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Evaluation of morpho-agronomic variability of wild and cultivated kola (*Cola* species Schott et Endl.) in South Western Nigeria

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Abstract

As part of a breeding programme, exploration and systematic selection exercise of kola (*Cola* spp.) was carried out in Nigeria from the large number of kola populations in the country based mainly on yield and various nut characteristics. The exercise gave rise to a collection of many accessions of the genus including five wild species that are currently being maintained in field genebanks of Cocoa Research Institute of Nigeria (CRIN), Gambari experimental station, Idi-Ayunre, Ibadan. In order to fully exploit the variability in these plants for genetic improvement, the plants were characterized and their morphological variability described. A list of descriptors, developed by International Plant Genetic Resources Institute (IPGRI) for Avocado, with modifications was employed recording 60 descriptors consisting of 33 qualitative and 27 quantitative characters. The characterization data revealed enormous morphological variability among the plants studied and have strong bearing on the taxonomy of the groups. The result also confirmed that the wild species of *Cola* form a special group with enormous agronomic traits that are yet to be exploited in kola breeding. Wild species identified with high nut and pod numbers, thick indehiscent pods and fruit size uniformity is recommended for use in interspecific hybridization programme.

Introduction

The genus *Cola* Schott et Endl. belongs to the family *Sterculiaceae* and is one of the economically important genera of this family. According to Bodard (1962) the genus comprises of about 90 species of which 50 have been described in West Africa. Two of these species, *Cola nitida* (Vent.) Schott et Endl. and *Cola acuminata* (Pal. de Beauv.) Schott et Endl. are of major economic importance in Nigeria. Both species bear a striking resemblance to each other and are cultivated for their edible seeds (Kolanuts). The nuts are consumed in large quantity in the Sudan savannah areas of West Africa because of its stimulating and sustaining properties. The nuts when chewed dispel sleep, thirst, hunger and fatigue and therefore serve as a substitute for coffee drinking. On account of its sleep suppressing effect, kolanut chewing is now very popular among students in West Africa. Labourers and drivers on long distance journeys also frequently chew it.

In Nigeria and Cameroon, two other wild *Cola* relatives (*C. verticillata* (Thorn.) Stapf ex A. Chev. and *C. anomala* K. Schum.) are also cultivated on smaller scale for their edible seeds. The seeds of *C. verticillata* is however slightly slimy and are chewed only when the main edible species (*C. nitida and C. acuminata*) are scarce. Other species that have economic uses but which are not cultivated include *C. gigantea* A. Chev., *C. millenii* K. Schum., *C. laurifolia* Mast., *C. ballayi* Cornu ex Heck. (occasionally planted [see Hanelt and 1PK, Mansfeld's Encyclopedia 3 (2001) 1589]), *C. lateritia* K. Schum. and *C. pachycarpa* Schum. These species occur in the wild throughout the rain forest and southern Guinea savannah belt of Nigeria. Unfortunately, like most indigenous forest trees of African origin, virtually nothing is known about the wild relatives of the cultivated *Cola* species especially their potential for domestication and use for genetic improvement. Existing trees occur either as emergent relics left standing when others were cut down during land clearing, or as natural regenerants protected by the landowner.

At the Cocoa Research Institute of Nigeria (CRIN), efforts have been going on since the 1960's to establish a wide genetic base for the genus *Cola* as part of a breeding programme. Consequently, exploration and systematic selection exercise was carried out from the large number of kola populations in the country based mainly on yield and various nut characteristics. Emphasis was later placed on obtaining accessions from a wide variety of locations and sources including wild species so as to understand the variability as well as their potential for use in breeding programmes. The exercise gave rise to a collection of many accessions of the genus including five wild species that are currently being maintained in our various field genebanks. Studies on these materials have been focused mainly on the two cultivated species (Morakinyo 1978; Morakinyo and Olorode 1984; Adebola 2000) with little attention on the wild relatives.

Several workers have emphasized the importance of wild species as a source of useful traits for plant improvement. Consequently, there has been considerable interest in the studies of such species. While numerous crossability barriers prevent successful gene transfer from wild species into cultivars, many of these barriers have been overcome (Khush and Brar 1988) and successful transfer of alien genes into many of the cultivated crops achieved. This is a constant objective of plant breeding and is pursued through several techniques. However, before this notable goal is achieved, basic information on existing morphological variability in the cultivated species and their wild relatives is very essential. Despite the routine use of molecular markers in recent years, morphological descriptor in genetic diversity is still worthwhile and necessary when exploring the possibility of choosing materials to be incorporated into breeding programmes (Sounigo et al. 1997) and it is a preliminary requirement for the exploitation of useful traits in plant breeding (Brandolini et al. 2000). Information in these areas is far from complete in *Cola* and in many cases is lacking. The objective of this work therefore is to carry out detail morphological characterization of the *Cola* species in our institute's collection, evaluate the genetic variation among them and identify wild species for use in interspecific breeding programme.

Materials and methods

The plant materials investigated in this study were accessions of seven species of the genus *Cola* consisting of two cultivated and five wild relatives. The materials represent a broad spectrum of *Cola* germplasm assembled at the experimental station of the CRIN. The species investigated are *C. nitida*, *C. acuminata*, *C. millenii*, *C. lateritia*, *C. gigantea*, *C. ballayi*, and *C. verticillata*. Ten representative accessions of each species were used. The plants were established in the CRIN, Idi-Ayunre, Ibadan (Lat. 07°10′ N Long. 03°52′ E) a transition savannah forest zone. Average annual precipitation is 1300 mm, average annual temperature is 28 °C and the average number of raining days is 105. Germplasm characterization including morphological assessment was carried out during 1999/2000, 2000/2001 and 2001/2002 flowering/fruiting seasons.

The interspecific hybrid were produced and raised to maturity at CRIN experimental station. The plot was established from seeds as progenies of crosses between *C. acuminata* and *C. nitida*. The *C. nitida* materials were selected around the kola growing regions of the country (Agege, Okuku, Labochi and Abejikolo) based on their yield characteristics and planted as clonal trials. The

Table 1. List of qualitative variables evaluated.

Ref. No.	Character description	Descriptor states
1	Tree crown shape	Multistage without logical order
2	Leave colour	Deep-green/light-green
3	Colour of young flushes	Multistage without logical order
4	Type of leaf veining	Acrodromous/Campylodromous/Eucamptrodromous
5	Leaf Hairiness	Glabrous/hairy
6	Leaf apex shape	Acute/very acute
7	Leaf base shape	Acute/cordate
8	Leaf margin	Entire/serrated
9	Leaf texture	Smooth/rough
10	Major flowering period	Multistage without logical order
11	Minor flowering period	Multistage without logical order
12	Flowering intensity	Low/intermediate/high
13	Flower colour	Multistage without logical order
14	Sepal pubescent	Absent/present
15	Colour of stigmatic lobes	Multistage without logical order
16	Flower stalk/pedicel	Absent/present
17	Major fruiting period	Multistage with logical order
18	Fruit set	Low/intermediate/high
19	Fruit size uniformity	Low/intermediate/high
20	Pod shape	Multistage with logical order
21	Colour of young pods	Olive-brown/greenish- gray
22	Colour of ripe pods	Multistage without logical order
23	Pod texture	Smooth/rough
24	Nut colour	Multistage without logical order
25	Fruit surface	Knobby/not knobby
26	Pod behaviour at maturity	Dehiscent/indehiscent
27	Pod beak at maturity	Multistage with logical order
28	Colour of new shoot[a]	Grayish-green/reddish-brown
29	Colour of young leaves[a]	Grayish-green/olive-brown
30	Leaf shape[a]	Multistage with logical order
31	Leaf hairiness[a]	Glabrous/hairy
32	Colour of stem[a]	Deep-green/light-green
33	Stem hairiness[a]	Glabrous/hairy

[a]Evaluated on seedlings at 12 weeks after planting.

C. acuminata trees consisted of unselected progenies of *C. acuminata* raised from locally purchased nuts at Ile-Oluji, Nigeria. *C. millenii*, *C. lateritia*, *C. gigantea*, *C. ballayi* and *C. verticillata* were wild relatives established purposely as clonal germplasm and some emergent relics conserved during land preparation in Idi-Ayunre, Ibadan.

Twenty-seven quantitative (20 reproductive and 7 vegetative) as well as 33 qualitative (18 reproductive and 15 vegetative) morphological traits of the plants were evaluated. Since there are no descriptors for kola, the descriptors used for evaluating the characters follow the method adopted for Avocado (*Persea* spp.) by IPGRI (1995) because most of the descriptors were found equally applicable to kola. Additional descriptors and descriptor states were used wherever necessary. The quantitative and qualitative variables were listed in Tables 1 and 2, respectively. Characters like canopy spread and tree height were evaluated on the field while other traits were evaluated in the laboratory within 24 h of collection. All leaf characters were taken on the fifth leaf of a flowering branch to ensure uniform treatment and all measurements were mean values of atleast 10 observations. Representative accessions of each species were randomly selected with atleast 10 replicates for each quantitative measurement taken. Descriptive analysis of central tendency and dispersion were applied to estimate the variability in the different species in terms of each quantitative character (Steel and Torrie 1988). Means, range and coefficient of variation of the quantitative morphological characters were calculated using

Table 2. List of quantitative variables considered and the reference number, nature, acronym and description of each character are given.

Nature	Ref. No.	Character description	Acronym
Overall tree	1	Tree height (m)	THT
	2	Canopy spread (m)	CNS
Leaf	3	Leaf length (cm)	LLT
	4	Leaf breadth (cm)	LBD
	5	Leaf petiole length (cm)	PTL
	6	Crotch angle of leaf petiole	ALP
	7	Number of primary leaf veins	NVP
Floral	8	Length of male flower (mm)	SMF
	9	Length of female flower (mm)	SFF
	10	Length of inflorescence main axis (cm)	LIM
	11	Number of male flowers (%)	NMF
	12	Number of female flowers (%)	PFF
	13	Number of male inflorescence (%)	NFF
	14	Number of female inflorescence (%)	NFI
	15	Number of mixed inflorescence (%)	MFI
	16	Number of flowers per inflorescence (%)	NFW
	17	Number of stigmatic lobes	NSL
Fruit	18	Fruit length (cm)	FLT
	19	Fruit diameter (cm)	FDM
	20	Number of days from flowering to fruit maturity	DFM
	21	Fruit weight (g)	FWW
	22	Number of pods per hand	NPH
	23	Husk weight (%)	PHW
	24	Testa weight (%)	PTW
	25	Number of nuts per pod	NNP
	26	Nut wet weight (g)	NWW
	27	Pod thickness (mm)	PDT

Genstat 5 Release 3.2 (PC/ windows 95). Colour descriptions were obtained subjectively by visual comparison with the English equivalent colour for the Methuen Codes printed in Kornerup and Wanscher (1978) and the Royal Horticulture Society (RHS) (1986) colour chart. All colour codes were given in parenthesis besides the descriptor states.

Results and discussion

Qualitative traits

Table 3 showed the qualitative morphological characters of the *Cola* species evaluated. Variations were recorded for flowering and fruiting period, flowering intensity, flower colour, degree of fruit set, uniformity of fruit size, pod shape, pod colour at maturity, leaf shape and pigmentation of the young flushes. The colours of the flowers ranged from creamy-white (158B-RHS) to brick-red (40B-RHS). Except for *C. millenii* with hairs at the inner part of the sepal, the flowers of the other species are glabrous. *C. millenii* is also distinct from all the other species by having sessile flowers with brownish-red (10D5) stigmatic lobes. The result of this study showed that the floral characters of each *Cola* species are constant and have been reported to be a strong taxonomic feature for species classification (Bekele and Butler 2000).

A marked difference in the uniformity and degree of fruit set was also recorded between the two cultivated species, *C. nitida* and *C. acuminata*, and some of the wild species. While the wild *C. millenii*, *C. gigantea*, *C. lateritia* and *C. ballayi* have good fruit set and relatively high fruit size uniformity, fruit set in the two cultivated species was generally poor and the size less uniform. Fruit set is a very strong yield index that can be effectively used as a selection criterion in kola breeding programme (Adebola et al. 2002). This is a valuable trait of the wild species that may be effectively exploited in interspecific hybridization

Table 3. Qualitative traits evaluated.

Traits	[a]*C. nitida* (Oji, Gbanja, Goro)	*C. acuminata* (Abata, Evbe)	*C. verticillata* (Owe, Abidun, Woba,Hanurua)	*C. millenii* (Obi-edun)	*C. ballayi*	*C. gigantea* (Ogugu,Ebenebe, Bokoko,Gushi,Ukponkpo)	*C. lateritia* (Eru)
Tree crown shape	Semi-circular to irregular	Pyramidal to semi-circular	Irregular	Obovate to irregular	Semi-circular to semi-elliptic	Irregular	Columnar to irregular
Leaf colour	Deep-green 29E8	Deep-green 29E8	Deep-green 29E8	Light-green 30A5	Light-green 30A5	Deep-green 29E8	Light-green 30A5
Colour of young flushes	Grayish-green 28C4	Olive-brown 4D6 or Grayish-green 28C4	Olive-brown 4D6	Grayish-green 28C4	Grayish-green 28C4	Olive-brown 4D6	Olive-brown 4D6
Type of leaf veining	Eucamptrodromous	Eucamptrodromous	Eucamptrodromous	Acrodromous	Eucamptrodromous	Campylodromous	Campylodromous
Leaf hairiness	Glaborous	Glaborous	Glaborous	Glaborous	Glaborous	Pubescent	Glaborous
Leaf apex shape	Very acute	Very acute	Acute	Acute	Very acute	Very acute	Acute
Leaf base shape	Acute	Acute	Acute	Cordate	Acute	Cordate	Cordate
Leaf margin	Entire	Entire	Entire	Serrated	Entire	Entire	Entire
Leaf texture	Smooth	Smooth	Smooth	Smooth	Smooth	Rough	Smooth
Major flowering period	July–September	December–March	July–September	January–March	December–March	January–March	January–March
Minor flowering period	January–March	August–September	January–March	–	August–September	–	–
Flowering intensity	High	High	Low	High	High	High	Intermediate
Flower colour	Creamy-white 158B	Creamy-white 158B	Creamy-white 158B	Brownish-red 10D5	Creamy-white 158B	Orange 32A to rich-pink 38B to red 180B	Yellow 14D to brick-red 40D
Sepal pubescent	Absent	Absent	Absent	Present	Absent	Absent	Absent
Colour of stigmatic lobes	Creamy-white 158B	Creamy-white 158B	Creamy-white 158B	Brownish-red 10D5	Creamy-white 158B	Creamy-white 158B	Creamy-white 158B
Flower stalk	Present	Present	Present	Absent	Present	Present	Present
Major fruiting period	August–January	February–July	August–January	February–May	January–June	February–May	February–May
Fruit set	Low	Low	Low	High	Intermediate	Intermediate	Intermediate
Fruit size uniformity	Intermediate	Intermediate	Intermediate	Low	Intermediate	High	High
Pod shape	Cylindrical follicle	Cylindrical follicle	Cylindrical follicle	Obovoid or ellipsoid	Cylindrical follicle	Boat-shaped	Broadly-ovate
Colour of young pods	Grayish-green 28C4	Olive-brown 4D6	Olive-brown 4D6	Grayish-green 28C4	Light-brown	Olive-brown 4D6	Red 180B
Colour of ripe pods	Deep-green 29E8	Grayish-green 28C4 or Olive-brown 4D6	Dull-green 30D3	Rich-pink 38B or orange-red 32A	Light-brown	Olive-brown 4D6	Red 180B
Pod texture	Smooth	Smooth	Smooth	Rough	Smooth	Rough	Smooth
Nut colour	Red 180B, pink 11A4, white 155B	Red 180B, pink 11A4, white 155B	Red 180B, pink 11A4, white 155B	Greenish to creamy-white	Red 180B, pink 11A4, white 155B	Red 180B, pink 11A4, white 155B	Red180B, pink 11A4, white 155B or brown
Fruit surface	Knobby	Not knobby	Not knobby	Not knobby	Knobby	Not knobby	Knobby
Pod dehiscent	Dehiscent	Dehiscent	Dehiscent	Indehiscent	Dehiscent	Dehiscent	Indehiscent
Pod beak	Prominent	Slight	Moderate	Absent	Moderate	Absent	Prominent
Colour of new shoot[b]	Grayish-green 28C4	Grayish-green 28C4	Grayish-green 28C4	Grayish-green 28C4	Grayish-green 28C4	Brownish-red 10D5	Brownish-red 10D5
Colour of young leaves[b]	Grayish-green 28C4	Grayish-green 28C4	Grayish-green 28C4	Grayish-green 28C4	Grayish-green 28C4	Olive-brown 4D6	Olive-brown 4D6
Leaf shape[b]	Lanceolate	Lanceolate	Lanceolate	Oblong lanceolate	Oblong lanceolate	Cordiform	Cordiform
Leaf hairiness[b]	Glabrous	Glabrous	Glabrous	Hairy	Glabrous	Glabrous	Glabrous
Colour of stem[b]	Deep-green 29E8	Deep-green 29E8	Deep-green 29E8	Light-green 30A5	Deep-green 29E8	Light-green 30A5	Light-green 30A5
Stem hairiness[b]	Glabrous	Glabrous	Glabrous	Hairy	Glabrous	Glabrous	Glabrous

[a]Local names in parenthesis.
[b]Evaluated on seedlings at 12 weeks after planting.

programme for the improvement of the two commercial species. The colour of ripe pods also showed great variability in these plants ranging from deep-green (29E8) to olive- brown (4D6) offering large scope for selection and breeding. Ripe-green pods of the commercial species mimics the green foliage of the tree crown and prevent the pods from being recognized for timely harvesting. This usually result into heavy yield loses in kola plantations as the overripe pods become infested by kola weevils (*Balanogastris colae*). Pods of *C. nitida* and *C. acuminata* are also dehiscent along the ventral sutures at maturity further exposing the nuts for weevil attack. On the contrary, pods of *C. mellinii* and *C. lateritia* are indehiscent. These are very valuable qualitative agronomic traits that can be incorporated into kola breeding programme.

Quantitative traits

Table 4 summarizes the parameters estimated for the quantitative variables in the seven *Cola* species. The mean values, range and coefficient of variation (*CV*) were presented. There was much variation in most of the listed attributes. The high *CV* (>20%) recorded in most of the evaluated traits indicates that wide variation exists both within the accessions and among the species in the population for these traits. Yield related characters with high *CV* were number of nuts per pod, number of pods per hand, fruit diameter and number of flowers per inflorescence indicating a wide scope for selection.

C. gigantea had the highest mean height (32.6 m) while *C. ballayi* had the lowest (4.9 m). The average mean height recorded for the two cultivated species is 12.9 and 6.2 m for *C. nitida* and *C. acuminata*, respectively. These values are far above the mean height of 3.0 m recommended for commercial orchards (da Silva et al. 1999). Larger heights hinder harvest, pest and disease control and routine farm operations, and are responsible for a significant percentage of crop losses in *Cola*. The shorter height of *C. ballayi* is therefore of particular interest. This species had the shortest mean height (4.9 m) and a very compact tree canopy (5.6 m). Shorter and robust stems better support the main branches and increase sap circulation for the canopy while a compact canopy allows management practices without affecting the neighboring trees.

Among the floral traits, the number of female flowers per inflorescence and the number of stigmatic lobes formed useful characters of agronomist interest. This is important because, the successful pollination of all stigmatic lobes of a female flower will result into the development of each lobe into a pod. Higher number of stigmatic lobes therefore implies potentially higher number of pods and consequent higher yield. The highest mean number of stigmatic lobes was recorded in *C. millenii* (9.2) as compared to 5.2 and 6.0 recorded for *C. nitida* and *C. acuminata*, respectively.

In relation to the fruit components, *C. gigantea* had the largest fruit diameter (28.4 cm) while *C. millenii* had the least (3.7 cm). *C. verticillata* had the highest value for fruit length (14.4 cm) and *C. millenii* the least (7.8 cm). This is expected because the fruits of *C. verticillata* are cylindrical follicles while those of *C. gigantea* had ovoid shape. A longer fruit length is desirable, as it had been shown to be correlated with higher number of nuts per pod, which is also an important index for yield (Adebola et al. 2002). Other fruit characters of agronomic importance include larger number of pods per hand as exhibited by *C. millenii*, larger number of nuts per pod as in *C. acuminata*; and very thick pod wall as recorded in *C. gigantea*. Thicker pod wall in *Cola* is an important agronomic character because it can serve as a deterrent to pod borers attack as described in Cocoa by Bekele et al. (2001)

The result of this study reveals that the wild species of *Cola* are repository of many desirable characters with potential for utilization in kola breeding. Based on the morpho-agronomic characteristics of the kola species just described, *C. millenii*, *C. ballayi*, *C. gigantea* and *C. lateritia* species are recommended for use in genetic improvement programme. Accessions of *C. millenii*, *C. lateritia* and *C. gigantea* characterized with heavy fruiting are specifically valuable for high-yield breeding.

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Table 4. Mean, range and coefficient of variation (*CV*) of seven *Cola* species for 27 quantitative traits evaluated.

Traits	*C. nitida*			*C.acuminata*			*C. verticillata*			*C. millenii*			*C. ballayi*			*C. gigantea*			*C. lateritia*		
	Mean	Range	*CV* (%)	Mean	Range	*CV* (%)	Mean	Range	*CV* (%)	Mean	Range	*CV* (%)	Mean	Range	*CV* (%)	Mean	Range	*CV* (%)	Mean	Range	*CV* (%)
THT	12.89	9.63–18.69	24.30	6.25	4.50–10.48	26.21	14.35	13.62–15.86	7.59	5.84	5.01–7.38	12.02	4.90	3.46–5.88	20.98	32.55	25.66–50.18	25.11	28.23	22.00–36.48	15.80
CNS	9.64	6.10–13.14	21.68	5.97	4.48–7.48	17.37	13.64	12.12–14.68	9.55	4.60	3.84–5. 23	9.21	5.61	4.98–5.36	7.20	10.78	7.83–14.18	19.05	15.20	12.18–18.23	12.92
LLT	22.17	19.00–26.20	10.21	17.07	11.80–20.50	16.59	14.58	12.50–16.80	7.96	19.46	17.00– 21.50	7.57	23.38	21.00–27.00	7.92	32.66	25.00–39.00	12.05	22.42	14.50–28.60	20.03
LBD	7.41	5.80–10.70	20.40	5.92	3.50–8.00	22.58	5.93	4.50–7.00	12.84	19.45	15.50– 23.50	13.37	9.54	8.50–11.50	9.18	32.08	27.20–43.00	14.96	20.94	14.26–28.10	22.30
PTL	4.14	2.20- 7.80	39.78	4.17	1.50–6.40	36.71	5.20	3.70–7.50	22.90	13.08	11.00–16.00	11.86	7.48	3.60– 14.00	37.56	17.22	12.60–23.30	19.10	11.64	7.20–16.50	26.06
ALP	65.62	60.84–73.44	5.67	59.53	55.34–63.48	3.91	37.57	28.14–43.88	13.24	90.95	78.48– 110.12	11.84	74.37	62.18–81.34	7.38	71.56	66.44–76.18	3.96	70.96	62.18–76.48	5.39
NVP	4.00	12.00–16.00	9.03	15.08	14.00–17.00	7.38	13.60	13.00–16.00	6.27	65.90	62.00– 70.00	5.09	16.30	14.00–20.00	14.00	41.70	34.00–53.00	13.00	14.90	14.00–16.00	6.33
SMF	27.28	20.00–37.00	18.03	23.37	20.18–29.82	13.41	7.05	4.00–10.18	22.38	10.64	9.46– 12.01	8.36	31.31	28.00–40.00	11.32	8.10	6.48–9.48	10.57	10.06	7.63–12.13	13.56
SFF	42.13	29.88–50.22	19.05	50.18	39.83–56.33	9.92	13.51	10.68–16.44	12.64	16.26	14.38– 17.48	5.75	50.05	43.00–55.00	8.07	10.16	8.48–12.64	10.98	15.67	13.48–18.48	8.79
LIM	5.68	3.50–8.40	29.10	5.22	3.56–6.44	15.58	4.65	3.68–5.91	17.32	0.00	0.00	0.00	9. 03	8.20–10.00	6.55	5.93	4.08–7.28	19.33	3.98	2.84–5.50	20.78
NMF	43.93	15.78–73.82	38.87	49.98	28.39–72.14	25.10	39.19	28.12–51.11	21.81	44.26	26.86– 58.22	20.30	43.69	28.43–73.38	29.21	39.88	28.18–50.98	18.30	42.67	26.52–61.52	25.53
PFF	56.06	26.18–84.22	30.46	50.02	27.86–71.61	25.05	60.45	48.89–71.88	14.79	55.58	41.78– 73.14	16.45	56.14	26.62–71.57	22.85	60.11	49.02–71.82	12.14	57.19	38.48–73.48	19.22
NFF	38.37	2.22–83.42	74.38	45.63	23.84–73.48	28.75	22.93	6.86–76.23	52.63	41.02	28.11- −70.24	30.06	21.37	10.18–36.18	41.20	31.51	10.44–49.38	39.80	35.09	12.96–51.09	37.88
NFI	29.44	5.30–87.44	80.38	28.41	13.00–40.34	30.27	52.74	30.82–76.23	29.61	38.89	9.64– 61.38	35.78	42.83	9.64–61.38	31.95	23.94	12.94–36.48	34.41	42.37	24.88–70.43	37.75
MFI	32.18	5.76–76.84	71.92	25.95	10.66–40.38	36.43	24.34	13.33–40.45	33.87	19.77	10.18– 36.11	36.88	35.98	25.89–70.24	34.67	42.36	23.48–76.23	44.30	22.24	5.68–33.48	36.58
NFW	12.9	6.00–23.00	42.80	10.80	8.00–12.00	19.77	12.60	9.00–18.00	21.64	9.94	6.00– 15.00	22.29	22.20	14.00–26.00	14.91	53.05	38.00–72.10	19.74	11.30	9.00–14.00	13.15
NSL	5.20	3.00–7.00	18.84	6.00	5.00–7.00	12.90	4.00	3.00–5.00	15.81	9.20	8.00–12. 00	12.67	6.10	5.00–7.00	11.47	4.60	4.00–6.00	14.42	2.60	2.00–3.00	18.84
FLT	17.06	11.90–23.8	22.45	15.03	10.80–22.44	26.88	14.40	10.00–21.80	24.15	7.77	6.00–10.20	16. 96	13.24	10.60–15.60	11.75	12.25	8.60–15.25	18.40	13.86	11.80–15.40	10.41
FDM	6.81	4.10–11.30	36.33	7.17	5.30–15.00	16.87	5.79	4.60–8.10	18.33	3.70	2.60–4.80	18.84	5.58	4.40–7.30	17.24	28.40	23.00–34.00	12.61	26.10	19.00–30.00	11.03
DFM	132.80	126.00–140.00	3.43	131.40	115.00–150.00	7.68	130.60	110.00–140.00	6.96	95.70	87.00–105.00	7.35	126.40	118.00–134.00	3.87	97.10	86.00–112.00	9.56	98.70	87.00–112.00	7.64
FWW	320.60	245.00–480.00	21.86	364.10	260.00–520.00	22.67	332.10	222.00–480.00	23.12	80.40	70.00–94.00	9.50	323.60	213.00–510.00	31.96	356	260.00–510.00	20.47	270.20	238.00–318.00	11.49
NPH	4.30	3.00–5.00	18.16	3.50	2.00–5.00	29.27	3.40	1.00–5.00	39.89	9.50	7.00–12.00	17.13	5.30	4.00–6.00	12.08	3.40	1.00–5.00	35.29	2.00	1.00–3.00	38.72
PHW	43.29	36.32–50.63	10.69	40.53	37.11–44.11	5.33	53.54	43.44–63.18	11.13	55.38	49.64–61.42	7.83	48.84	42.16–11.00	9.22	69.84	56.38–78.26	9.09	51.54	43.68–57.44	7.63
PTW	4.90	4.00–6.10	13.13	3.96	2.60–5.00	18.52	3.47	2.40–4.30	19.63	6.54	5.40–7.60	11.11	3.59	2.18–4.54	22.68	3.69	2.60–4.32	15.25	5.19	3.80–6.00	12.58
NNP	6.10	3.00–10.00	35.50	9.70	6.00–12.00	19.03	6.70	5.00–9.00	18.93	9.40	8.00–12.00	12.76	8.50	6.00–11.00	23.67	6.66	5.00–8.00	16.87	4.30	3.00–6.00	25.58
NWW	13.67	6.90–20.30	32.36	18.54	14.80–23.50	16.33	13.22	7.50–20.10	30.30	3.36	2.50–4.50	21.59	13.30	8.40–18.60	25.02	6.28	4.80-7.60	14.91	9.61	6.30–11.80	19.63
PDT	6.40	5.00–8.00	15.93	5.70	5.00–8.00	15.78	6.30	5.00–8.00	17.46	6.30	5.00–8.00	17.46	6.60	5.00–8.00	13.88	11.80	10.00–14.00	12.45	7.90	6.00–10.00	19.15

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