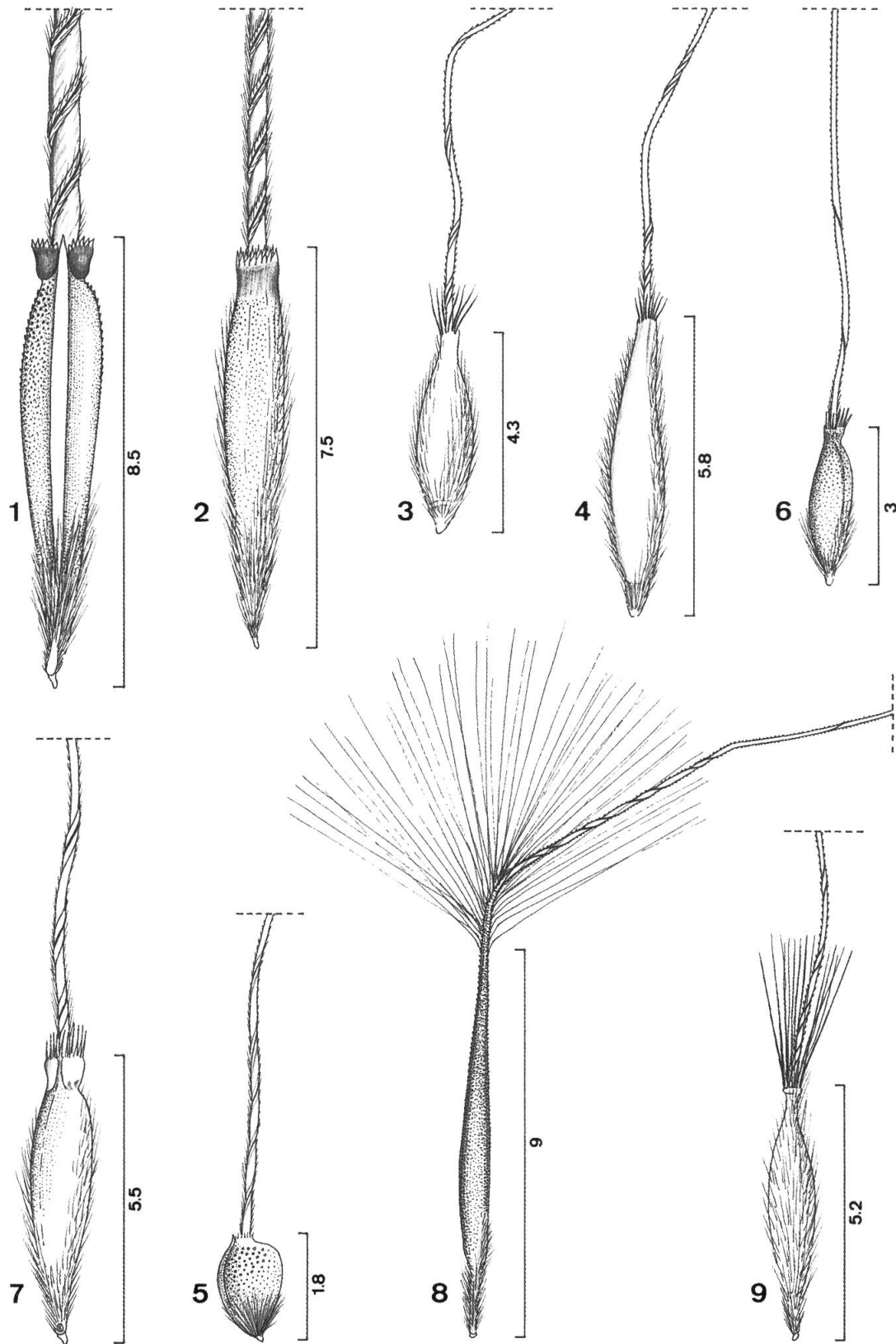


Fig. 2. – Enlargements of spikelets (glumes removed) of: 1. *Nassella neesiana*. 2. *N. poeppigiana*. 3. *J. brachychaeta*. 4. *J. caudata*. 5. *N. trichotoma*. 6. *N. tenuissima*. 7. *N. mucronata*. 8. *J. plumosa*. 9. *J. ambigua*. [Measurements are in mm]. (Drawn by Robert Portal).

