A Check List of Weeds in Rice Fields of Coastal Orissa, India

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Abstract

A survey was undertaken to different rice ecologies to collect, identify and conserve the weed species as herbarium specimens in coastal districts of Orissa. In this programme, 201 angiosperm taxa and 3 pteridophytes under 146 genera belonging to 56 families were collected, identified and documented. Poaceae was the dominant family followed by Fabaceae and Cyperaceae. Families are arranged according to modified Bentham and Hooker’s system of classification in the enumeration. Genus and species were arranged alphabetically under each family and genus. The number of weed species was more in upland followed by irrigated, semi deep water and deep water. Conservation strategies are also highlighted in this paper.

Keywords: exploration, weeds rice fields, Orissa, conservation

1. Introduction

Rice is widely grown cereal crop that feeds millions of people in world (Kumar et al., 2008). It is the most important cereal crop cultivated in wide range of habitat under varying temperature and water regime. Rice fields are one of the large and extensive fresh water ecosystem on earth. The total rice areas is about 44.6 Mha in India. These act as a ideal habitat for numerous species of aquatic, amphibious and terrestrial weeds that compete with rice crop for space and nutrients. With the dominance of rice crop, grasses, sedges and broad leaves plants are referred as weeds. Biodiversity is the key component for sustainable environment. Currently rice fields are under serious threat owing to rapid increase in human population and urbanization. This phenomenon sets the biodiversity of rice fields at stake making it necessary to take immediate step for conservation. Application of agrochemical and inorganic fertilizer is the major concern for biodiversity loss. Rice fields are the transitional ecosystem that acts as both aquatic for one part of the year and terrestrial the rest. This unique ecosystem acts as potential habitat for numerous species of biota that have adapted to the highly disturbed environment. In Orissa most of the rice fields are rainfed which means it depends on rainwater only.

During rainy season, the rice fields are full of rain water but in Rabi season the fields are completely dry, so the floral succession differs in both the season due to different water regime. Most of the aquatic plants did not appear during dry season. Rice fields are colonized by terrestrial, semiaquatic and aquatic species (Moody & Drost, 1983). Moody (1989) reported 2049 species of weeds from 15 south-east Asian countries. Till now, no systematic survey of weed species was made in Orissa in particular and eastern India in general except some sporadic reports. For effective weed management practice, study of weed phenology and their biology is highly essential. Some sporadic reports regarding the occurrence of weeds in Orissa were made by Patnaik (1956), Tripathy and Mishra (1988), Maiti et al. (1983). Mishra and Choudhury (1996) made extensive survey of aquatic plants in different areas of Bhubaneswar in Orissa state. Subudhi et al. (2002) and Subudhi and Choudhury (2000) reported deep water weed flora and floristic diversity of weeds in Cuttack district of Orissa. Besides these, Bahar and Bhat (2012) reported rice weeds of Kashmir. Pragada and Malliboyana (2010, 2012) and Singh and Rao (1973) reported the phytosociological study rice weeds of Andhra Pradesh respectively. Realizing these, extensive survey were undertaken in seven districts of coastal Orissa in different seasons. A total 201 Angiosperm taxa and three pteridophytes were collected identified and housed in as herbarium specimen in P. G. Department of Botany,
2. Material and Methods

Field trips were undertaken regularly to different rice growing areas during Kharif and Rabi season. Weeds in upland are different from irrigated and lowlands. In irrigated, usually marshy plant are met with. In lowlands, aquatic and submerged plants are commonly grown, in bunds, terrestrial plant are grown. The plant samples were collected with flowering and kept inside polythene bag. The detailed information regarding associate, ecology, other field characters are recorded in note book. After collection, the specimens were dried, poisoned and fixed in herbarium sheets (Jain & Rao, 1977). The samples are identified in consultation with regional and modern flora. Information regarding utility were collected from local people. Some unidentified specimen were confirmed after matching with the herbarium at Central National Herbarium, Calcutta and regional herbarium at Regional Research Laboratory, Bhubaneswar. Correct name was given to each plant in consultation with the flora of British India (Bentham & Hooker, 1882-1883; Saxena & Brahmam, 1994; Haines, 1921-1925) and modern floras.

2.1 Study Area

Orissa is one of the coastal district lies in coast of Bay of Bengal. It is situated in 17°49’ to 22°34’ N latitudes and 81°27’ to 87°29’ E longitudes. The coastal districts are Cuttack, Puri, Bhadrak, Balasore, Kendrapara, Jagatsinghpur and Khurda etc. (Figure 2). These districts are having maximum rainfed areas. High rainfall occurs due to south west monsoons during the month of July and August (Figure 3).
2.2 Climate

Rice is the main crop in Orissa. It is grown in two seasons i.e. Kharif (June-December) and Rabi (January-May). South west monsoon is the principal source of rain contributing 80% of rainfall during kharif season. Kharif crop starts with onset of monsoon i.e. on June, the diversity of weeds is very rich in this season due high rainfall. During Rabi season, diversity is less due to less water. The average annual rainfall in Orissa is 1350.6 mm. Maximum rainfall occurs in the month of July-October. The temperature varies from 15-44 °C. December is the coldest month and May is the hottest month of the year.

2.3 Cultural Practices

In Orissa, most of the lands are rainfed because there is no irrigation facility and direct seeded in rainfed areas is the usually practice of the farmers. It is also economical and better suited for lowlands. After summer plough, in the month May/June, fields are broadcasted. Germination occurs after onset South west monsoon along with weeds. In July, there is heavy rainfall, which encourages the growth of weed species of different category much quicker than rice. After one month of germination, beusaning followed by laddering are the usually practices in Orissa which destroyed most of weed species. Water remains in fields up to October in lowlands, most of the hydrophytes grow in lowland as weeds, it remains up to December, there after, weed species dies. During Rabi season, other weed species appear and diversity is very less due to non availability of water. In irrigated field, the species richness is low but some dominant species occur very luxuriantly.

3. Results and Discussion

During exploration, 201 numbers of species under 145 genera belonging to 56 families were collected, identified and documented. The weed species are categorized 1) upland, 2) irrigated, 3) lowland, 4) saline ecology. The species are different from ecology to ecology. The number of weed species are more in upland (65) followed by irrigated (61), semi deep water (54) and deep water (21) (Figure 4). It is interesting to note that upland weeds can not be available in lowland/irrigated conditions. Upland weeds are having xeric adaptation due less water and flowers in August and September, whereas lowland weeds are hydrophytic adaption. These plants flower in October-December, the vegetative growth starts with onset of rainfall.
During the present survey programme a total of 201 Angiosperm species under 146 genera belonging to 56 families along with three pteridophytes. Out of 201 species, 123 species of dicots are distributed under 88 genera belonging to 40 families, while 78 monocot species spread over 57 genera under 16 families. It is interesting to note that out of 78 species of monocots 48 species are sedges and grasses, which constitute 64.97% of the total monocots. The approximate ratio of monocot and dicots species is 1:2.8. So it indicates that dicots are represented by nearly about three times than the monocots, which is represented in the Table 1. Out of 56 families, 20 families are represented by single species. Poaceae is the first dominant family where as it is in the 2nd and 3rd position in the flora of Bihar and Orissa and flora of British India respectively (Figure 5). On the other hand, Fabaceae and Cyperaceae are the 2nd and 3rd largest family respectively.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Families</th>
<th>No.</th>
<th>%</th>
<th>Genera</th>
<th>No.</th>
<th>%</th>
<th>Species</th>
<th>No.</th>
<th>%</th>
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</thead>
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<td>Dicotyledones</td>
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<td>78.76</td>
<td>88</td>
<td>75.52</td>
<td>123</td>
<td>73.73</td>
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<td>Monocotyledones</td>
<td>16</td>
<td>21.24</td>
<td>57</td>
<td>24.47</td>
<td>78</td>
<td>26.26</td>
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</tbody>
</table>

Due to population growth, operation of biotic factors like conversion of agriculture land to residential complexes, application chemical, pesticide and inorganic fertilizer, the biodiversity both flora and fauna in rice fields are declining at alarming rate. Again many weed species are having potential value for food, medicine and check soil
erison (Oudhia, 2001). So awareness should be given to the farmers/common people to conserve the species in general and weeds in particular for future use. There are four rice ecologies namely upland, irrigated, semideep water and deep water.

3.1 Upland Weeds

Rice fields, where there is no standing water are called as Uplands. The plant species in uplands are having some xeric adaptation and tolerance for drought. The species germinate immediately after rain in the month of mid June. Weeds remain in the field up to October/ till maturity. The weed diversity is very high in this ecology. The common species are Cleome viscosa, Cleome monophylla, Argemone mexicana, Spermacoce articulatus, Spermacoce pusilla, Allmania nudiflora, Celosia argentea, Aerva lanata, Sebastiana chaemelia, Scoparia dulcis. The common sedges are Bulbostylis barbata, Cyperus rotundus, Fimbristylis dichotoma, Fiurena ciliaris, etc. Similarly The grasses are Chloris barbata, Chrysopogon acicularus, Cynodon dactylon, Daucyluctenium aegyptium, Dicanthus pertusus, Digitaria ciliaris, Eragrostis ciliaris, Imperata cylindrical, Oplisenmus compositus, Chrysopogon acicularus, Perotis indica.

3.2 Irrigated Ecology

Water is irriged at regular interval to the field, so that there is no water stress to the plant. Sometimes the field is irrigated with regular water, so that there is no water stress to the plant. The diversity of species is very less. The common species in this ecology are Portulaca oleracea, Bergia ammaniodes, Crotalaria prostrata, Desmodium triflorum, Rotala indica, Glinus oppositifolia, Dentella repens, Grangea maderaspataana, Bacopa monnieri, Oxalis corniculata, Marsilla minuta, Zornia gibbosa, Centella asiatica, Gnaphalium polyacaulon, Mecadonia dianthera, Lindernia crustacea, Hygrophila polysperma, Commelina benghalensis. The grasses are Elusine indica, Elytrphorus spicatus, Leptochloa chinensis, Panicum repens, Paspalidum flavidum, Setaria intermedia, Echinochoa crus-galli, Echinochoa colona, etc.

3.3 Semi-Deep Water Ecology

In this ecology, the standing water remain up to 50 cm throughout the crop season. So only aquatic/semiaquatic plants occur in this ecology. In this ecology, the paddy seeds were broadcasted before onset of monsoon, so after rain, weed seeds germinate quickly and grows faster than rice plants. But the diversity of species is very less. The common species in this ecology are Bergia capensis, Oxalis corniculata, Hydroceras triflora, Aeschnomene aspera, Aeshynomene indica, Sesbania bispinosa, Myriophyllum tetrandrum, Ludwigia adscendens, Trapa bispinosa, Enydra fluctuans, Sphionoclea zeylanica, Ipomoea aquatica, Hydroelea zeylanica, Limnophila aquatica, Limnophila heterophylla, Polygononum hydropiper, Alternanthera philoxeride, Alternanthera sessilis, Otellia alismoides, Monochoria hastata, Typha elephantiana, Typha angustata, Limnophyton trifolia, Limnophyton obtusifolia, Potamogonetum pectinatus, Potamogonetum nodosus. The sedges and grasses are Schoenoplectus articulatus, Cyperus iria, Cyperus platiclalis, Cyperus corymosus, Echinochoa crusgalli, Echinochoa stagnina, Leersia hexandra, Panicum paludosum, Sacciolepis indica, Eriochloa procer, Oryza rufipogon, etc.

3.4 Deep Water Ecology

In deep water ecology, standing water remains above 50 cm throughout the crop season. After the field was dried, boro rice crop was grown. The species diversity was still less than semi deepwater. The floating plant and emergent types were met with in this ecology. The common species are Nymphaea nouchali, Nymphaea stellata, Nelumbo nucifera, Neptunia oleacea, Nymphoides indica, Nymphoides hydrophylla, Utricularia stellaris, Byrxa echinosperma, Ceratophyllum demersum, Nechamandra alternifolia, Vallisnaria spiralis. Pistia striatotes, Spirocula polyrrhiza, Woffia globosa, Azolla pinnata, Oryza rufipogon, Eichhornia crassipes, Leersia hexandra, Utricularia inflexavari stellaris.

4. Conservation

Every plant has theraptical value so weeds are not exception. Weeds have many utilitarian values such as medicinal, food, fodder, ritual purpose and soil conservation, etc. The species viz., Enydra fluctuans, Hydroelea zeylanica, Monochoria vaginalis, Limnophila indica, Nelumbo nucifera, Neptunia oleacea, Nymphaea nouchali, Pistia striatotes, Trapa natans var. bispinosa, etc. are having medicinal properties for different diseases. Oudhia (2001) reported many medicinal weeds from Chhatishgarh. The species such as Alternanthera sessilis, Centella asiatica, Commelina benghalensis, Ipomoea aquatic, Portulaca oleacea, Mollugo pentaphylla and Marsilla minuta, etc. are used as leafy vegetable but the rhizome of Nelumbo nucifera, Trapa bispinosa var. bispinosa, etc. are used as food. The grasses like Panicum repens, Cynodon dactylon, Paspalum flavidum, Digitaria ciliaris, Eriochloa procer, Chloris barbata, etc. are used as fodder. Azolla pinnata is very good fodder for cattle. Similarly Woffia globosa is used as feed of duck and fishes. The species like Cynodon dactylon is used in every
ritual of local people. Rice ecologies have been destroyed due to habitat destruction, construction of houses and conversion of rice field for other purposes so the flora in general and economic plants in particular are on the verge of extinction. It is high time to conserve all the useful weed species as species cafeteria/weed garden so that awareness will be developed among the common people about the utilitarian value of weed species.

References


Appendix

Appendix 1. Enumeration

**Nymphaeaceae**
*Nymphaea nouchali* Burm.f.
*Nymphaea pubescens* Willd.

**Nelumbonaceae**
*Nelumbo nucifera* Gaertn.

**Papaveraceae**
*Argemone mexicana* L.

**Capparaceae**
*Cleome gynandra* L.
*Cleome monophylla* L.
*Cleome rutidosperma* Roxb.
*Cleome viscosa* L.

**Violaceae**
*Hybanthus enneaspermus* (L.) Muell.

**Polygalaceae**
*Polygalac arvensis* Willd.
*Polycarpaea corymbosa* (L.) Lamk.
*Polycarpon prostratum* (Forsk.) Asch. & Sch.

**Portulacaceae**
*Portulaca oleracea* L.
*Portulaca quadrifida* L.

**Elatinaceae**
*Bergia ammannioides* Roxb.
*Bergia capensis* L.

**Hypericaceae**
*Hypericum jopinicum* Thunb. exMurry

**Sterculiaceae**
*Melochia corchorifolia* L.

**Zygophyllaceae**
*Tribulus terrestris* L.

**Oxalidaceae**
*Biophytum sensitivum* (L.) DC.
*Oxalis corniculata* L.

**Balsaminaceae**
*Hydrocera triflora* (L.) Wt. &Arn.

**Fabaceae**
*Aeschynomene indica* L.
*Aeschynomene aspera* L.
*Aeschynomene americana*
*Alysicarpus monilifer* (L.) DC.

**Alysicarpus vaginalis** (L.) DC.
*Crotalaria prostrata* Rottl. exWilld.
*Crotalaria quinquefolia* L.
*Desmodium triflorum* (L.) DC.
*Indigofera linnaei* Ali
*Indigofera glabra* L.
*Melilotus indica* (L.) All
*Sesbania bispinosa* (Jacq.) Wt.&Arn.
*Smithia conferta* Smith
*Smithia sensitiva* Ait.
*Vigna trilobata* (L.) Verd.
*Vigna sublobata* Ravi
*Zornia gibbosa* Span.

**Caesalpiniaaceae**
*Cassia mimosoides* L.
*Cassia pumila* Lam.

**Mimosaceae**
*Mimosa pudica* L.
*Neptunia oleracea* Lour.

**Droseraceae**
*Drosera burmani* Vahl
*Drosera indica* L.

**Haloragaceae**
*Myriophyllum tetrandrum* Roxb.

**Lythraceae**
*Ammannia baccifera* L.
*Ammannia multiflora* Roxb.
*Rotala indica* (Willd.) Koehne

**Onagraceae**
*Ludwigia adscendens* (L.) H. Hara
*Ludwigia perennis* L.

**Trapaceae**
*Trapa natans* L. var. *bispinosa* (Roxb.) Makino

**Aizoaceae**
*Glinus lotoides* L.
*Glinus oppositifolius* (L.) DC.
*Mollugo pentaphylla* L.

**Apiaceae**
*Centella asiatica* (L.) Urb.

**Rubiaceae**
Dentella repens (L.) Forst. et Forst.
Hedyotis brachiata Wt. & Arn.
Hedyotis corymbosa (L.) Lamk.
Spermacoce articulata L.f.
Spermacoce pusilla Wall.

*Asteraceae*
Ageratum coryzoides L.
Blumea membranacea DC.
Eclipta prostrata (L.) L.
Emilia sonchifolia (L.) DC. ex Wt.
Enydra fluctuans Lour.
Gnaphalium polycaulon Pers.
Grangea maderaspatana (L.) Lour.
Mikania cordata (Burm.f.) Robinson
Sparaeanthus indicus L.
Tridax procumbens L.
Vernonia cinerea (L.) Less.

*Sphenocleaceae*
Sphenoclea zeylanica Gaertn.

*Gentianaceae*
Canscora decussata (Roxb.) Sch. & Sch.
Canscora diffusa (Vahl) R. Br.
Hoppea dichotoma Willd.

*Menyanthaceae*
Nymphoides hydrophylla (Lour.) Kuntze
Nymphoides indicum (L.) Kuntze

*Hydrophyllaceae*
Hydrolea zeylanica (L.) Vahl.

*Boraginaceae*
Coldenia procumbens L.
Heliotropium indicum L.
Heliotropium strigosum Willd.

*Convolvulaceae*
Ipomoea aquatic Forssk.
Ipomoea cymosa (Desr.) Roem. & Sch.
Merremia tridentata (L.) Hall. f.

*Solanaceae*
Solanum surattense Burm. f.

*Scrophulariaceae*
Bacopa monnieri (L.) Pennell.
Centranthera tranqueterica (Sperigl.) Merr

*Dopatrium junceum* (Roxb.) Buch-Ham. ex Benth.

*Limnophila aquatica* (Roxb.) Alston
Limnophila heterophylla (Roxb.) Benth.
Limnophila indica (L.) Druce
Lindernia anagallis (Burm.f.) Pennel
Lindernia crustacea (L.) Muell.
Lindernia viscosa (Horn) Bold
Mecardonia procumbens (Mills.) Small
Scoparia dulcis L.

*Lentibulariaceae*
Utricularia inflexa Forssk. var. stellaris (L.f.) P. Taylor

*Acanthaceae*
Hygrophila auriculata (Schum.) Haine
Hygrophila polysperma (Roxb.) Anders.

*Justicia betonica* L.
Justicia diffusa Willd.
Lippia geminata Roxb.
Rungia pectinata (L.) Nees
Rungia repens (L.) Nees
Phyla nudiflora (L.) Rich

*Nyctaginaceae*
Boerhavia diffusa L.

*Amaranthaceae*
Achyranthes aspera L.
Aerva lanata (L.) Juss ex Sch.
Alternanthera philoxeroides (Mart) Griseb.
Alternanthera sessilis (L.) R. Br. ex DC.

*Celosia argentea* L.
Gomphrena celosoides L.

*Polygonaceae*
Polygonum hydropiper L.
Polygonum plebeium R. Br.

*Euphorbiaceae*
Crozophora rottleri (Geisel) Juss
Croton bonplandianum Baill
Euphorbia hirta L.
Euphorbia rosea Retz.
Phyllanthus urinaria L.

*Sebastiania chaemaelea* (L.) Muell.

*Urticaceae*
Pilea microphylla (L.) Liebr
Pouzolzia indica (L.) Benn
Ceratophyllaceae
Ceratophyllum demersum L.

**Hydrocharitaceae**
- *Blyxa echinosperma* (Clarke) Hook.f.
- *Hydrilla verticillata* (L.f.) Royle
- *Nechamandra alternifolia* (Roxb.) Thw.
- *Ottelia alismoides* (L.) Pers.
- *Vallisneria natans* (Lour.) H. Hara

**Orchidaceae**
- *Spiranthes sinensis* (Pers.) Ames
- *Zeuxine strateumatica* (L.) Schltr.

**Amaryllidaceae**
- *Crinum defixum* Ker-Gawl.
- *Crinum latifolium* L.
- *Curculigo orchioides* Gaertn.

**Pontederiaceae**
- *Eichhornia crassipes* (Mart.) Solm-Laub.
- *Monochoria hastata* (L.) Solm.
- *Monochoria vaginalis* (Burm.f.) Presl. ex Kunth.

**Xyridaceae**
- *Xyris indica* L.

**Commelinaceae**
- *Commelina benghalensis* L.
- *Murdannia nudiflora* (L.) Brenan
- *Amiscophacelus axillaris* Rao & Kamathy

**Typhaceae**
- *Typha angustata* Bory&Au.B.
- *Typha elephantiana* Roxb.

**Araceae**
- *Pistia stratiotes* L.

**Lemnaceae**
- *Spirodela polyrrhiza* (L.) Schleid.
- *Wolfia globosa* (Roxb.) Hartog& Vander Plas

**Alismataceae**
- *Limnohyton obtusifolium* (L.) Miq.
- *Sagittaria guayanensis* HBK
- *Sagittaria trifolia* L.

**Najadaceae**
- *Najas faveolata* A. Br. ex Magam.

**Aponogetonaceae**
- *Potamogeton nodosus* Poir.
- *Potamogeton pectinatus* L.

**Eriocaulaceae**

**Cyperaceae**
- *Bulbostylis barbata* (Roxb.) Kunth
- *Cyperus castaneus* Wild.
- *Cyperus cephalotes* Vahl
- *Cyperus compressus* L.
- *Cyperus difformis* L.
- *Cyperus esculentus* L.
- *Cyperus iria* L.
- *Cyperus playstyla* R. Br.
- *Cyperus rotundus* L.
- *Eleocharis acutangula* (Roxb.) Schutt.
- *Eleocharis dulcis* (Burp.f.) Henschel
- *Fimbrystylis dichotoma* (L.) Vahl
- *Fimbrystylis ovata* (Burp.f.) Kern
- *Fimbrystylis schoenoides* (Rzet.) Vahl
- *Fuirena ciliaris* (L.) Roxb.
- *Schoenoplectus articulatus* (L.) Palla

**Poaceae**
- *Brachiaria ramosa* (L.) Stapf.
- *Brachiaria reptans* (L.) Gardet&Hubb
- *Chloris barbata* Sw.
- *Chrysopogon aciculatus* (Rzet.) Trin
- *Cynodon dactylon* (L.) Pers.
- *Dactyloctenium egyptium* (L.) Beauv.
- *Dicanthium pertusum* (L.) Clayt
- *Digitaria ciliaris* (Rzet.) Koel
- *Echinochloa colonum* (L.) Link
- *Echinochloa crusgalli* (L.) Beauv.
- *Echinochloa stagnina* (Rzet.) Beav.
- *Eleusine indica* (L.) Gaertn.
- *Elytrochrophus spicatus* (Willd.) A. Camus
- *Eragrostis ciliaris* (L.) R. Br.
- *Eragrostis japonica* (Thunb.) Trin.
- *Eriochloa procera* (Rzet.) Hubb
- *Imperata cylindrica* (L.) H. Beav.
- *Isachne globosa* (Thunb.) Kuntze
- *Leersia hexandra* Sw.
- *Leptochloa chinensis* (L.) Nees
- *Opilismenus compositus* (L.) Beav.
- *Oryza rufipogon* Griff.
- *Oryza nivara* Sharma etShastry
Panicum paludosum Roxb.
Panicum repens L.
Paspalidium flavidum (Retz.) A. Camus
Perotis indica (L.) Kuntze
Rottboellia cochinensis (Lour.) Clayton
Sacciolepis indica (L.) A. Chase
Setaria intermedia (Roth) Roem & Sch.
Sporobolus indicus (L.) R. Br.
Vetiveria zizanioides (L.) Nash

Azollaceae
Azolla pinnata R. Br.

Parkeriaceae
Ceratopteris thalictroides (L.) Brongn

Marsiliaceae
Marsilia minuta L.

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