

Table S1. Comparative assessment of validation capabilities across genome assembly evaluation tools

“Yes” indicates that the tool directly detects or evaluates the corresponding error type. “Partial” indicates that the tool provides indirect or limited evidence related to the error type. “No” indicates that the tool does not assess the corresponding feature.

Tool	SNP / Small indel	Large indel	Structural misassembly	Repeat / Duplication	Completeness	Contamination	Plasmid / Circularity
REAPR	Yes	Yes	Yes	Partial	No	No	No
Inspector	Yes	Yes	Yes	Partial	No	No	No
QUAST	Yes	Yes	Yes	Yes	partial	No	No
Assemblytics	No	Yes	Yes	No	No	No	No
CheckM	No	No	No	No	Yes	Yes	No
BUSCO	No	No	No	No	Yes	No	No
KAT	No	No	No	Yes	Yes	Partial	No
Merqury	Yes	Yes	No	Yes	Yes	No	No
Bandage	No	No	Yes	Yes	No	No	Yes
gfatools	No	No	Yes	Yes	No	No	Yes
Circlator	No	No	Partial	No	No	No	Yes
MOB-suite	No	No	No	No	No	No	Yes