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Validation of associations for the temporary ponds of the class *Isoeto-Nanojuncetea* in Puglia (southern Italy)

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Abstract. This paper presents the validation of 16 new associations, described in a previous contribution, for the temporary ponds of the class *Isoeto-Nanojuncetea* in Puglia (southern Italy).

Keywords: association; ICPN; nomenclature; syntaxonomy; vegetation

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Introduction

Temporary ponds represent one of the extremely specialized and most interesting wet habitats in the Mediterranean bioclimatic region, both for the particular ecology, their rarity and scattered distribution. Plant communities occurring in this environment are rich in ephemeral hydrophytes of exceptional geobotanical value and, for this reason, have always drawn the attention of botanists and especially of phytosociologists (among others: Braun-Blanquet, 1936; Rivas Goday, 1970; Médail *et al*., 1998; Quézel, 1998; Molina, 2005). The extremely patchy and scattered distribution, as well as the complex ecological and floristic characterization, make this vegetation extremely challenging for syntaxonomical classification; over time, numerous syntaxonomic treatments have been proposed, with often contrasting outcomes (among the most recent: Brullo & Minissale, 1998; Rivas-Martinez *et al*., 2002; Deil, 2005; Biondi *et al*., 2014; Mucina *et al*., 2016; Brullo *et al.,* 2022). The *Isoeto-Nanojuncetea* class in Puglia (Southern Italy) has been recently subject of increasing interest by numerous authors, especially for the wide variety of different plant communities occurring in this area and for the presence of rare species (Ernandes *et al*., 2010, 2017; Ernandes & Marchiori, 2012a, 2012b, 2013; Brullo *et al*., 2019; Bartolucci *et al*., 2019).

In a previous contribution, published on the first issue of the online journal *Mediterranean Botany* (41(1), 2020), a survey on the ephemeral hygrophilous vegetation occurring in the temporary ponds of Puglia (southern Italy) has been provided, with the description of 16 new associations (out of a total of 19 associations identified for the study area; Tomaselli *et al*., 2020). The 4th edition of the International Code of Phytosociological Nomenclature (Theurillat *et al*., 2021) recognises as valid the new syntaxa published on electronic journals registered in the ISSN system, but this rule (Art. 1) has taken effect only on 1 January 2021. Thus, a syntaxon name published online before this date is to be considered as a *nomen ineditum*, consequently, the new associations reported in Tomaselli et al. (2020) are to be considered ineffectively published and are here proposed new and validated.

As concerns the floristic nomenclature, we followed Pignatti *et al.* (2017–2019), Troia & Greuter (2014), and Brullo *et al.* (2019); as regards *Solenopsis laurentia* subsp. *caespitosa* and *S. laurentia* subsp. *pusilla*, we refer to Tomaselli *et al*. (2020). For the syntaxonomic classification of the validated syntaxa, as well as complete descriptions and tables, see Tomaselli *et al*. (2020).

Validation of the new associations

Isolepido cernuae-Ranunculetum saniculifolii ass. nova
Holotypus: rel. 1, Table 1

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Ranunculo ophioglossifolii-Callitrichetum brutiae ass. nova
Holotypus: rel. 2, Table 1

Ranunculo ophioglossifolii-Elatinetum alsinastri ass. nova
Holotypus: rel. 3, Table 1

Ranunculo saniculifolii-Elatinetum macropodae ass. nova
Holotypus: rel. 4, Table 1

Pilulario minutae-Isoetetum longissimae ass. nova
Holotypus: rel. 5, Table 1

Coronopodo squamati-Damasonietum polyspermi ass. nova
Holotypus: rel. 6, Table 1

Triglochino laxiflorae-Isoetetum longissimae ass. nova
Holotypus: rel. 7, Table 1

Solenopsio laurentiae-Isoetetum todaroanae ass. nova
Holotypus: rel. 8, Table 1

Solenopsietum caespitosae ass. nova
Holotypus: rel. 9, Table 1

Poo jubatae-Isoetetum histricis ass. nova
Holotypus: rel. 10, Table 1

Radiolo linoidis-Solenopsietum parvulae ass. nova
Holotypus: rel. 11, Table 1

Anagallido parviflorae-Sperguletum arvensis ass. nova
Holotypus: rel. 12, Table 1

Phalarido minoris-Agrostietum pourretii ass. nova
Holotypus: rel. 13, Table 1

Moenchio erectae-Isoetetum siculae ass. nova
Holotypus: rel. 14, Table 1

Chamaemelo mixti-Agrostietum pourretii ass. nova
Holotypus: rel. 15, Table 1

Damasonio alismae-Verbenetum supinae ass. nova
Holotypus: rel. 16, Table 1

Table 1. Holotypus of validated associations; see text for explanations.

Plot size (m^2)	10	10	5	1	1	10	10	2	3	5	1	2	0,5	2	10	5
Total cover (%)	80	100	100	100	100	100	100	100	100	100	70	90	100	100	90	90
Altitude (m)	1	110	115	1	3	66	51	1	101	51	8	110	64	460	2	140
Species N.	12	10	10	11	15	19	12	18	22	24	13	12	12	23	16	16
Relevé N.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Characteristics of associations																
Isolepis cernua	3	.	.	1	1	.	.	1	1	1	1	.	.	.	.	.
Ranunculus ophioglossifolius	.	4	3	.	.	+	.	.	.	.	.	.	.	.	.	.
Elatine alsinastrum	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.
Elatine macropoda	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.
Pilularia minuta	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.
Eleocharis multicaulis	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
Damasonium polyspermum	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.
Coronopus squamatus	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	2
Triglochin laxiflora	.	.	.	.	.	.	2	.	.	.	2	.	.	.	.	.
Isoetes todaroana	.	.	.	.	+	.	.	4	1	.	.	.	.	.	.	.
Solenopsis laurentia subsp. *caespitosa*	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.
Isoetes histrix	.	.	.	.	.	.	.	.	.	4	2	.	.	.	.	.
Isoetes sicula	.	.	.	.	.	.	.	.	.	+	.	.	.	4	.	.
Poa jubata	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
Solenopsis laurentia subsp. *parvula*	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.
Radiola linoides	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.
Spergula arvensis	.	.	.	.	.	.	.	.	.	.	.	3	.	.	+	.
Phalaris minor	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	1
Moenchia erecta	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.
Euphorbia cuneifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.
Chamaemelum mixtum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.
Cornucopiae cucullatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Damasonium alisma	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3
Characteristics of *Preslion cervinae*																
Ranunculus saniculifolius	4	2	.	2	1	+	.	.	.	.	.	.	.	.	.	.
Callitriche brutia	2	5	2	1	2	1	.	.	.	.	.	.	.	.	.	.

Plot size (m^2)	10	10	5	1	1	10	10	2	3	5	1	2	0,5	2	10	5
Total cover (%)	80	100	100	100	100	100	100	100	100	100	70	90	100	100	90	90
Altitude (m)	1	110	115	1	3	66	51	1	101	51	8	110	64	460	2	140
Species N.	12	10	10	11	15	19	12	18	22	24	13	12	12	23	16	16
Relevé N.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Characteristics of *Cicendio-Solenopsion laurentiae*																
Anagallis parviflora	.	.	.	.	.	.	.	.	1	2	2	1	.	1	.	.
Centunculus minimus	.	.	.	.	.	.	.	2	2	2	1	.	.	.	.	.
Solenopsis laurentia subsp. *laurentia*	.	.	.	.	.	.	.	2	1	4	.	.	.	.	.	.
Cicendia filiformis	.	.	.	.	.	.	.	.	.	2	2	.	.	.	.	.
Riccia cf. *crozalsii*	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.
Characteristics of *Agrostion salmanticae*																
Agrostis pourretii	.	.	.	.	.	.	.	.	.	.	.	.	4	2	4	.
Trifolium dubium	.	.	+	.	.	.	.	.	.	+	.	.	3	1	.	.
Characteristics of *Isoetetalia*																
Bulliarda vaillantii	+	.	.	4	+	+	.	.	.	.	.	.	.	+	.	.
Briza minor	.	.	.	.	.	.	.	.	+	+	.	1	+	.	+	.
Lythrum borystenicum	2	.	4	.	.	.	+	.	2	.	.	.	.	.	.	.
Isoetes longissima	.	.	.	.	3	1	4		.	.	.	.	.	.	.	.
Lotus angustissimus	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.
Veronica acinifolia	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.
Archidium phascoides	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.
Ranunculus trilobus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.
Characteristics of *Verbenion supinae*																
Paspalum distichum	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	1
Verbena supina	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3
Characteristics of *Nanocypereitalia*																
Spergularia rubra	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+
Characteristics of *Isoeto-Nanojuncetea*																
Juncus bufonius	1	2	.	1	.	2	1	2	2	+	1	3	.	1	3	+
Lythrum hyssopifolia	1	2	.	2	.	.	2	1	2	1	.	1	.	.	.	1
Ranunculus sardous	.	.	.	.	2	2	1	2	+	2	.	1	3	2	.	.
Mentha pulegium	.	.	2	2	1	2	2	2	.	2	.	.	.	1	.	.
Polypogon subspathaceus	2	.	.	1	.	3	2	3	+	1	.	.	.	.	.	.
Juncus capitatus	.	.	.	.	1	.	.	1	2	+	+	1	.	1	.	.
Juncus pygmaeus	.	3	.	1	2	2	1	.	+	.	.	.	.	.	.	.
Lotus parviflorus	.	.	.	1	+	.	.	2	1	.	.	+	.	1	.	.
Eryngium pusillum	.	.	.	.	1	.	.	.	.	.	.	.	2	.	.	.
Gaudinia fragilis	.	.	.	.	.	.	.	1	.	2	.	.	.	.	.	.
Poa infirma	.	.	.	.	.	2	+	.	.	.	.	.	.	.	.	.
Lythrum tribracteatum	.	.	.	.	.	3	.	.	.	.	.	.	.	.	1	.
Lythrum thymifolia	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Anthoceros dichotomus	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.
Other species																
Alopecurus rendlei	.	2	1	.	.	.	.	.	+	.	.	1	.	.	.	.
Sagina apetala	.	.	.	.	.	1	.	.	.	+	.	.	.	+	.	+
Bellis annua	1	.	.	.	.	.	.	3	.	2	.	.	.	.	.	.
Convolvulus arvensis	.	.	.	.	.	1	.	.	.	.	.	.	1	.	.	+
Glyceria notata	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Rumex sp.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Polygonum aviculare subsp. *aviculare*	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Symphyotrichum squamatum	1	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.

Plot size (m^2)	10	10	5	1	1	10	10	2	3	5	1	2	0,5	2	10	5
Total cover (%)	80	100	100	100	100	100	100	100	100	100	70	90	100	100	90	90
Altitude (m)	1	110	115	1	3	66	51	1	101	51	8	110	64	460	2	140
Species N.	12	10	10	11	15	19	12	18	22	24	13	12	12	23	16	16
Relevé N.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Oenanthe pimpinelloides	.	.	.	.	.	.	2	.	.	2	.	.	.	.	.	.
Trifolium resupinatum	.	.	.	.	.	.	.	2	.	.	.	.	2	.	.	.
Serapias lingua	.	.	.	.	.	.	.	.	.	+	.	.	.	1	.	.
Silene gallica	.	.	.	.	.	.	.	.	.	.	.	1	.	.	+	.
Carex divisa subsp. *chaetophylla*	.	.	.	.	.	.	.	.	.	.	.	.	2	1	.	.
Cynodon dactylon	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	3

Other species: *Lythrum junceum* 1 in 2; *Alisma plantago-aquatica* + in 3; *Arabidopsis thaliana* and *Epilobium sp.* +in 6; *Alopecurus myosuroides* 2 in 7; *Triglochin barrelieri* 2, *Plantago lagopus* 2, *Linum bienne* and *Plantago coronopus* 1, in 8; *Carex flacca* subsp. *serrulata* and *Romulea ramiflora* + in 10; *Romulea sp.* and *Euphorbia exigua* 1, *Moenchia cf. mantica* 2, in 11; *Raphanus raphanistrum* +, *Rumex bucephalophorus* 1, in 12; *Rumex pulcher* 1, *Eleocharis multicaulis* 2 in 13; *Sherardia arvensis*, *Cerastium glomeratum* and *Vulpia geniculata* +, *Cerastium semidecandrum*, *Oenanthe lachenalii* and *Prospero autumnale* 1, *Anthoxantum odoratum* and *Poa trivialis* 2, in 14; *Anagallis arvensis*, *Rumex acetosella*, *Lolium rigidum* and *Polygonum aviculare* subsp. *aviculare* +, *Rumex crispus* 1 in 15; *Verbena officinalis* +, *Lotus ornithopodioides* and *Arenaria leptoclados* 1, *Rumex conglomeratus* 2 in 16.

Original localities: 1: La Strea, Porto Cesareo, Lecce (Tomaselli et al. 2020, tab. 2, rel. 3); 2: Foresta district, Cutrofiano, Lecce (Tomaselli et al. 2020, tab. 2, rel. 8); 3: Cutrofiano marsh, Zello district, Lecce (Tomaselli et al. 2020, tab. 3, rel. 2); 4: "La Strea", Porto Cesareo, Lecce (Tomaselli et al. 2020, tab. 3, rel. 16); 5: "Palude del Capitano", Masseria Bellimento, Nardò, Lecce (Tomaselli et al. 2020, tab. 4, rel. 3); 6: "Iacorizzo", Salice Salentino, Lecce (Tomaselli et al. 2020, tab. 4 rel. 7); 7: cork oak woods of Bosco Preti, Brindisi (Tomaselli et al. 2020, tab. 4, rel. 17); 8: "La Strea", Porto Cesareo, Lecce (Tomaselli et al. 2020, tab. 5, rel. 16); 9: "Padula Mancina", Montesano Salentino, Lecce (Tomaselli et al. 2020, tab. 6, rel. 8); 10: cork oak woods of Bosco Preti, Brindisi (Tomaselli et al. 2020, tab. 6, rel. 12); 11: rocky coast near Posticeddu, Brindisi (Tomaselli et al. 2020, tab. 7, rel. 1); 12: Foresta district, Cutrofiano, Lecce (Tomaselli et al. 2020, tab. 7, rel. 9); 13: Capraro Lake, Soleto/Sternatia, Lecce (Tomaselli et al. 2020, tab. 8, rel. 8); 14: Difesa Grande wood, Splendore Lake, Gravina di Puglia, Bari (Tomaselli et al. 2020, tab. 9, rel. 4); 15: Punta della Contessa saltworks, Brindisi (Tomaselli et al. 2020, tab 9., rel. 10); 16: Iavorra Lake, Conversano, Bari (Tomaselli et al. 2020, tab. 10, rel. 2).

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